

National Exercise & Sports Trainers Association

PERSONAL FITNESS TRAINER MANUAL



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the NESTA system of personal training

The importance of being a personal trainer

By definition, a personal trainer is a fitness professional that provides individualized exercise programming and client instruction. Programming and client instruction has changed dramatically over time and will continue to change for years to come. Your NESTA education and continuing education courses are designed to keep you at the forefront of the latest developments in exercise science applications within the fitness industry, allowing you to position yourself as a professional in this important field.

Personal training has evolved significantly over the past 30 years. It is no longer only the rich and famous that have personal trainers. Health and fitness programs have increased in popularity and personal training continues to be among the fastest growing of all careers. People from almost every demographic are willing to retain professional fitness advice. Why is personal training becoming so popular?

Primarily due to our rapidly changing society, modern medicine and technology have combined to lengthen the average lifespan. However, many of these technological advances have made our society very sedentary and unhealthy. People sit in front of computers, spend more time on their cellular phones and drive their cars more than ever before. This causes some muscles to be overused, weakens others and increases the average person's bodyweight, girth and body fat percentage. Although food itself is overly abundant in most areas, it was not long ago that our ancestors had to work for their food on a daily basis just to keep from starving. We are now faced with high quantity, but low quality processed and chemically altered food choic-

es. Our bodies were designed to move and eat natural foods. While individuals in our society are living longer, we are actually "dying" longer due to our habitual tendencies to lead sedentary lives and the staggering trend to consume convenient and processed foods. These convenient and processed foods lack the nutrients our bodies need on a daily basis.



Fortunately, people are also becoming more informed about safe and effective ways to attain a healthy and fit lifestyle. Consumers are becoming savvy about the exaggerated claims of quick fixes and "magic pills" offered through infomercials. True health and fitness is neither quick nor does it use magic. Many people now recognize that they need direction and professional guidance. More than ever, personal trainers are in demand; and the need will only become greater as personal fitness trainers seek to bridge the gap between fitness and medicine. You will play an integral part in this movement toward fitness and health.

Traits of a successful trainer

What does it mean to be a professional personal fitness trainer (PFT)? What does professional personal fitness training entail? Does professional personal fitness training simply involve loving to workout and the enjoyment of teaching others to do the same? The answer is yes...and no.

Being a personal trainer versus being a “professional” personal trainer takes a lot more than most people think. While it does take a love for fitness and a willingness to help others, a personal trainer should have a solid understanding of the movement and functions of the human body. Looking the part of a personal fitness trainer by appearing fit and healthy is important, but this is only image. Image is external. But more importantly, a professional personal fitness trainer understands that fitness and health have a strong internal component as well. This understanding must include foundational knowledge of human anatomy, exercise physiology, kinesiology, biomechanics, exercise programming and nutrition. Many personal fitness trainers base most of their programming upon experience rather than science. The professional personal fitness trainer bases decisions first upon science. Personal experience and anecdotal evidence (information passed on by word-of-mouth) are secondary.

A professional personal fitness trainer is a coach and teacher, who provides not only motivation, but the right amount of program supervision and appropriate exercise progression to assist clients in reaching the goals they desire. To accomplish these tasks, a trainer must have excellent communication skills. Remember, a professional personal fitness trainer is not just a motivational coach or physical education teacher; they are also a guide who directs the client toward the destination of increased health and well-being. Being a great coach and teacher is helpful, but does not solely make an individual a great personal trainer.

A professional personal fitness trainer must have effective business and sales skills. Most trainers do not like to think of themselves as salespeople. However, the world's most knowledgeable personal trainer, from a scientific standpoint, is destined to be unsuccessful without a strong business sense and effective sales skills. Other than education level, this is perhaps the most crucial aspect in differentiating personal fitness trainers from professional personal fitness trainers. Without these skills, there will be no one to train.

With increasing advances in technology and research a certified personal fitness trainer must possess the capability and willingness to learn continuously. Mastering the art of selling must be one of the main learning priorities to catapult the fitness professional toward continued success. As with many things in life, you will only get out of it what you choose to put into it.

Job of a trainer

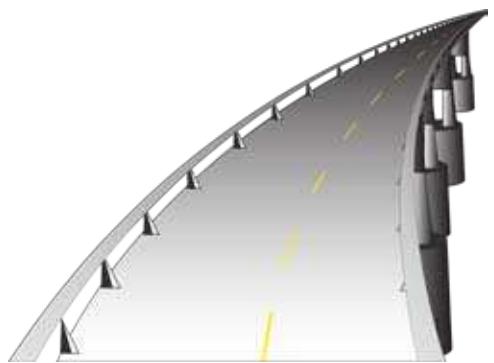
What is the job of a professional personal fitness trainer? How does it work? What does a professional personal fitness trainer really do?

The goal is simple: to help clients reach their goals the most efficient, effective and safest way possible. This means designing programs which include exercising without wasted effort. Such programs minimize injury and maximize the benefits of improved performance, whatever the goal may be. This cannot be accomplished without taking the time to understand the principles of exercise science and taking into account the individual limitations and needs of each client. There is not one perfect program for everyone. The job of the professional personal fitness trainer is to fit the program to the client (never the other way around).

The professional personal fitness trainer is a guide who leads clients from point A (their current health and fitness status) to point B (their fitness goals and health needs). This is also known as **Bridging the Gap**.

BRIDGING THE GAP

Fitness wants and needs



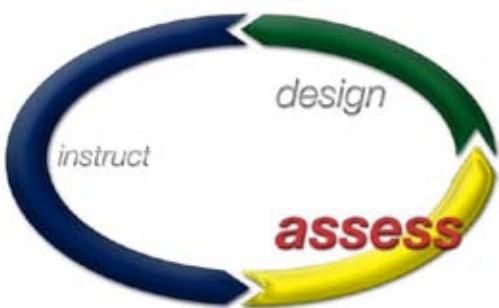
Current health & fitness level **A**

How do we get from point A to point B in the shortest and quickest way possible? NESTA breaks it down into simple steps:

Assess

step 1

Why assess? What does it mean to assess?



If the job of a personal fitness trainer is to get a person from point A to point B, you must first find out where your client is now (A) and where they wish to go (B). To properly design programs for clients, the trainer must determine the client's explicit and implicit wants and needs (goals). Explicit goals are goals that are mentioned by the client. Your client may tell you that they would like to lose weight. This is an explicit goal. Implicit goals are implied but are not necessarily mentioned. In this case, your client would clearly like to lose weight in the saf-

est and quickest way possible. They don't want to waste a lot of time and money. While they may not mention this, it should be obvious. Determine your client's goals in explicit detail by asking questions until you know what they want and the deeper reasons why they want it. You cannot plan to meet their goals until you understand what drives them.

Know your client. They may be with you for a long time. More on goal setting will be covered in the assessments chapter. An individual client assessment may help form a client's goals (by showing them their own capabilities and limitations firsthand) and will provide you as a personal fitness trainer with their needs (through your close observations during the physical and fitness assessments). An initial assessment gives a baseline fitness level, helps to identify risk factors, and can be an effective motivational tool. The results should be used to develop goals and design an effective and efficient exercise program.

What do you assess?

Point A - Begin with the client's current health and fitness level.



This would include performing a health history, an exercise history, and any physical (i.e. blood pressure, body composition, etc.) and fitness assessments (i.e. cardiovascular and strength endurance tests, etc.) which would help to establish a baseline for later personal comparison. Assessments are more valuable as a comparison to the individual themselves as compared to a norm. As their personal fitness trainer, it is your job to improve your client's individual skills

and abilities, not solely to seek or to meet the guidelines of a societal norm. A proper health screening must be performed to establish a possible need to be seen by a physician before proceeding with a new exercise regimen.

A trainer may choose from varying cardio-pulmonary, metabolic or musculoskeletal assessments. These must be standardized assessments with a specific protocol to ensure consistency and validity. This establishes a baseline and gives you greater recognition of your client's current fitness level and the need for future improvements based upon their needs. Assessments are vital in establishing your professionalism. Performing an in-depth assessment protocol (a precise and detailed plan) shows that you both care enough to learn more about your client and that you are professional enough to be extremely thorough before proceeding with their program. You cannot train what you do not understand.

Point B – The needs and wants (goals) of the client.

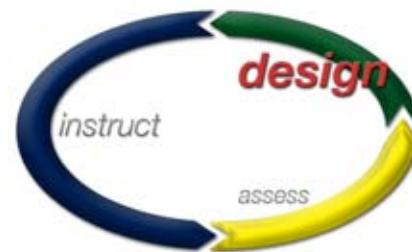
Identifying a client's goals can mean the difference between success and failure, and maintaining or losing a client. A trainer must have a clear idea exactly what the client wants to accomplish, in order to successfully reach their end goals (point B). Showing the client that you care by investing in their needs is crucial to not only gain a new client (Chapter 12), but to also retain long term customers. A select few trainers are able to maintain a steady client base. Your client base will either grow, or it will decline. Your clients are your walking billboards. They are a testament to your abilities as a trainer and their physical success leads directly to future business for you.

EXAM ALERT

What are the four steps in “Bridging the Gap” between current client health and fitness levels, and their future goals and needs? What is the difference between implicit and explicit goals?

Design step 2

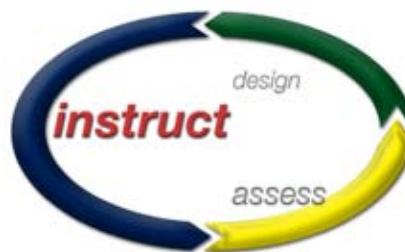
How does a personal fitness trainer begin to design an exercise program?



Once you have gathered all the necessary information you need through a thorough client assessment (all performed within one training session), the principles of proper program design and progression (Chapter 9) must be implemented to properly customize the client's exercise program. The principles of program design are based on the fundamental sciences (i.e. anatomy, exercise physiology, nutrition, etc.) that are covered in this manual.

Instruct step 3

What is the basis for proper instruction?



Based upon the principles of proper biomechanics (Chapter 4), the personal trainer will teach proper exercise technique (Chapter 10) while making appropriate modifications. You must advise your clients by using both scientifically proven principles of training combined with effective coaching skills. This will motivate the client into taking action, and ultimately move them closer to the results they desire.

Re-assess

step 4

What specifically must the personal trainer re-assess?

The personal trainer will continually assess the progress of a client on both a **micro** level and intermittently assess on a **macro** level. A micro assessment is the close monitoring of every exercise repetition. If form breaks down, you should be able to identify the cause (roughly speaking, as this can be very difficult and complex) before you can expect to design the appropriate exercise in order to see marked improvement. It is the job of the trainer to both identify a client's strengths and to discover weak areas. A macro assessment concerns the individual as a whole and the 1-2 month full reassessment is crucial in order to determine progress. A professional personal fitness trainer must devote the greatest amount of their time toward a client's imbalances or deficiencies while highlighting the client's abilities. Weaknesses must be isolated and treated before strengths can be harnessed.

Remember: Every rep of every set is an assessment!

Macro assessments are the 1-2 month follow-up to the assessments which were completed in the first step. This will show that you have designed the workout properly and whether your instruction and coaching has been beneficial in producing the desired client results. If results are not acceptable (or exceptional) from the client's perspective, changes must be made (to redesign or make necessary program changes and reestablish new goals). This task becomes easier with experience as you commit to listening to your client by applying their assessment information toward bridging the gap between their personal needs and wants and their individual goals.

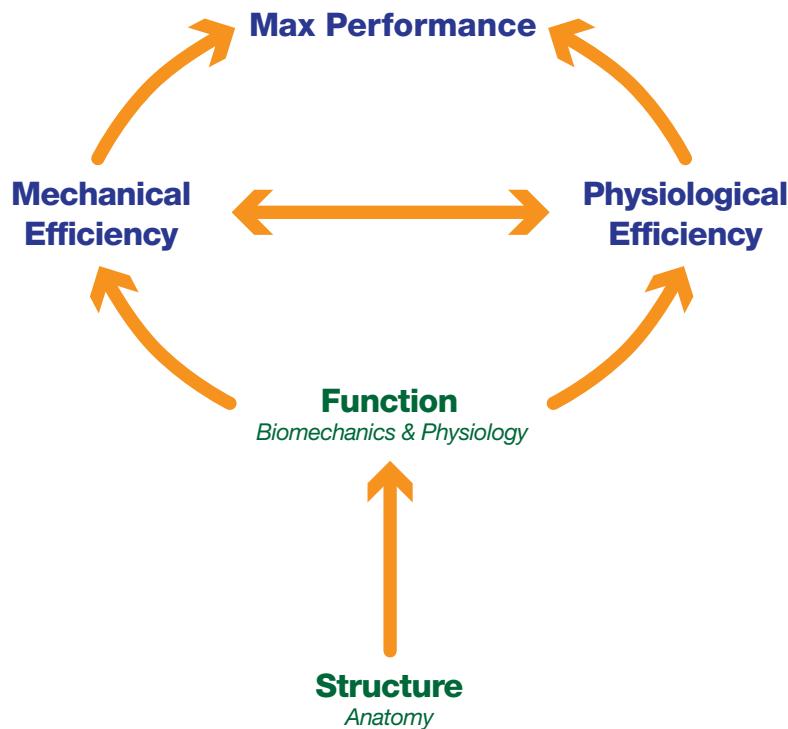
What Do You Need to Know?

In a sense, the process of *bridging the gap* can be looked at as the process of **maximizing performance**. Maximum performance is performing efficiently both physiologically and mechanically. In order for this to happen, you must first understand the basic **sciences** of the structure (anatomy) and function (physiology and biomechanics) of the human body. Only then can you understand the proper **applications** of the various sciences to ensure both physiological and mechanical efficiency for your clients.

The structure of this program requires that you prepare to be a trainer just like an athlete prepares for an event. Before athletes approach the starting line they must first prepare themselves physically and mentally for the challenge to come. You must also prepare yourself by learning and understanding the basic sciences before you can understand the applications of safe and efficient training.

Once an athlete reaches the starting line they will apply their knowledge and skills obtained in training to successfully complete the race. In a similar way, after you master the fundamental sciences and prepare for your "race" by preparing as a trainer, you are then ready to start by beginning the practice of being a personal fitness trainer. For a novice athlete, the race is often long and arduous. Your learning must be the same. The most successful trainers are lifelong students of the structure and function of the human body and how to optimize it for their clients .

This course will follow the flow chart displaying the path from knowledge of structure to maximum performance (see the following page). When you focus on the basic sciences first, only then will you be able to successfully utilize tools you have learned. It is the ongoing process of assess-design-instruct where you will apply foundational sciences. It is not enough to simply have the tools to be a great trainer, you must also know how to apply the tools better than other trainers and better than what your clients can do on their own.



The Mindset of a Successful Personal Fitness Trainer

NESTA and the Spencer Institute have come together to create a system that is designed to maximize your success. The first thing you need to do is start asking yourself a few important questions.



What's your vision?

In the world of fitness, there are no guarantees. There is no way to eliminate all of the risks associated with starting a fitness practice. Whether you work as an independent contractor, an em-

ployee for a gym/club, or you own your own fitness practice, the success of your fitness practice is always up to you, and no one else. Some trainers judge their success by the frequency of mistakes they have to overcome whereas others, judge themselves only by their clients' successes. You can increase your chances for success by visualizing success. A vision is a vivid mental image of your fitness practice and your successes in clear detail. Why is visualization important? It separates trainers who have not taken the time to know what their vision is, and ends up setting themselves up to fail. Don't let this happen! Read on...

- Why do you want to become a personal fitness trainer?
- What does this mean to your life? Can you see the “big picture”?
- How will your new profession impact others? How will they benefit from you?
- What do you hope to accomplish? Why is this important?

You must take the time to answer these questions and return to them often. Over the first few months as a NESTA Certified PFT, you will continuously evolve and change your fitness practice. Your vision should be so clear, you will never have to alter it. Once you have created a vision for yourself, you will have a clear purpose and a reason for doing what you do. This is not something that needs to be shared with others (unless you want to), this vision and a sense of purpose are the things that will keep you motivated while giving you reason to get out of bed every morning (for most successful trainers, this means before the sun). It's your personal vision and purpose which will help you get through the challenging times in your life and your business. When things seem difficult, you will always know what you want and stay committed to get there. After all, if you don't know where you are going, how will you know when you are there? Think about it.

Once you have a vision, what's next?

Create a plan. It doesn't have to be elaborate, but it should be a road map outlining where you are going and how you plan to get there. Whether you plan on working in a health club or want to train people on your own, successful fitness professionals know what they want and have a plan for getting there. Some questions to consider as you develop your plan are:

- What are your financial goals? How much money do you want and expect to make?
- Do you have any additional tools available to help achieve your financial goals?
- What is your timeline for achieving those financial goals? Is it realistic?
- How many clients do you need to train each week to get there?
- Does your club have a minimum number of clients you need to train to keep your job?

If you plan on training people outside of a club or want to open your own gym, how many clients or members do you need to attract and retain to break even? Have you accounted for no-shows and cancellations? Break even numbers give us a good place to start, however, very few small businesses can operate for extended periods of time on break even numbers. Consider that element when you outline your goals.

Let's say you want to make \$50,000 your first year as a personal trainer while working for a gym, and you start out at \$20/session. \$50,000 a year equates to about \$1000/week and \$4000/month. If you want to make \$1000/week at \$20/session, how many clients will you need to train? That's 50 sessions a week! And that's if every one of them shows up! You will need to work very hard and very smart. If you don't take the time to both plan and to figure out what you have to do to earn what you need, you may receive a lot less than you want. Make a pact with yourself to plan your work and work your plan. Make a plan, and act on it.



think about it

Would you expect to run your fastest time without knowing your previous best time? You must build upon what you have done, not continue to start over.

Self-Assessment

Now that you have a vision, a purpose and a plan, what's next?

There is no way to eliminate all risks associated with starting your own fitness practice but you can improve your chances for success with a vision, proper planning and good preparation.

Start by evaluating your strengths and weaknesses as a potential fitness instructor, employee, or small business owner. Consider the following questions:

Are you self-motivated?

It is up to you to develop your client base, organize your time and follow through on all facets of your fitness practice. This includes:

- Getting new clients
- Creating plans for their success
- Filing all necessary paperwork
- Billing for your time
- Following up with clients between sessions
- Marketing and advertising to attract new clients
- Attending networking mixers where you will meet potential clients
- “Working” the gym floor
- Staying fit

How well do you relate to different personality types?

Fitness professionals need to develop working relationships with many different people. Some people will help you grow your fitness practice, while others may try to undermine your efforts. Ask yourself if you can professionally handle a demanding/flaky client or, a negative/unsupportive manager if the success of your fitness practice/vision depends on those people?

“ You have to expect things of yourself before you can do them. ”

-Michael Jordan, NBA legend

How well do you make decisions? What's involved in that process for you?

Fitness professionals must make a variety of decisions all day long. Some are snap decisions while others require more thought.

Do you have the endurance and emotional capacity to have your own fitness practice?

While a career in the fitness industry can be exciting, it requires a lot of hard work. Can you work 7, 8, 12 or even 15 hour work days? This includes the time that you spend training your clients, developing new relationships and filing paperwork. This is also typical for a personal fitness trainer who is building their business. You cannot expect to “take off” if you have not developed enough speed to get off the ground. The power and effort needed to fly an airplane is minimal once it has lifted off the runway. The power and effort needed to get off the ground is enormous. Building your business is no different. If you have laid the groundwork and worked your “tail” off, you will get off the ground, and you will be able to succeed with less long term effort. But first, you must get off the ground.

How well do you plan and execute your ideas?

Poor planning is one of the main reasons why business practices fail. Organizing your time, client records, managing your client base and having a clear direction for getting new clients, will help you overcome many obstacles in your fitness practice. You must take time at the beginning and end of each day to go over your plan. The best personal fitness trainers have a plan, know it well, and adjust their plan when necessary. They may change their daily, weekly or monthly plan, but they never work without one.

Are you driven to succeed?

Managing a fitness practice can be physically and emotionally demanding. Some fitness professionals burn out quickly because they literally feel like “the weight of the world is on their shoulders.” If you are driven to succeed in your fitness practice and you truly want to help your client’s achieve their goals, you will overcome those challenging times when you are on the brink of throwing in the towel.

How will your fitness practice affect your personal life?

The first several months of any new career, business or practice can present some challenges in your personal life. It's important that your friends and family know what you are trying to accomplish so they can support you during this temporary phase in your life. You may need to take a pay cut for the first several months until you develop your fitness practice and find yourself having to spend less time on new client development. It all points back to your vision, purpose and plan. Until you achieve the success you deserve, you may need to make some adjustments to your spending habits in order to achieve your short term goals. There is no surer way to sabotage yourself than to spend more than what you have.

Playing to Your Strengths

OK, now what? You've identified your strengths and weaknesses. How will that knowledge help you develop and expand your client list?

“My attitude is that if you push me towards something that you think is a weakness, then I will turn that perceived weakness into a strength.”

- Michael Jordan, NBA Legend



think about it

Would you try out for a position on a team, and expect to make the team, without playing upon your strengths or working to overcome your weaknesses?

imagine this...

You and five other trainers are hired to help open up a gym in an area where there is little or no competition. Your employer has done his/her homework. The community has been crying out for a gym like the one in which you now work. You are one of five personal fitness trainers that were hired to train new members.

All of you are eager to build your fitness practices. Every one of you has been given two new clients in an effort to launch your new fitness business. The rest is up to you.

- How do you differentiate yourself from the other trainers at your gym? Do you have an area of specialization?
- Why would a client want to work with you instead of the other four trainers? What would you tell them?
- What's your niche? How will others be aware of your niche?

Playing to your strengths involves developing your “story” or “elevator pitch.” If you were standing next to someone in an elevator and they asked you what you do for a living, you would have the remainder of the elevator ride to tell that person your story. Develop your pitch now. It may change, but you must develop one. Test it out on your friends, family and other personal trainers and ask for honest feedback. Were they sold on you?

When you approach potential clients you need to be ready to tell them a quick, yet interesting story about what or why you do what you do. This is your chance to stand out from the rest of the trainers at your gym.

Example:

My name is Shelly Rainer. (Briefly pause so the other person can introduce themselves.) I'm part of the fitness team who opened the gym. I specialize in creating fast results train-

ing programs for busy professionals. What made you decide to join our gym?

Example:

My name is Ed Smythe. (Briefly pause so the other person can introduce themselves.) I'm a member of the fast fitness team who opened up the gym. Two years ago I was an attorney with XYZ Company and realized there was more to life than depositions and courtroom appearances. When I left the firm, I lost 100 pounds and was so invigorated that I realized my true calling was to help others who weren't happy with their personal appearances. That's my story... Why did you decide to join our gym?

You will need to give your "elevator pitch" many times before it will feel natural. Like anything, practice makes perfect. The more people you talk to, the more comfortable you'll be.



think about it

Would you give a professional presentation without planning what you were going to say to your audience?

Take Your Strengths and Start Talking

Here's the hard reality. You won't build your fitness business over night. Unless you are Donald Trump and you are making a career move, it's a tough bet to assume you'll have your time slots filled in the first few days of your business. Building a fitness practice is a process that requires discipline, focus and mental stamina.

“It’s a funny thing, the more I practice the luckier I get.”

-Arnold Palmer, Golfing Legend

One of our favorite former fitness trainers, now a club owner, told us this when he started out:

"It was tough. I wanted to build a big base of clients quickly. With no sales background to speak of, I bought some traditional Zig Ziglar books and pulled some nuggets from there. After landing my first client, I did the math. I needed to hear 60 no's before someone would say yes to me. So, my reality was, I had to talk to 600 people before I would land 10 clients and make some headway in my business. The good news is, the more people I approached at and outside of the gym, the easier it became for me. At the end of the day, it is a numbers game."

“You've got to take the initiative and play your game. In a decisive set, confidence is the difference.”

-Chris Evert, Tennis Legend

What is the new NESTA PFT 2.0?



NESTA is committed to providing you with the education and tools necessary to become a professional personal fitness trainer. It is for this reason that we are excited and proud to announce the development of the NESTA PFT 2.0 System. The NESTA PFT 2.0 System is a collaboration between the National Exercise & Sports Trainers Association and Polar - the leader in heart rate monitoring technology. PFT 2.0 is intended to give NESTA students and graduates the necessary tools to ensure their clients' success and thus, their own success.

Utilization of heart rate monitoring has been a staple of the professional trainer for many years, primarily in the cardiovascular arena; that has changed and the new era of personal fitness training is here. There is now substantial data regarding heart rate monitoring during resistance training, cardiovascular training, exercise programming and program design that we have included in this program to enhance your educational experience and the expertise you will gather while working with your clients during their training sessions, and even during their independent training days without you.

“ *These days, the electronic measurement of the heart rate in therapeutic, fitness and competitive sport is taken for granted, and is the most important way of controlling and monitoring load intensity. However, measurement is still not really a training aid in itself. A heart rate monitor is only really useful if the user can correctly evaluate the data it measures.* **”**

*-Dr. Kuno Hottenrott
Heart Rate Monitoring Specialist and author of
“Training with the Heart Rate Monitor”*

The above quote by noted heart rate training expert Dr. Kuno Hottnerott points out the inherent flaw with any device or tool - a tool is only a benefit if you know how to properly use it. While heart rate monitors have been an essential tool for personal fitness trainers for many years, many trainers and clients do not take full advantage of the technology simply because they do not understand all that it can do for them. The NESTA PFT 2.0 program will go over the benefits of heart rate monitoring technology and how to properly integrate it with your clients.

You clients will have various goals. Some may want weight loss, others may have specific performance goals while others may want simply to improve overall health and fitness. No matter what their goals may be, in order to achieve these goals it is very important to listen to the

benefits to heart rate monitoring

improved performance	Training in appropriate heart rate zones will allow the client to progress more quickly.
improved efficiency	Maximizes the benefits of exercise in a limited amount of time.
increased motivation	By tracking cardiovascular capacity in an objective manner as well as having an accurate measurement of calories burned every workout.
increased knowledge	Of the function of the heart, of the effects of stress and health problems on heart rate, and how heart rate varies during training will enable the client to take more responsibility for his or her own training.
adaptability	Regular measurement and correct interpretation of heart rate will allow the trainer and client to train based on the client's current performance level and state of health.
accountability	The exercise diary will keep client's accountable for their workouts on the days they are not training with a trainer.
objective assessment	For assessing performance, intensity and recovery management. Unlike RPE (Rate of Perceived Exertion), the heart does not lie - it shows the response of the body at any moment in time.
objective training	Takes the guesswork out of cardiovascular program design by customizing exercise intensity to the individual (i.e. the trainer doesn't have to do any mathematical formulas or complicated testing).

body's signals as you train and use these signals to your benefit. As stated earlier, workouts should be based on the client's current ability and their goals. If the workout intensity is too low they will not reach their full potential. If workout intensity is too high, it can often lead to injury, overtraining and discouragement. In order to train effectively, exercise must be properly planned at the proper intensity.

Benefits of the Polar FT60

We chose to offer you the Polar FT60 for numerous reasons. It is Polar's preferred heart rate monitor for use in a personal training environment. The monitor is easy to use and comes with an interactive tutorial. Trainers can actually see and track their client's workouts, monitoring heart rate levels, calories burned, and total time in which they exercised. All of this data is captured on the FT60 and easily accessible for the trainer to track and review. The monitor is sleek in appearance and can be used as a watch as well.



OWNZONE®: this feature of the FT60 is perfect for your client's individual physiological status. The OWNZONE® pt feature allows you to enter your client's target heart rate zone for maximal training. It also provides you with total number of calories your client should be burning on a weekly basis to help achieve their goal. This feature takes the guesswork out of all of the formulas trainer's used to have to figure out.

Benefits of Trainers Selling the Polar FT60

Once you successfully pass the PFT certification test and become a NESTA graduate, we are proud to announce an additional way for you to succeed as a professional fitness trainer – NESTA certified Trainer Polar distributor. To help ensure the success of your clients we have developed a program that will allow trainers to become an authorized distributor of the FT60 heart rate monitor.

This is how it works: trainers fill out a distributor agreement, located on our website at: www.nestacertified.com/graduates. Once the agreement is processed and approved, certified NESTA graduates can then order the FT60 monitor at NESTA graduate preferred pricing. The trainer can then sell the monitors to their clients and earn up to \$60 per unit sold! This will ensure your clients will achieve their goals in the quickest, safest way possible when they are not training with you. This program gives NESTA trainers the ability to actually hold their clients accountable for you now have the capability to track their workouts on their off days.



You will NOT be tested on any Polar FT60 specific information on your NESTA PFT exam. This information is provided to help ensure your success as a trainer, so it is to your benefit that you understand how to use this technology. However, you WILL be expected to understand the scientific premise for heart rate monitoring.

heart rate training for various populations

- by Chris Hagar, Polar Training Resource Specialist

the first timer	The first timer is maybe the luckiest. They can start out in the right direction with an understanding of building lean mass, proper nutrition and what intensity to work in and for how long. They can work smarter and not harder from day one.
overweight/ deconditioned	This person might need HR training the most. How many times have you seen these members over on a piece of cardio equipment going full speed and sweating profusely? It's obvious that they are there to lose weight and they are giving it all they have. Unfortunately we all know that in 2 – 3 weeks they will either be too sore or injured to workout any more. They will not be back to the club, they won't reach their goal and there goes another member retention casualty. This group needs you and your knowledge of the correct way to reach their goals.
the average gym member who exercises moderately	Again it's all about working smarter and not harder. There are a lot of members that are going exercise only as much as they think they need/ want to. That's fine, but they should understand that as long as they are going to exercise, they should spend that time productively. This is the group that might be exercising below the zones that would want make a change in their body composition.
the dedicated member exercising 5 times/week	If they are going to spend so much time in the club, why not make every minute count. Even though they already have the motivation to be there, why not make their time there more fun and productive too. Are they burning calories or just burning time?
the elite athlete who trains daily	This is the member that is constantly stepping over the edge of over training. Their VO2 max, Max HR, Resting HR and HR recovery between efforts all suffer from overtraining. They need to constantly monitor their training intensity and insure they have enough resting and active recovery.
the weighlifter/ bodybuilder	This member needs to monitor his intensity for several reasons. Building lean mass and decreasing fat is his goal. Working at the wrong intensity can break down hard earned muscle and add fat as well as increase fat if they are working too hard or not hard enough. For the competitive body builder, this becomes critical the closer they get to contest time.
the “cardio junkie”	They are already addicted to working out. They will also get that same feeling when they learn to monitor and track their workouts. There should be special promotions / contests for this group. Show them how easy it is to use the HRM and the benefits they can get by making all of their workout time count.
the personal training client	The FT60 is the perfect tool for the PFT client and the PFT. The PFT and client can build and agree upon the STAR fitness program. They can agree that the client will work out a certain amount of days with and without the PFT, the intensity / time and the calories to be burned. For the client and PFT, it will be like having the PFT always on their wrist, creating accountability. The Clients know that their PFT is going to check the HRM files daily and or weekly so they have to do the work. It lets the PFT know what their client is or is not doing when they are not training together. Every PFT who gets an HRM on their client increases the buy in from their client.

The NESTA System for Infinite Training Success

Congratulations on choosing to become a NESTA Certified Personal Fitness Trainer. You are invited by the entire NESTA staff to enjoy the process of learning and obtaining the tools necessary to help your clients make lasting positive changes in their lives – and yours! It's time to get started...

Polar Resources

- www.polar.fi At this site, go into the Global Site. On the lower right side, choose Go To Support, Download & Research to find research articles on the validation behind Polar HRM's.
- www.polarpersonaltrainer.com This site will show you how to create an online training program and will also give the link to download the link to your computer that will allow you to communicate with the FT60.
- www.polarusa.com At this site you can go into the Health Clubs tab and choose Personal Trainers. There is quite a bit of training information here as well as the opportunity to register and get Polar discounts and promotions.

This Manual

You will see that the manual is broken down into three sections. Section one covers the fundamental sciences that every personal trainer should know. Section two reviews the practical application of the sciences and how they relate in the four step process of “bridging the gap”. Section three will explain how to successfully implement the NESTA System to turn your love of health and fitness to a lucrative career.

look for these symbols throughout your manual:



think about it

These boxes have valuable information to help you think critically.

These boxes contain useful tips and information.

VIDEO
click here

EXAM ALERT

Can you guess what these boxes are for? That's right, potential exam questions! Make sure you pay attention to these, they will help you pass your test!



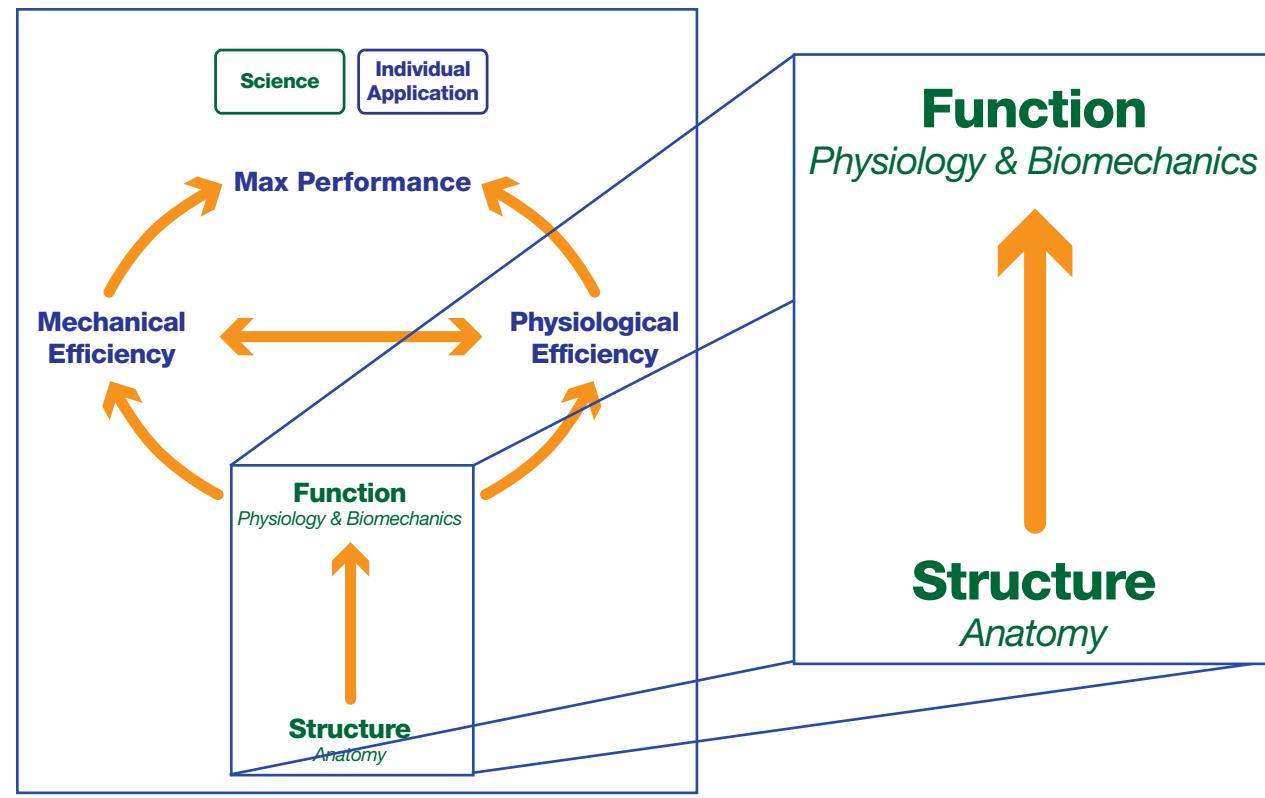
Click these to see videos and get more in-depth information. However, you will not be expected to know this material for the exam.
-Internet connection required

STOP!

Before you go on, here's a few things to remember.

The following three chapters are the scientific foundation for all of your training as a Personal Fitness Trainer. As was covered in the introduction chapter, it is essential that your training programs are based on an understanding of the structure (anatomy) and function (physiology and biomechanics) of the human body. That said, for some of you who have a background in exercise science, this will be review. For others who have not learned this in the past, it may be a bit overwhelming.

Do **NOT** try to **memorize** everything. It is more important that you **understand** the "big picture" of these chapters. Only when you understand the basic concepts on how the systems of the body adapt to exercise will you be able to train your clients appropriately. As far as the little details, you can always come back to this manual for reference.



chapter 2

Exercise Physiology

What is Exercise Physiology?

Exercise physiology is the study of the cellular reactions within the body during and after exercise. Observe the pictures to the right. Why do these individuals' bodies look so different? Other than genetics, each of their bodies has adapted differently to the stimuli (exercise) placed upon them. The bodybuilder has greater lean body mass than the swimmer or the yoga instructor. The swimmer may have a larger VO₂ max than the bodybuilder and the yoga instructor is probably the most flexible. Each individual has undergone adaptive changes to their body based on the activity they perform. This is exercise physiology in action. In other words, we can look at exercise physiology as the sum total of all human physiological responses and adaptations to physical activity.

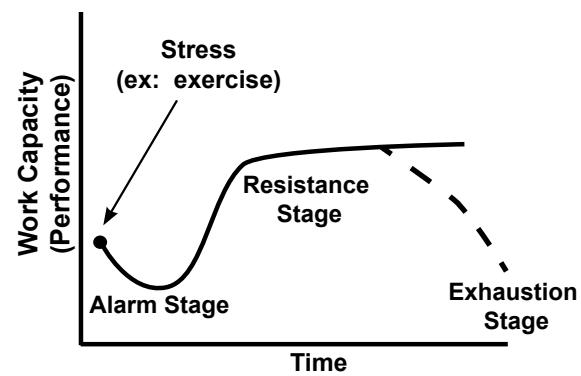


How Does the Body Adapt to Exercise?

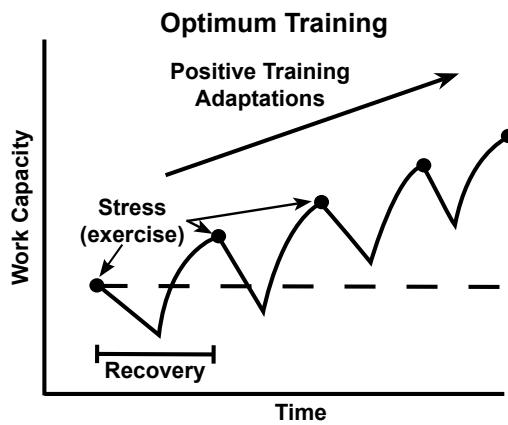
The human body is an amazing machine that is able to adapt to the stress that is placed upon it. The process of adaptation due to stress is known as **General Adaptation Syndrome (GAS)**. The body first reacts to stress by entering the Alarm Stage - the "flight or fight" stage where the body prepares for physical activity. Next is the Resistance Stage, where the body attempts to adapt in order to cope with the stress. Lastly, if the stress persists the body's resources are depleted and the body enters the Exhaustion Phase.

These physiological adaptations are the premise of exercise. The role of a Personal Fitness Trainers is to **assess** what type of stress (exercise) is needed to meet a client's goals, to **design** the appropriate exercise program (stress) and to **instruct** proper execution of the program.

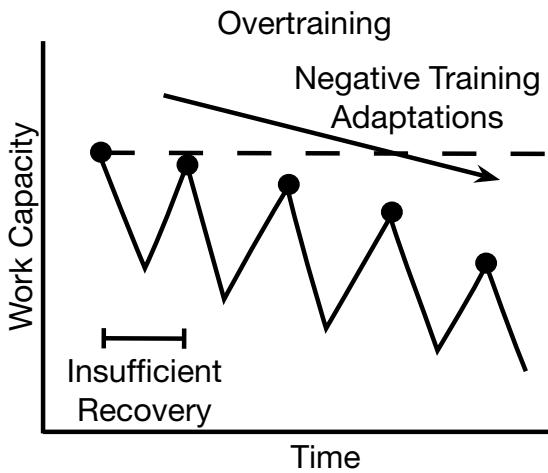
Too much of any type of stress can be detrimental to one's health (even too much exercise!). Prioritizing events in one's busy life can be challenging (which can be stressful itself). Identifying those good stressors (eustress) such as implementing a properly planned exercise program may decrease bad stressors (distress) and improve our quality of health.



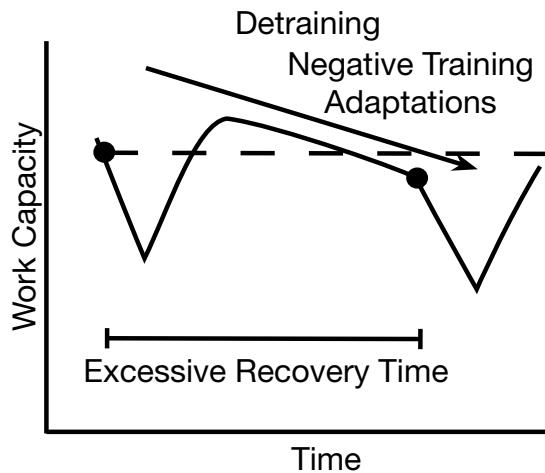
When a stress (exercise) causes the body to increase effort more than it is normally accustomed, the body has been put into a situation of **overload**. Overload will temporarily decrease the body's ability to do work (i.e. **work capacity**). After the body has had enough time to recover from the original bout of exercise, its work capacity increases to a level greater than the original. Please look at the figure below labeled "**optimum training**" and you can see that not only is the proper form of overload (stress/exercise) important, but also the proper amount of time between training - **recovery**.



What happens when the stress is too intense and/or there is insufficient recovery time? This is called **overtraining** and work capacity goes down.



Lastly, if the time between exercise bouts is too long (too long recovery), **detraining** occurs.



Exercise and the Systems of the Body

At this point it is important to note that the stress of exercise does not only affect the muscles of the body, but rather the body as a whole. While science divides the body into eleven different “systems”, one needs to remember that the body works as an integrated unit and that every system of the body is affected by exercise (albeit, arguably some more than others). So before detailing specifics on the primary affects of exercise on the various bodily systems, here is a brief review of the systems of the body.

System	Primary Function(s)
Nervous System	The body's means of perceiving and responding to events in the internal and external environments.
Muscular System	Specialized cells of the body with contractile ability in order to create movement.
Skeletal System	Creates the basic structure of the body, giving framework to the muscular system to allow movement. Also the site of blood cell formation.
Circulatory System	The “transport system” of the body (ex: O ₂ , CO ₂ , fuel, nutrients, waste, immune cells, hormones, etc.). Often divided into the cardiovascular system and the lymphatic system.
Respiratory System	Brings in O ₂ from the air and excretes CO ₂ and H ₂ O
Gastrointestinal System	Uses the processes of ingestion, digestion, absorption and metabolism to convert consumed food into smaller molecules for use in the body and excretes the unused remnants..
Integumentary System	The covering of the body (i.e. skin, hair, nails). Provides protection, structure and serves as a sensory interface with the external environment.
Urinary System	Creates, stores and eliminates urine (which contains by-products (many nitrogen rich) of cellular metabolism).
Reproductive System	Consisting of the gonads and the sex organs for the development of offspring.
Immune System	Protects the body by distinguishing between the body's cells and foreign cells/substances and provides mechanisms to neutralize and/or destroy.
Endocrine System	Like the nervous system, serves as a communication system for the body. The endocrine system produces chemicals (hormones) which then signal changes for the body.



What is the Kinetic Chain?

The study of exercise physiology must begin with an understanding of how the body moves. To fully understand human movement, one must first understand the structure and function of bodily muscle and its interdependence upon the nervous and skeletal systems. Much like the checks and balances that exist in human organizations to ensure efficient operation, there is a delicate balance within the system known as the **kinetic chain**. The kinetic chain is composed of the nervous system, muscular system and skeletal system. The systems of the kinetic chain must function efficiently for proper

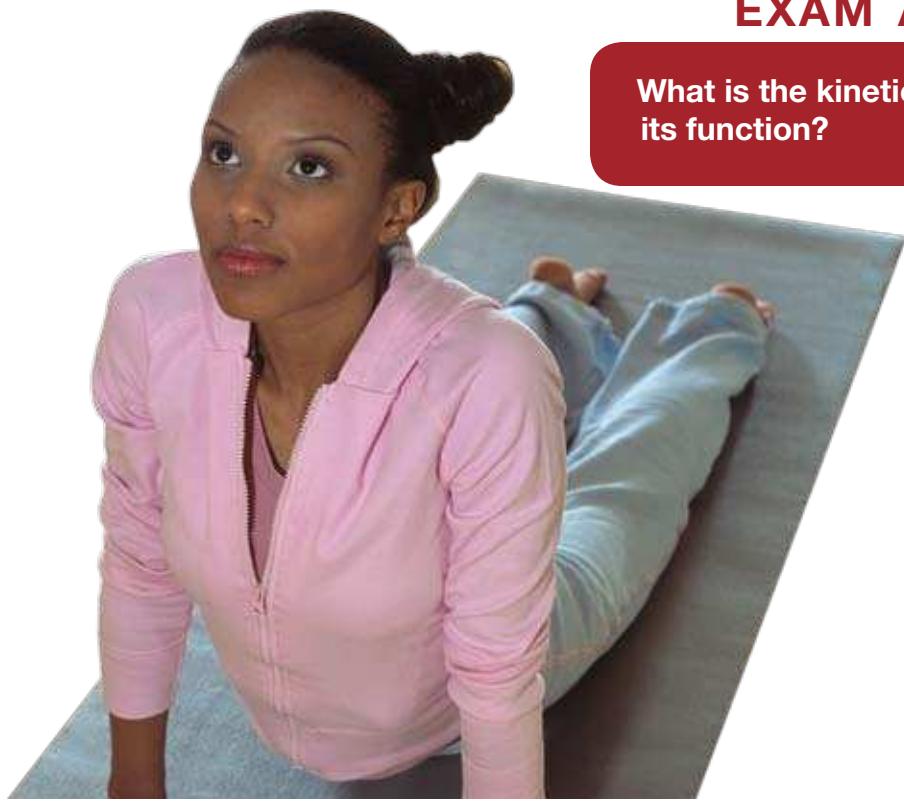
functioning of the entire body. *Kinetic* is usually defined as relating to, or produced by motion. Therefore, the kinetic chain is the “chain” of systems that “link” together to create human movement.

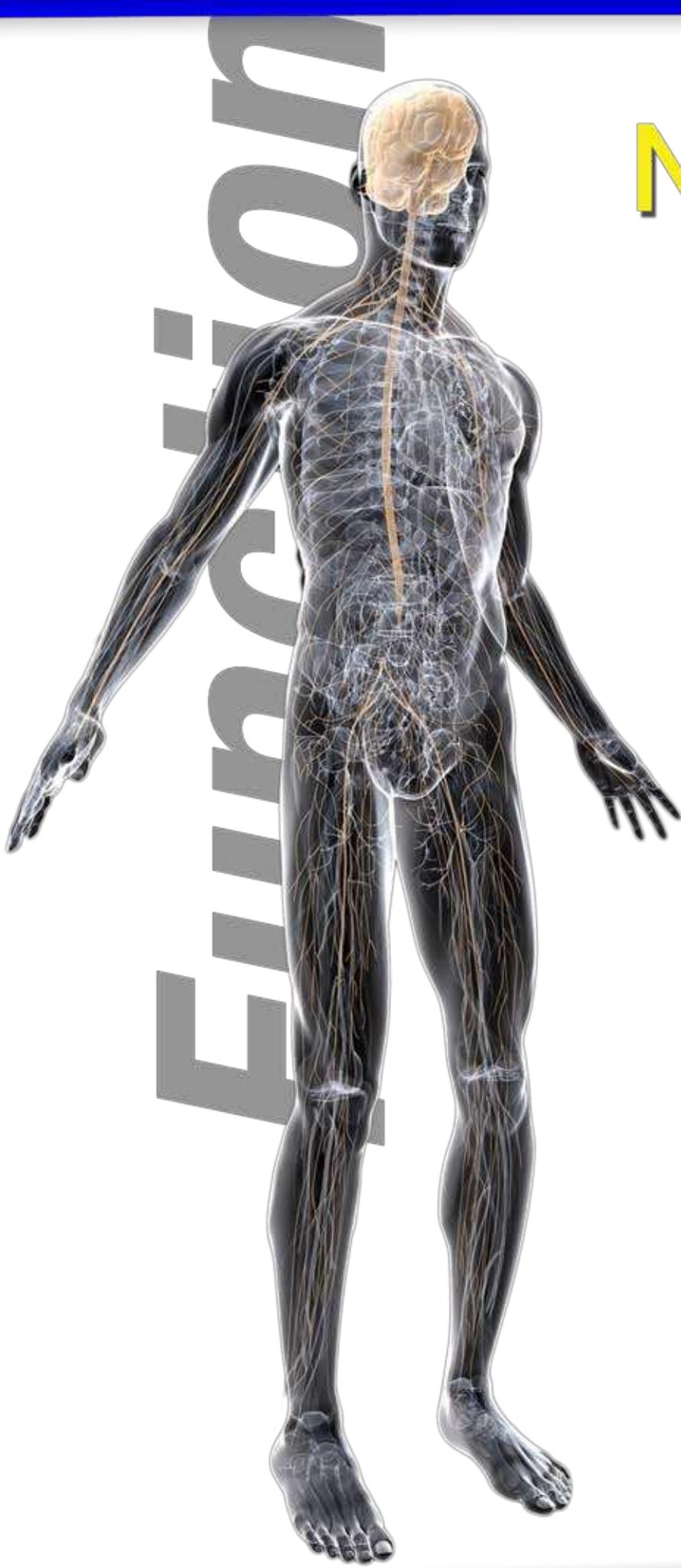
While we define the kinetic chain as three separate systems which work together to create movement, again one must remember that the entire body must work as an integrated unit. For example, the respiratory and digestive systems must import the fuel sources, which power physiological movement. The circulatory system must transport fuel to the muscles before movement can occur.



EXAM ALERT

What is the kinetic chain? What is its function?





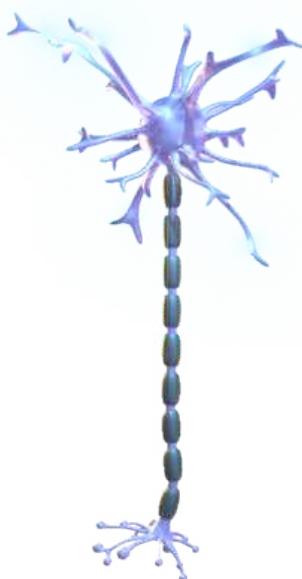
Nervous SYSTEM

The Nervous System

Introduction and Goal

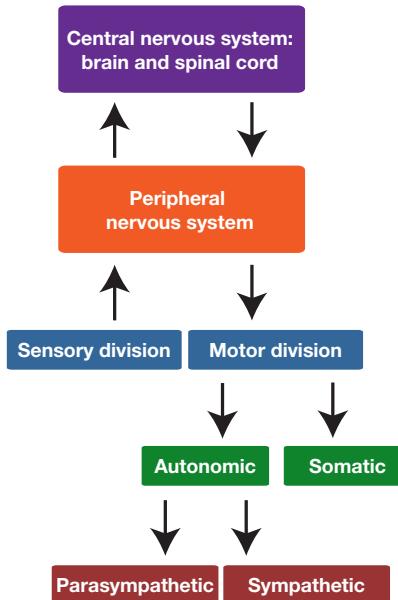
The **nervous system** is the command center of the body. It plans, initiates and synchronizes our movement and is the first of our bodily systems to significantly adapt due to exercise. This work is performed by specialty cells (nerve cells or **neurons**) located throughout the body) which are able to process and transmit information between the central nervous system and the body. When an individual reaches for a dumbbell to do a biceps curl, it is the nervous system response that activates the appropriate number and type of muscle fibers to perform the movement. Neuromuscular adaptations (the interaction and adaptations of the nervous and muscular systems) are primarily responsible for initial gains in strength, balance, agility, and speed during the first few weeks of training. Ironically, this essential system is often neglected by trainers in exercise program designs. Many trainers create “on the fly” or “cookie cutter” programs. This is NOT personal training. In order to create customized, personal training programs, the trainer must recognize the interactions of the nervous

neuron



system and the entire kinetic chain. The goal of this section is to review the basic organization of the nervous system and to demonstrate the importance of a proper, “neurologically enriched” exercise program.

Structure and Function of the Nervous System



central nervous system (CNS)

The Nervous System has two major divisions: the Central Nervous System and the Peripheral Nervous System.

CNS Central Nervous System

Composed of the brain and spinal cord. The CNS integrates, modifies and controls information transmitted through signals sent by neurons.

PNS Peripheral Nervous System

The region of the Nervous System that lies outside the Central Nervous System. The PNS has two types of nerves (divisions):
1. Sensory Division
2. Motor Division

divisions of the peripheral nervous system (PNS)

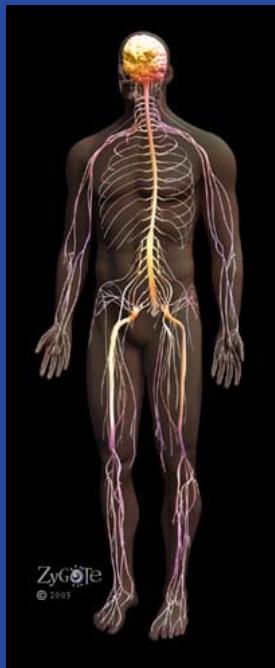
sensory division

Neurons (*sensory neurons*) running from the point of stimulus to the CNS that inform the CNS of the stimuli. The five primary types of sensory nerves and the stimuli they react to:

1. **Mechanoreceptors** – respond to touch, pressure, vibrations, or stretch
2. **Thermoreceptors** – respond to changes in temperature
3. **Nociceptors** – respond to painful stimuli
4. **Photoreceptors** – respond to light to allow vision
5. **Chemoreceptors** – respond to chemical stimuli (ex: foods, odors, changes in concentration of oxygen, carbon dioxide, glucose and electrolytes in blood).

motor division

Neurons (*motor neurons*) running from the CNS to the muscles and glands (called effectors) that initiate both muscular and glandular response. Muscles and glands that are stimulated by motor nerves are said to be innervated. The Motor Division also has two divisions, the Somatic and Autonomic Nervous Systems:



somatic nervous system

Innervates skeletal muscle to create movement via Motor Neurons. Always excitatory.

Controls the body's involuntary internal functions such as:

- Heart rate
- Blood pressure
- Respiration

May be excitatory or inhibitory, depending on whether stimulation is sympathetic or parasympathetic, the two divisions of the autonomic nervous system.

autonomic nervous system

sympathetic nervous system

"Fight or Flight" response, blood pressure/heart rate increases, digestive slowing

parasympathetic nervous system

"Rest and Digest" response, blood pressure/heart rate decreases, digestion increases

Training Adaptations to the Nervous System

The type of neural adaptation which occurs depends upon the stimulus placed on it. This is what training is – the body's adapting to a new stimulus. In fact, the first results obtained from a new training stimulus are neural adaptations. Early strength gains (within the first few weeks) from resistance training are not due to increases in muscle mass. The body adapts to a new stimulus with more efficient movement or enhanced ability to move greater loads due to the improved communication between the nervous and musculoskeletal systems, if the training stimulus has been correctly applied. This method of adaptation is called the **Law of Facilitation**. The law of facilitation states that when an impulse passes through a given set of neurons to the exclusion of others, it will tend to do so again, and each time it transverses this path, the resistance will be smaller. The body will then adapt and be able to respond with greater ease and increasing ability.

Trainers must understand how an individual learns. Anytime an individual learns something new, several mistakes are often made. This is normal and called the **cognitive phase of learning**. In this phase the individual must think about the action, requiring the involvement of the central nervous system. Movement is usually gross and uncoordinated and relies on visual and verbal cues. However, with continued practice, less errors or mistakes are made. This is called the **associative phase of learning**. There is greater consistency in replicating the movement while less visual cues and greater **proprioception** are required. Proprioception is an awareness of one's position in space. Ultimately, with continued (quality) practice, an individual will perform movements "flawlessly." This is called the **autonomic phase of learning**. The skill is now performed automatically. Conscious thought is not required, which is the ultimate goal in performing efficient movement. This is known as the **Fitts and Posner Three-Stage Model of Motor Learning**.

What does this mean? The more an action is repeated, the more efficient the brain becomes in communicating with the muscles, and the message between the brain (central nervous system) and muscles (musculoskeletal system) is enhanced. Personal trainers should view this as the process of *learning technique*. If a person learns poor technique and repeats it continually, the client will only be good at poor technique. That's why teaching proper form from the beginning is the key. Trainers must not only teach good form, but the *importance* of good form. Proper form (technique) leads to the development of proper motor skills and proper motor skills lead to **mechanical efficiency** (see next section).

The more appropriately the nervous system is challenged, the better the overall adaptation. In other words, exercises which challenge overall balance and coordination are going to allow for better neuromuscular adaptation and improved bodily control. All other movements should see improvement. Movement starts with the brain. If a trainer is able to have their client "realize" and "become conscious" of what is happening, this will lead to more effective and efficient exercise execution and result in an increase in performance. This is no easy task. This is your challenge.

Lastly, when talking about neuromuscular development, we must mention power. Remember, power is the rate that work is performed and power has a HUGE neuromuscular component. What is going to determine how fast and powerful someone is able to move? A major factor is how quickly their brain can tell their muscles to fire.



think about it

It has been said that it may take 300-500 repetitions to create a new movement pattern, and 3000-5000 repetitions to break a bad habit or faulty pattern.

What is Mechanical Efficiency?

In the introduction chapter, the job of the personal fitness trainer is defined as maximizing your client's performance safely and efficiently. It was later pointed out that Maximum Performance will be determined by Mechanical and Physiological Efficiency.

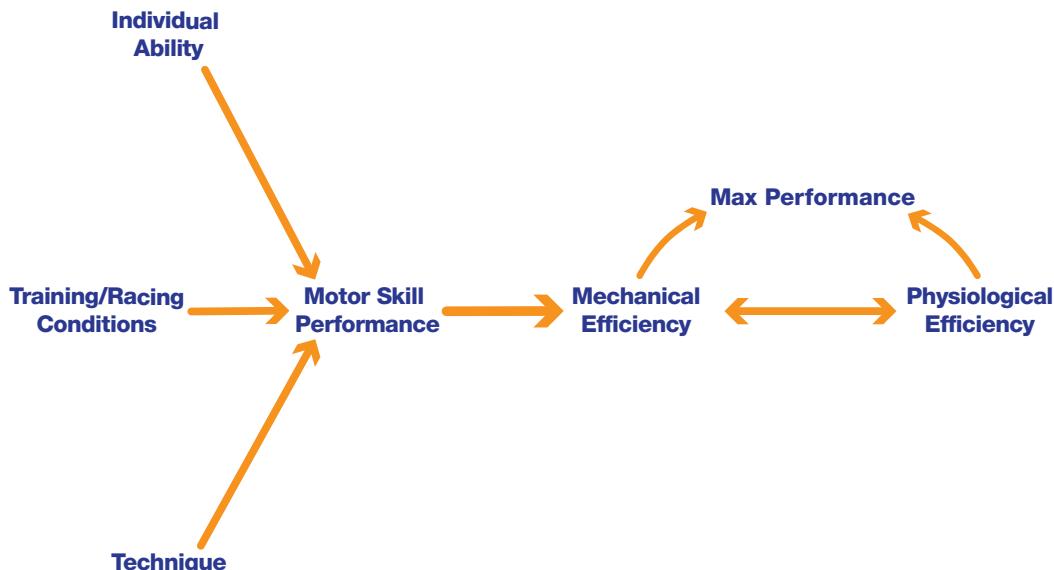
In physics, mechanical efficiency measures the efficiency of a machine. Mechanical efficiency is a ratio of the work output to work input.

$$\text{Mechanical Efficiency} = \frac{\text{Work Output}}{\text{Work Input}}$$

So if a machine is 100% efficient, all the work going into it would be transferred to work output (an "ideal machine"). Well, there are no ideal machines and the human body is far from ideal. That said, we want to be as efficient as possible. We don't want "wasted" energy.

Motor Learning Definitions

Movement Pattern	A general series of anatomical movements that have common elements of spatial segmental movements occurring in the same plane of motion (such as walking, running, jumping, pushing, pulling, bending, twisting, striking, swimming, or kicking)
Motor Skills	Activities or tasks that require voluntary head, body, and/or limb movement to achieve a goal. It is a general movement pattern that is adapted to the constraints of a particular task or sport. Motor Skill Performance = Technique + Individual Ability + Current External Environment
Technique	The basic movements of any sport or event. Depending on the task or event, multiple techniques may be required to complete a movement.
Motor Learning	The study of the acquisition of motor skills, the performance enhancement of learned or highly experienced motor skills, or the reacquisition of skills that are difficult to perform or cannot be performed because of injury, disease, or other motor impairment. Behavioral and/or neurological changes that occur during motor learning are also significant and important for the coach to observe and learn from.
Motor Control	The study of how the neuromuscular system functions to activate and coordinate the muscles and limbs involved in the performance of a motor skill. Researchers investigate and study motor control while a person is learning a new skill or performing a well-learned or highly-experienced skill.



Muscular

system



The Muscular System

Structure and Function of the Muscular System

A muscle is a structure composed of tissues which produce the movements of the body through muscular contractions. Muscles that are capable of voluntary contraction are referred to as **striated** or **skeletal muscle**, while involuntary muscles, except the heart, are termed smooth muscle.

muscle tissue		
smooth	Involuntary actions (autonomic nervous system). No striations.	Digestive tract, bladder, uterus, blood vessel walls
skeletal	Voluntary movement (somatic nervous system). Has striations.	All muscles controlling movement
cardiac	An involuntary muscle but has some striations.	Heart only

The skeletal muscular system is the anatomical system most affected by exercise. The framework for the body is provided by the bones and joints. However, movement is enabled by the contraction and relaxation of specific muscles. The goal of this section is to give the student a fundamental understanding of how muscles are able to contract and how they adapt to the stimulus of exercise.

EXAM ALERT

What is the difference between smooth, cardiac and skeletal muscle?

Skeletal Muscle and Related Connective Tissues

Skeletal muscle or striated muscle cells are some of the largest cells in the body and it is their job to create movement. They do so by contracting (shortening), which pulls the opposite ends of the muscle together. There are over 600 muscles in the human body, and more than 400 are skeletal muscles.

Fascia is a sheet or band of fibrous connective tissue which separates and contains muscles within their compartments. A **tendon** is a fibrous cord (consisting primarily of collagen) which attaches muscle to bone, although fascia can also act as a site for muscle attachment.

In addition to the fascia, there are three layers of connective tissue which surround, protect, and enable separate innervation of muscle fibers (muscle cells) within a muscle. The outermost layer is the **epimysium**, which completely surrounds muscle. The next layer groups muscle fibers in bundles called **fasciculi** and is referred to as **perimysium**. The innermost layer, the **endomysium** surrounds individual muscle fibers. The epimysium is continuous (becomes one) with the endomysium and perimysium. Continuations of the epimysium form tendons that become continuous with the **periosteum** (outer layer of bone). This interweaving of connective tissue makes the muscle-bone connection extremely strong.

Why do we care?

By understanding how muscle, bone and connective tissue are interdependent to one another, we will not only understand the rationale in creating safer programs but also the underlying causes of injuries such as tendonitis (inflammation of the tendon) and plantar fasciitis (inflammation of the fascia at the arch of the foot).

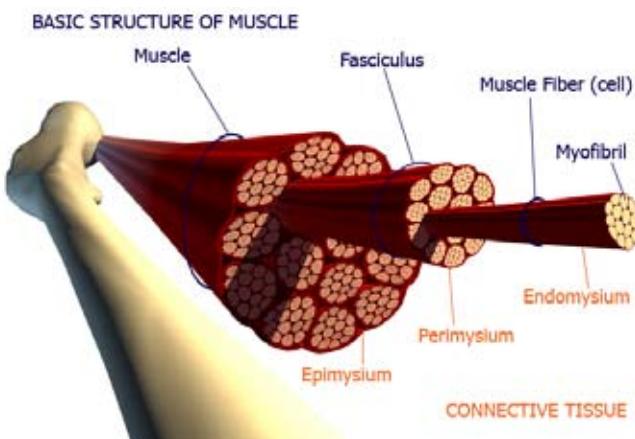
EXAM ALERT

What are the 3 layers of fascia? What is their significance?

Skeletal Muscle Cells

Skeletal muscle is composed of bundles of long, parallel fibers (cells) known as **myofibers** (i.e. muscle fibers). Embedded in the muscle fibers are filaments called **myofibrils** which further divided into **sarcomeres**. Sarcomeres are the smallest contractile unit of skeletal muscle. Muscle fibers are called striated because they have striations of light and dark bands created by the alternating **actin** and **myosin** filaments in the sarcomeres. Muscles are divided by layers of connective tissue to enable them to be innervated from smaller to larger numbers of fibers and sizes. A motor neuron and all the muscle fibers it activates is known as a **motor unit**. According to the **size principle of recruitment**, smaller numbers of fibers will be selected before larger numbers of fibers to preserve muscular energy by smaller and then larger motor neurons. Furthermore, once a muscle fiber is innervated, it is either on or off, there can be no partial contraction; this is the **all or none theory of muscle fiber activation**.

Action Potentials

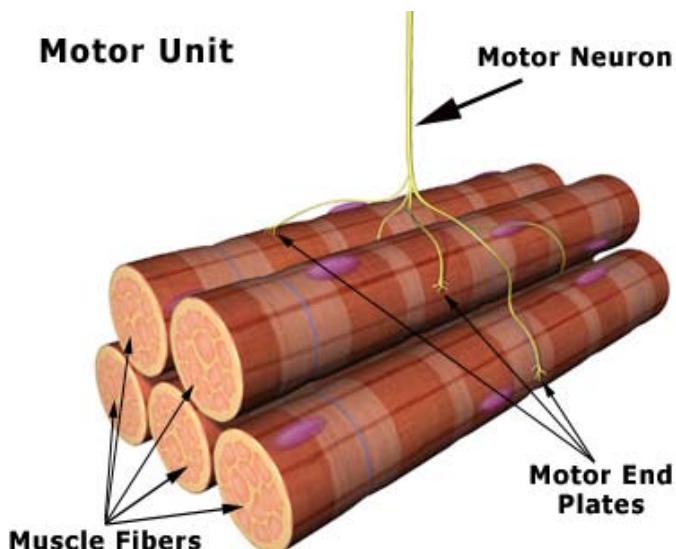


Muscle fibers contract in response to an electrical signal sent by the motor neuron. This signal is known as an **action potential**. The signal is sent down the motor neuron to its terminal ending on a muscle fiber known as the **motor end plate**. Where the motor end plate meets the muscle fiber is the **neuromuscular junction**.

If the signal is strong enough, an action potential of the muscle fiber is generated. This causes the muscle fiber to contract.

EXAM ALERT

What is the structure of the motor unit?
What is the sliding filament theory?



Courtesy of 3DScience.com

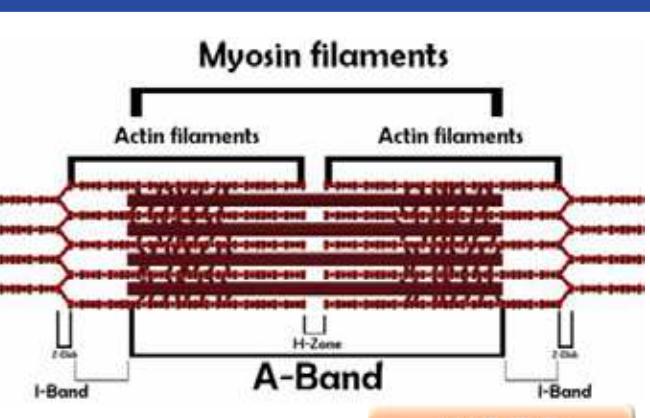
Sarcomere and the Sliding Filament Theory

The sarcomere is composed of thin filaments (chains of globular actin) and thick filaments (organized bundles of myosin). These elements will slide over each other, with the resulting action of all the sarcomeres shortening together, causing the muscle to contract as a whole.

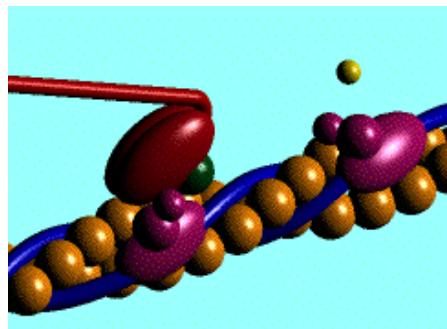
Understanding the function of the sarcomere is essential for understanding biomechanical training concepts such as Length-Tension Relationship and Active Insufficiency (see Chapter 4: Biomechanics).

structure of the sarcomere

Z-lines	Defines boundary of a single sarcomere
M-line	Runs down center of sarcomere
I-band	Contains thin filaments only
H-zone	Contains thick filaments only
A-band	Contains thick filaments in their entirety without any overlapping portions of thin filaments



VIDEO
click here



muscle fiber types

type I fibers	RED, slow twitch, aerobic fibers These fibers are fatigue-resistant. They are rich in capillaries and myoglobin (enhancing oxygen delivery). They also have increased number of mitochondria which enhances their ability to oxidize fats. Muscles containing a predominant amount of slow twitch muscle fibers tend toward stabilizing functions rather than prime movers of muscle tissue. Individuals with a greater number of Type I fibers tend to excel in endurance related activities that last longer than 3 minutes.
type IIA fibers	PINK, moderately fast twitch These fibers have traits of both Type I and Type IIB. Individuals with a greater number or more conditioned Type IIA fibers tend to excel in activities lasting between 30 seconds and 2 minutes with a moderate level of strength and aerobic capacity capabilities.
type IIB fibers a.k.a. “type IIx”	WHITE, fast twitch, anaerobic fibers These fibers are larger in diameter and well suited for brief, powerful contractions. They have little mitochondria and small capillary beds. These fibers tend to be prime movers of joints. Individuals with a greater number of Type IIB fibers tend to excel in highly explosive activities such as maximal lifts and sprinting or jumping. These are also the fibers that have the greatest potential for hypertrophy. NOTE: Historically these fibers are known as “type IIB” in humans. However, based on newer techniques to classify muscle fibers based on the type of myosin they have, the newer designation of “type IIx” is now used.

Fried Chicken

If you want to get a clear idea of the difference between muscle fiber types, look no farther than your nearest bucket of fried chicken. Chickens tend to either sit or walk all day, so their legs and thighs need endurance (the dark meat are Type I fibers). On the other hand, to avoid predators, chickens can explosively use their breast and wing muscles (the white meat - Type IIB fibers) to respond to danger (that is the extent of their flying capabilities).

Note: Traditional aerobic training will primarily utilize type I fibers while traditional strength training will primarily utilize type II (A and B) fibers.

Is it easier to accelerate, stabilize or decelerate a load? While running, is it easier to speed up or slow down? It is easiest to speed up and the most difficulty is found in attempting to slow down. It is also much harder to stabilize a load in space than it is to create movement with a load in most situations. Therefore, eccentric contractions are referred to as the “strongest” muscular action and concentric the “weakest” of the three. Keep in mind that most injuries occur eccentrically as the muscles attempt to control the downward phase or decelerate load. When running, jumping or lifting, injury often occurs because of an inability to decelerate due to the build-up of forces from the previous acceleration and the acceleration of gravitational, or other resistance forces.

Training Adaptations to the Muscular System

The increase in the size of the muscle is known as **hypertrophy**. Hypertrophy is an increase in the size of myofibrils inside muscle fibers. **Hyperplasia** is an increase in the number of muscle cells in the body with a corresponding increase in muscular size. The phenomenon of hyperplasia is extremely rare, and has only been seen in a few highly advanced bodybuilders and professional athletes. Muscle **atrophy** on the other hand, refers to the wasting or loss of muscle tissue resulting from disease or lack of use.

Muscle Soreness After Workout

Muscle soreness can be very common. However, it is not essential to be sore after a workout to gain progress or improvement. If an individual is sore between 24-48 hours following a workout, this is commonly referred to as **Post Exercise Muscle Soreness (PEMS)**. This is normal and not necessarily harmful. If the soreness extends beyond 48 hours it is referred to as **Delayed Onset Muscle Soreness (DOMS)** and should be avoided. The goal is to gain muscular, joint and nervous system benefits, not tissue microtrauma and soreness. It is normal for a muscle and connective tissue to tear and rebuild. It is not normal to create excessive trauma to muscle fibers and connective tissue by creating pain that lasts more than 1-2 days. Treatment for excessive soreness and muscular pain is described in the injury prevention chapter.

EXAM ALERT

Know the difference between eccentric, isometric and concentric muscle actions. Which is “strongest”? Which is “weakest”? What is the difference between hypertrophy, hyperplasia and atrophy?

EXAM ALERT

What are the 3 different skeletal muscle types? Be able to identify which type is dominant in an exercise.

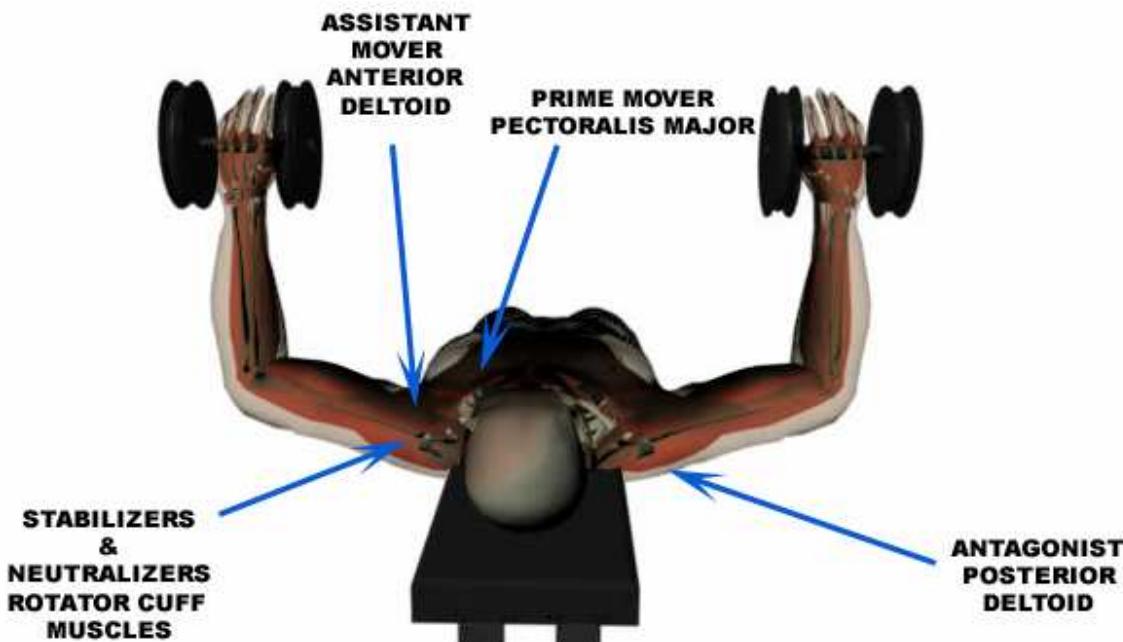
roles of skeletal muscle

prime mover or agonist	A muscle that acts directly to bring about a desired movement through concentric muscle action
assistant mover or synergist	A muscle that assists indirectly to bring about a desired movement
antagonist	A muscle responsible for opposing the concentric muscle action of the agonist (more susceptible to injury).
stabilizer	A muscle responsible for stabilizing an adjacent segment
neutralizer	A muscle responsible for eliminating or canceling out an undesired movement

EXAM ALERT

What are the various roles of muscle? Be able to identify various roles during movement.

ROLES OF MUSCLES ON THE SHOULDER JOINT (GLENOHUMERAL JOINT) DURING A DUMBBELL BENCH PRESS



Muscular Strength and Endurance

There are many types of strength that an individual may need in order to improve performance and/or function. In order to understand the benefits of exercise, we must first define and describe the different types of strength.

Neural Factors Influencing Strength Gains

Exercise elicits a training stimulus. One effect is structural (e.g. hypertrophy of muscles and connective tissues) while the other is functional. Functional affects of training will be seen as both increased intramuscular coordination (within a muscle) and increased intermuscular (within a group of muscles). During any movement, certain muscles will be activated as a primary, secondary, stabilizer, and/or neutralizer, to coincide with facilitation (actual recruitment or disinhibition) or inhibition (shut off). This sequence of events takes place during all movements, especially during the initial stages of training (motor learning/motor ability stage).

adaptations to strength training

Increased strength due to increased motor unit recruitment (i.e. able to contract a greater number of motor units simultaneously)

Increased strength due to muscle hypertrophy (increase in muscle cell size)

Possible conversion of Type I to Type II fibers

Possible hyperplasia leading to hypertrophy (increase in muscle cell number - rare)

Increased ATP, CP and glycogen stores (energy stores)

Increase in size of the left and right ventricles of the heart (wall thickness and chamber diameter)

net muscle actions

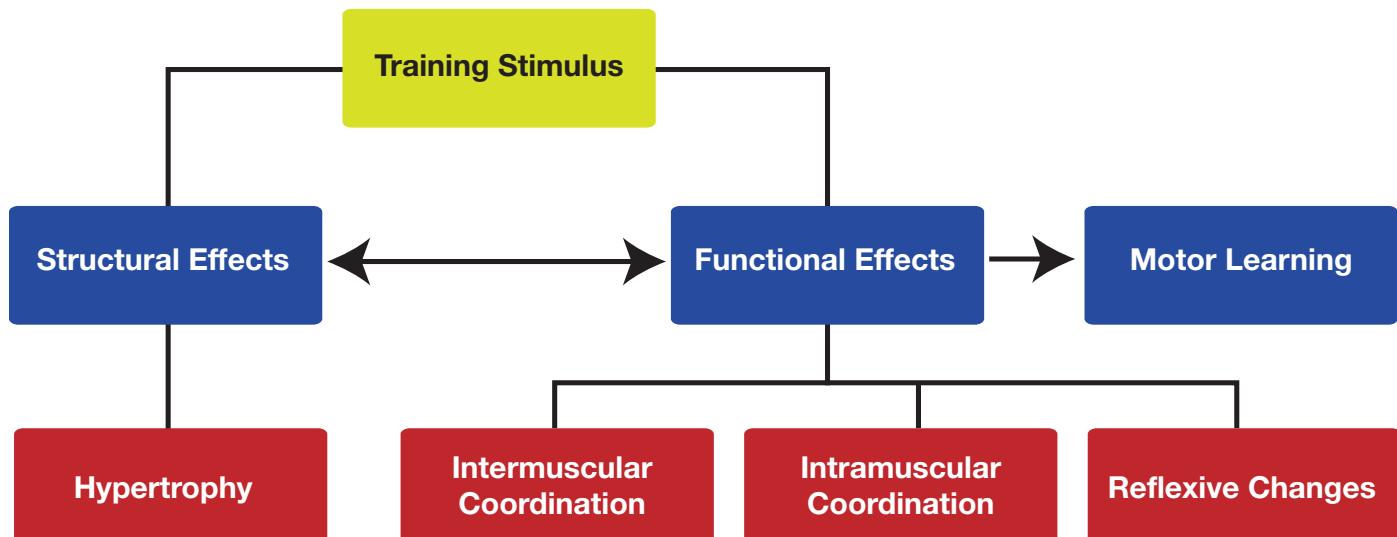
concentric	<p>Definition: Shortening of a muscle fiber against a load</p> <ul style="list-style-type: none">- “Raises” the load- “Accelerates” the load- Ex: Upward phase of a dumbbell biceps curl
eccentric	<p>Definition: Lengthening of a muscle fiber against a load</p> <ul style="list-style-type: none">- “Lowers” the load- “Decelerates” the load- Ex: Downward phase of a dumbbell bicep curl
isometric	<p>Definition: Where a muscle neither lengthens nor shortens against a load (no net joint movement). A co-contraction of agonist and antagonist muscles.</p> <ul style="list-style-type: none">- “Stabilizes” the load- Ex: Holding the elbow still at 90° in a dumbbell bicep curl
isotonic	<p>Definition: Exercise where a concentric and/or eccentric action is generated to move a load through a range of motion where the force on the muscle does not change</p>
isokinetic	<p>Definition: Exercise on a specialized piece of equipment where the muscle action speed is constant</p>

types of strength

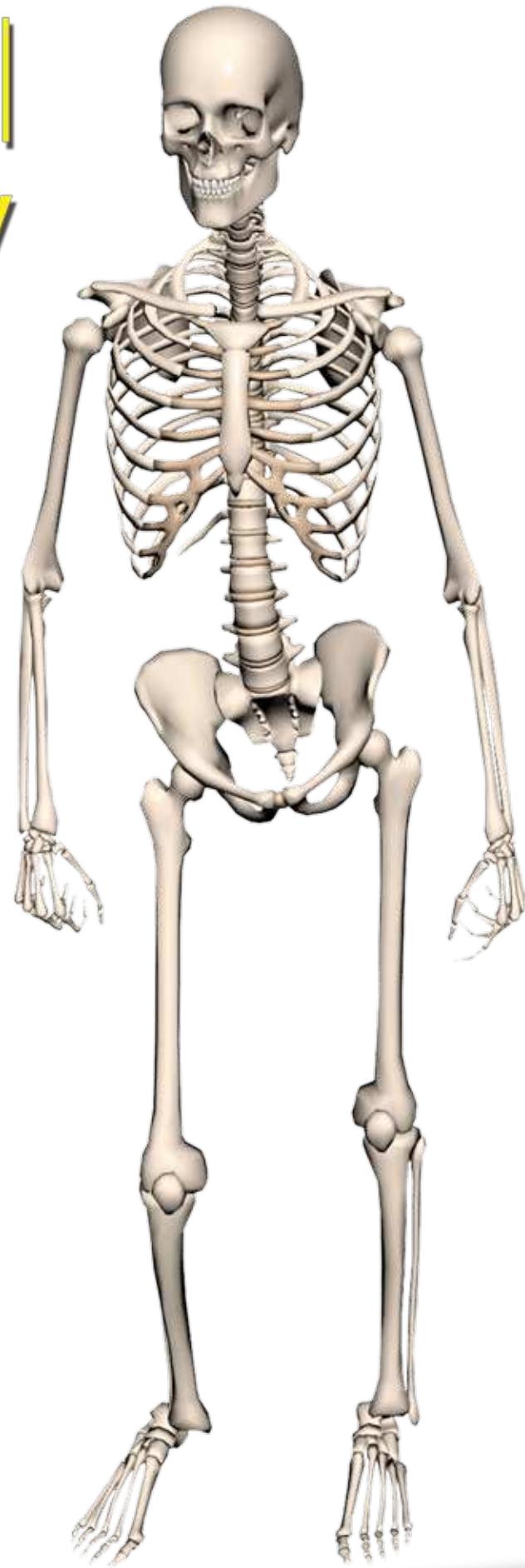
absolute strength	The maximum amount of force an individual can produce in a one repetition maximum lift (one rep max or 1RM), irrespective of body weight and time of force development. This type of strength is particularly important for shot putters and football linemen where bodyweight has a high correlation to an increase in sports performance.
relative strength	The maximum force that muscles can generate in relation to one's body weight. This type of strength is important for individuals who have to move their entire body weight, such as a gymnast. This type of strength is also important for individuals who want to get stronger, but don't necessarily want to gain mass, as well as an important strength stage to fulfill prior to mass-building.
strength endurance (muscular endurance)	The ability to sustain muscular contractions for a long duration of time. This type of strength is important for mid-level endurance events such as cycling or rowing.
power	The physics definition of power is Force x Distance/Time. In other words, power measures how quickly work is performed (Work = Force x Distance). The different ways to increase power are to increase the Force (ex: weight), increase the Resisted Distance (ex: up if force is due to gravity) or to decrease the Time (ex: move faster). The factor most influential in increasing power is decreasing the time to perform a movement or exercise.

EXAM ALERT

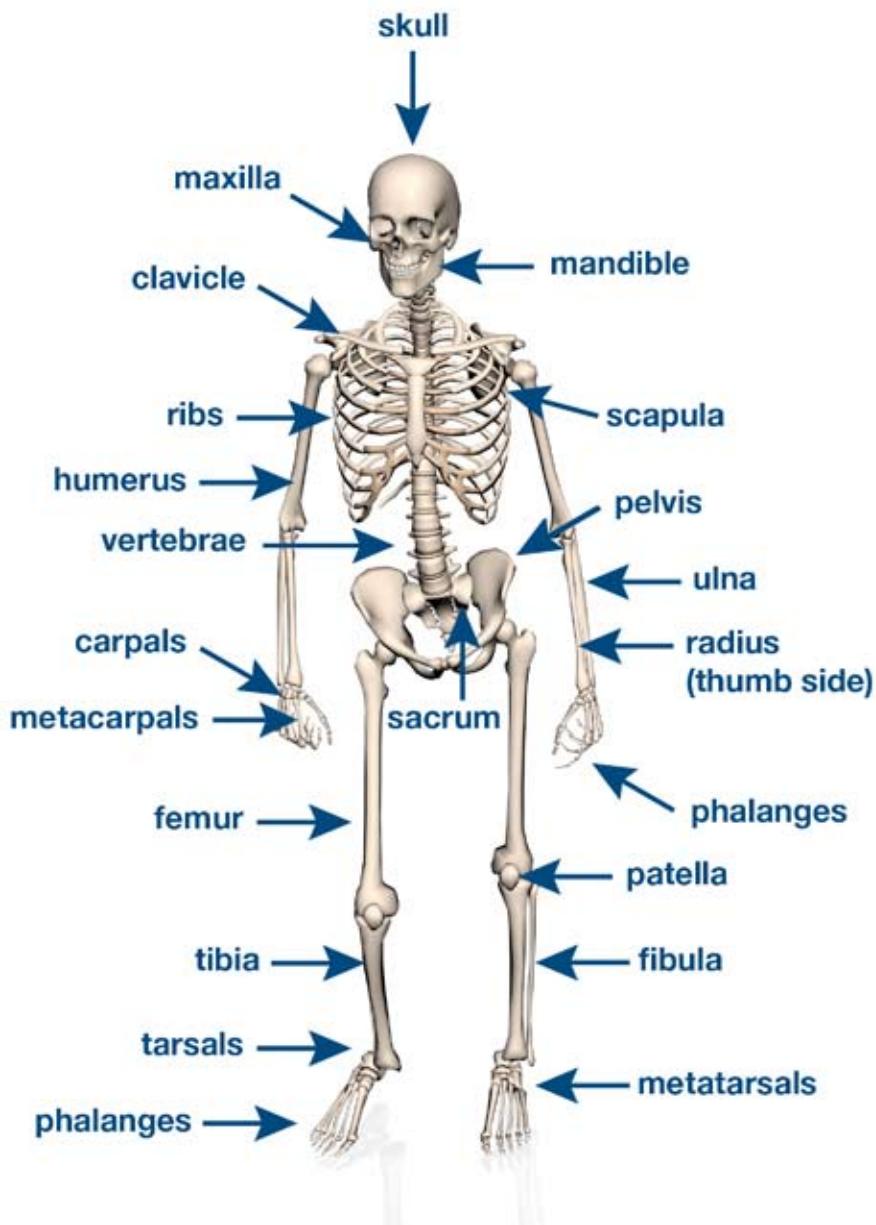
What are the various types of strength? Be able to identify exercises which emphasize a particular type of strength. What factors contribute to muscle soreness?



Skeletal & Physiological Anatomy



the skeletal system



Introduction and Goal

The human skeleton consists of 206 bones. We are actually born with more bones (about 300), but many fuse together as we grow up during childhood. These bones support our body and allow us to move. Bones contain large amounts of calcium (an element found in milk, broccoli, and other foods) and they also manufacture blood cells. Additionally, minerals are stored in bones for use by the body.

The longest bone in our body is the femur (thigh bone). The smallest bone is the stirrup bone located inside the ear. Each hand has 26 bones in it. The nose and ears are not made of bone; they are made of cartilage, which is a flexible

substance and is not as hard as bone.

The Goal of this section is to give the reader an understanding how the skeletal system is designed for both support and movement as well the necessity for movement to ensure proper bone health. Just like muscles, bones require progressive levels of resistance in order to grow strong.

Males and females have slightly different skeletons, as well as having a different elbow angles. Males have slightly thicker and longer legs and arms to accommodate their "hunter-gathering" role; females have a wider pelvis and a larger space within the pelvis to make the whole birthing process possible!

roles of the skeletal system

levers	For motion and restriction of motion
support	The skeletal system is passive and can only move by muscular action. Active systems (such as the muscular system) can only move with the support of the skeletal system.
protection	The simplest example is the ribcage which provides protection for internal organs such as the lungs and heart.
storage	The spongy section of bone is composed of calcium, phosphate and magnesium
blood cell formation	In the bone marrow

structure and function of bone

short		The bone is wider than it is long; tarsals and carpals								
flat		Pelvis								
irregular		Vertebrae								
long	 <p>The bone is longer than it is wide (bones of the appendages); femur, humerus</p>	<table border="1"> <tr> <td>diaphysis</td><td>Cylindrical shaft composed mostly of compact bone surrounding a cavity of bone marrow</td></tr> <tr> <td>epiphysis</td><td>Dilated ends, composed of spongy bone surrounded by a thin layer of compact bone</td></tr> <tr> <td>epiphyseal plate</td><td>Disk of cartilaginous cells separating diaphysis and epiphysis - site of longitudinal growth</td></tr> <tr> <td>periosteum</td><td>Fibrous sheath, surrounds long bone, site of attachment to muscle tissue</td></tr> </table>	diaphysis	Cylindrical shaft composed mostly of compact bone surrounding a cavity of bone marrow	epiphysis	Dilated ends, composed of spongy bone surrounded by a thin layer of compact bone	epiphyseal plate	Disk of cartilaginous cells separating diaphysis and epiphysis - site of longitudinal growth	periosteum	Fibrous sheath, surrounds long bone, site of attachment to muscle tissue
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periosteum	Fibrous sheath, surrounds long bone, site of attachment to muscle tissue									
sesamoid		Patella								

bone tissue

One of the body's hardest structures

60-70% of bone are made of the minerals calcium and phosphate, and the connective tissue collagen

Collagen gives bone its ability to withstand tensile (pulling) loads as well as bone's ductile properties

Minerals give bone brittleness and the ability to withstand compressive loads

Composed of 25-35% water

Wolff's Law

Wolff's Law states that "the form of bone being given, bone elements place or displace themselves in the direction of functional pressure." What does this mean? The general shape and structure of our bones are determined by our genetics (DNA). Bones will continue to grow (hypertrophy) in response to forces applied to them, specifically; bones will atrophy in the absence of force. Bones respond best to compressive forces, while lateral forces may cause the greatest stress and potential damage. Such forces may have the greatest risk in young athletes/individuals, with epiphyseal plate (growth plate) slippage more likely during the years of greatest pre-pubescent growth (between the ages of 11 and 14). Epiphyseal plate slippage may inhibit the growth of bone at a joint, but will not necessarily affect growth of the entire body.



think about it

This is simply an extension of the General Adaptation Syndrome mentioned at the beginning of the chapter. Wolff's Law is just specific to how bones adapt to stress (forces) on them. Soft tissues (including muscles) adapt similarly. This is known as Davis' Law.

architecture of bone

compact/ cortical bone

Dense, compact tissue on the exterior of bone that provides strength and stiffness to the skeletal system.

spongy/ cancellous bone

Lattice-like and having high porosity, it is capable of high energy storage. Found on interior of bones and in the ends of long bones. Made up of small flat pieces of bone (trabeculae) that adapt to the direction of the imposed stress/force on bone.

Resorption and Deposit of Bone

Bone is highly adaptive, self-repairing and can alter its properties and configuration in response to mechanical demand. Wolff's Law states: "Every change in the form and function of a bone or of their function alone is followed by certain definitive changes in their internal architecture, and equally definite secondary alteration in their external conformation, in accordance with mathematical laws." In other words, bone adapts to the mechanical stress placed upon it. Large volumes of bone are removed through bone resorption and replaced through deposit. In young adults, the bone deposits equal the bone resorption, and total bone mass is fairly constant. Weight training will increase the amount of bone deposits. Osteoporosis occurs when bone resorption exceeds bone deposits.

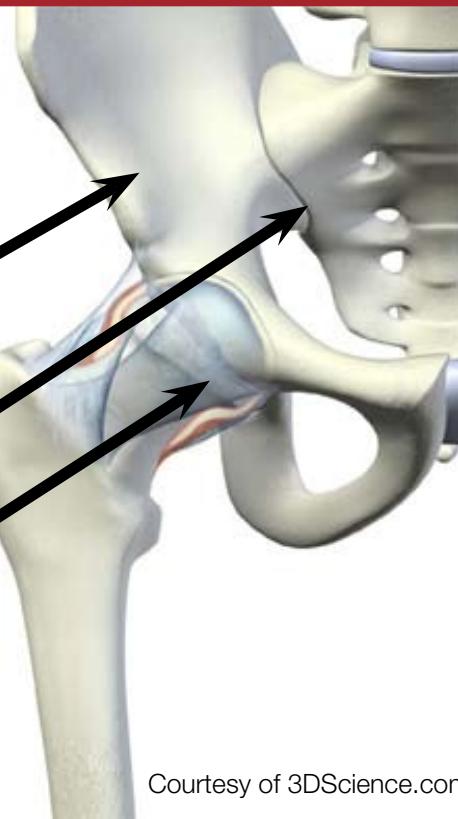
Bones require mechanical stress that is created by physical activity in order to grow and become strong. This stress must be performed on a daily basis. Bone loss following a decrease in activity may be significant without sufficient stress.

Structure and Function of Joints

A Joint is an articulation between two bones, which is used to connect one component of a structure with one or more other components. The design of a joint is determined by its function and the nature of its components. Once a joint is constructed, the structure of the joint will determine its function. Joints that serve a single function are less complex than joints that serve multiple functions. Joint typing is based on the type of materials and the methods used to unite bony components.

EXAM ALERT

What are the basic structure and functions of joints? What are the different types of diarthrodial joints? Be able to give examples of each. What is the Epiphyseal Plate? What is Epiphyseal Plate slippage?



Courtesy of 3DScience.com

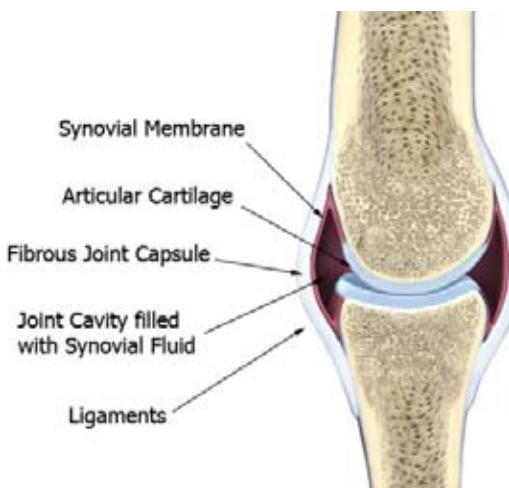
joint types

synarthrodial
immovable joints (pelvis)

amphiarthroses
semi-movable joints
(sacroiliac (SI) & pubis)

diarthrodial
freely movable joints
(hip and knee)

5 characteristics of synovial (diarthrodial) joints



1. Articulating bones are separate (not fused)
2. Held together by a capsule of fibrous connective tissue
3. Joint capsule is lined by a synovial membrane
4. Articulating surfaces are covered by cartilage (usually hyaline), but can be fibrocartilage, such as an atypical synovial joint like the sternoclavicular joint or temporomandibular joint
5. A small amount of synovial fluid can be found between articulating bones.

Articulating bones. Synovial fluid is a liquid that reduces friction in the joint. The synovial fluid changes viscosity (fluid friction) in response to joint movement (this is one of the many reasons for an efficient warm-up prior to exercise).

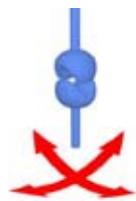
diarthrodial joint type

movement

(Degrees of Freedom are the number of independent movements allowed at a joint)

example

saddle



Two saddle shaped surfaces allowing two degrees of freedom



carpo-metacarpal joint of the thumb

condyloid



Biaxial, one plane of movement that dominates two planes of motion



tibiofemoral joint, Interphalangeal joint

hinge

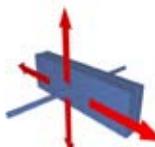


One degree of freedom



humeroulnar

plane “gliding”

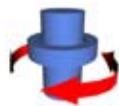


Flat surface that allows translation between two bones



acromio-clavicular joint

pivot

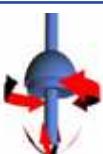


One degree of freedom



atlantoaxial joint

multiaxial



“Ball and Socket;” three degrees of freedom, freely movable, allowing motion in all three planes of human movement



hip joint

positions affecting joint ROM and stability

close-packed

Joint position in which there is maximal contact between two joint surfaces. The majority of ligaments are taut, forcing two bones to act as a single unit. For example, a “locked” (fully extended) knee or elbow is very stable, but is vulnerable to injury due to decreased mobility at either end range of muscular length (excessively short or long).

loose-packed

Joint position with less than maximal contact between joint surfaces and in which contact areas are frequently changing. For the most part, any other joint position that is not close-packed (not locked). Less stable than closed-packed, but not as susceptible to injury due to increased mobility and muscular ability.

forms of joint stabilization during exercise

passive

Internal passive stabilization

- Performed by noncontractile components (ex: Ligaments)
- Needed when there is no anatomical muscular support (ex: lateral knee), physiologically muscular support (i.e. no motor pattern), or during active insufficiency (see Chapter 4 - Biomechanics)

External passive stabilization

- Performed by an outside force (ex: Bench)

active

(generated from muscular systems)

Static

- Achieved by an isometric contraction of various muscular groups to prevent movement at a joint
- While not very functional, it is often required for proper force distribution

Dynamic

- This is stabilization that takes place throughout motion. The prevention of undesirable motions is controlled by dynamic stabilizers in order to maintain relative positions of the appropriate segments.

While muscular injuries are fairly common, joint injuries are often the most devastating, causing long-term problems. Unlike most muscular injuries, joint injuries are more likely to last a lifetime. Hence, it is imperative that trainers understand joint structure and function to prevent the occurrence of such devastating injuries.

characteristics of ligaments

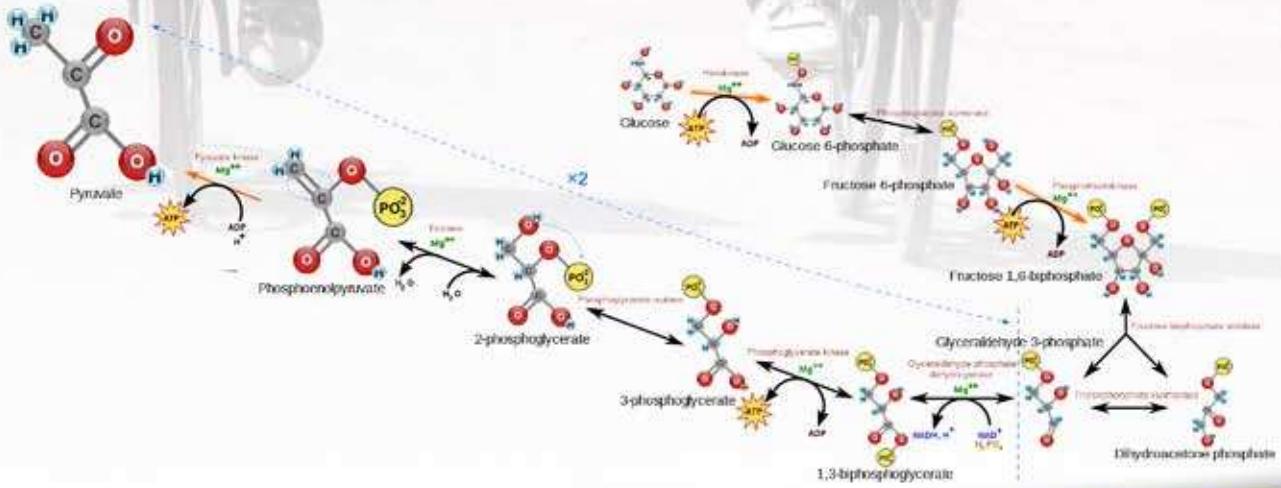
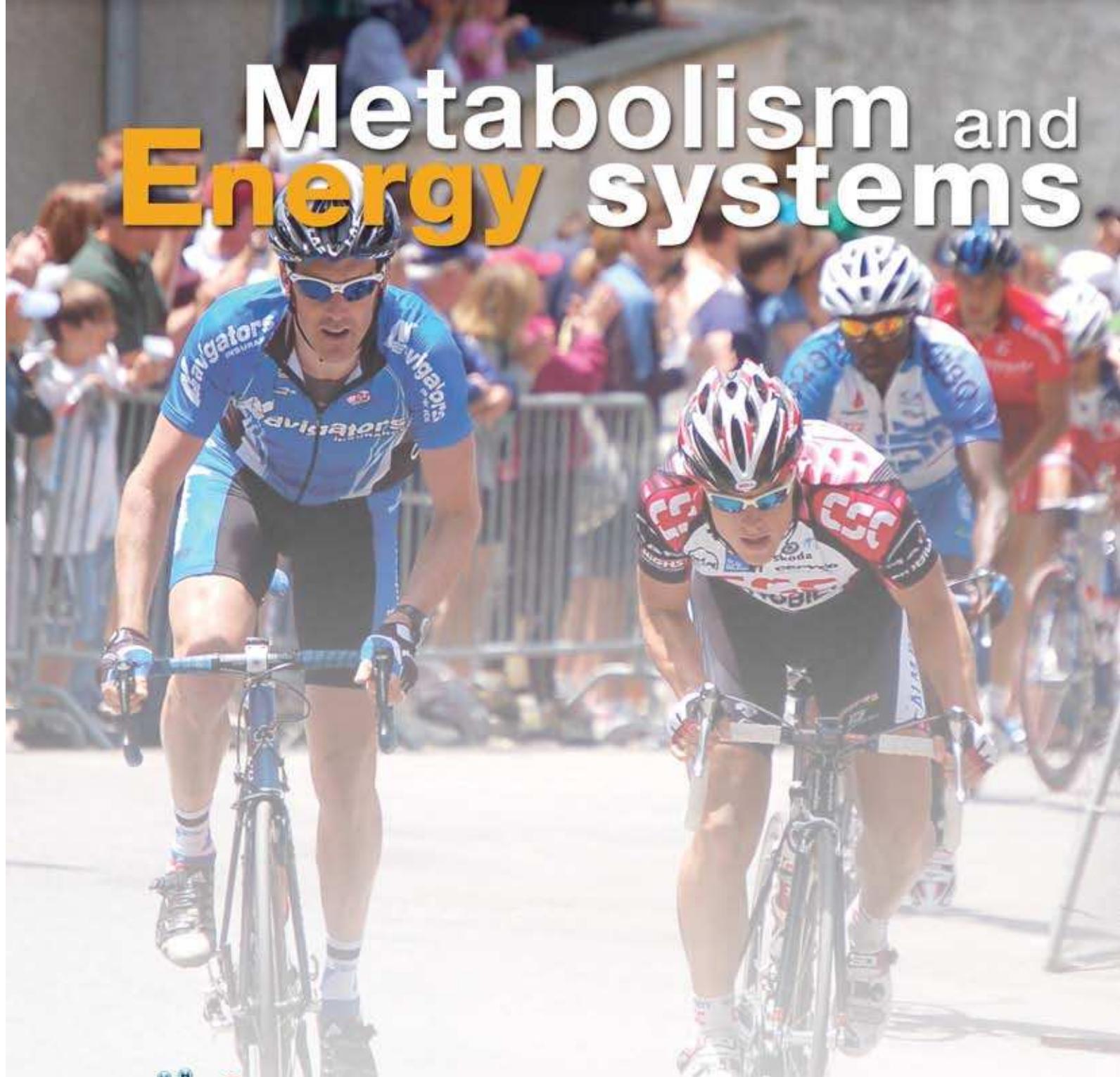
connective tissue that connects bone to bone

comprised of collagen which is arranged to handle tensile and shear loads

maintains contact surfaces at the joint by either limiting or completely preventing “unwanted” (potentially harmful) motion

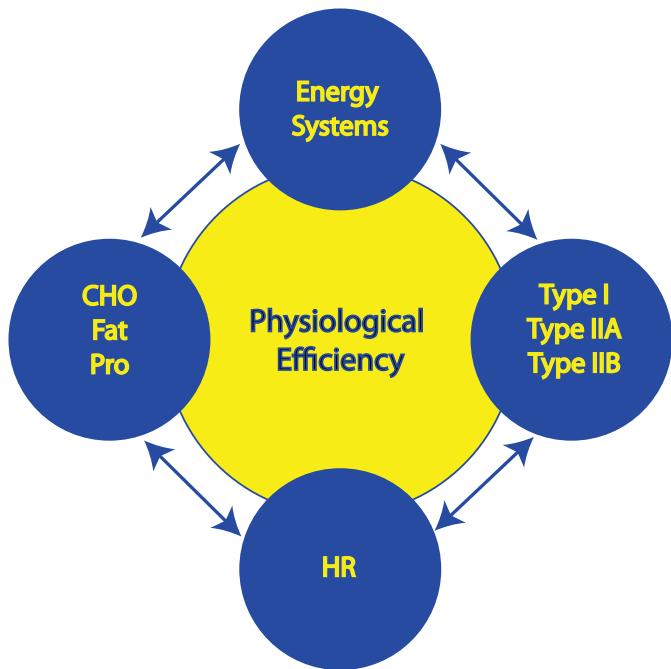
passive stabilizers of the joint which are not meant to be stretched!!!

Metabolism and Energy systems



Metabolism & Energy Systems

The following pages explain how the body obtains and utilizes energy. Why is this important to a personal fitness trainer? All movement and performance comes down to energy. By understanding how the body utilizes energy, we can better understand the fuel sources (carbohydrates, fats, or proteins) utilized during training, which muscle fiber types (Type I, IIA or IIB) are involved, and how to monitor energy systems using heart rate measurement.



What are Energy Systems? While not considered one of the eleven bodily systems, these are the processes the cells that the body uses to convert the chemical energy we get from food to a form chemical energy they body can use (**ATP**). By understanding how we utilize energy (ATP), we will better understand the how to make the body's systems work better with less effort - **Physiological Efficiency**.



Energy

Energy is required by all cells to perform work. Cells have the capacity to convert food (carbohydrates, proteins, and fats) into usable energy. All cells must have a constant supply of energy or work will cease. If a muscle cell doesn't have adequate energy supply (the mechanical energy necessary to perform movement), there won't be any muscular contractions. Work is one form of energy, known as mechanical energy.

In order to achieve a constant energy supply, muscle cells are constantly breaking down molecules into usable forms of energy and utilizing the energy released from these chemical reactions to build and repair tissue. **Catabolism** is the breakdown of molecules and **anabolism** is the synthesis of molecules. Anabolic reactions utilize the energy created from the breakdown of molecules in catabolic reactions for the building process. Both reactions are normal and necessary, but if catabolic reactions are so substantial that repair and synthesis from anabolic reactions cannot occur, injury and illness/disease occur. This is what happens when training is too intense or the right nutrients or rest/recovery is not achieved (**overtraining**).

Energy transfer (since energy cannot be created, merely transferred or transformed) occurs when energy is released from the chemical bonds of molecules (food molecules in this case). The process of removing an electron from a molecule is called **oxidation** (which will often include the addition of oxygen to a substance). The speed of cellular chemical reactions such as oxidation is regulated by catalysts called **enzymes** (cell proteins which are crucial to the metabolic process).

What is a calorie?

There are a variety of ways to express energy. However, the most common measurement in the system, used in the United States, is the calorie. Everyone knows that food contains calories, but few know how to define a calorie. A calorie is a measure of heat. It is the amount of heat needed to raise the temperature of one gram of water one degree Celsius. A calorie is

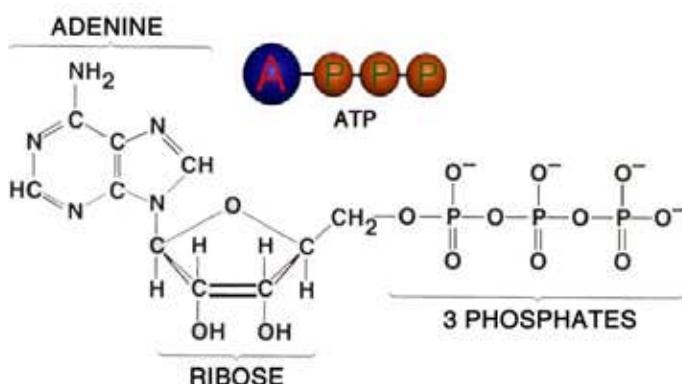
such a small unit of energy, it is often referred to as a kilocalorie (which is equal to 1,000 small calories because kilo = 1000) and is commonly abbreviated “kcal”. The “calories” on food labels are actually kilocalories.

What is a kilojoule (kJ)?

The term kJ is not often used in the United States, but is more common in other parts of the world and is actually the proper unit for energy in the International Unit System. 1 kcal is equivalent to 4.2 kJ.

Adenosine Triphosphate

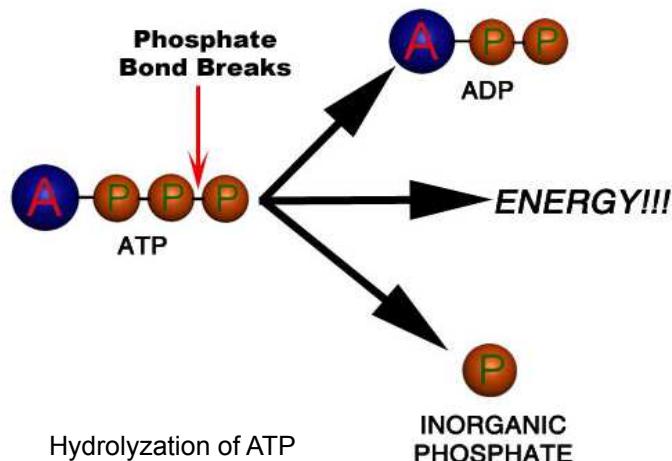
The immediate source of energy for muscular contractions is **adenosine triphosphate (ATP)**. Without sufficient amounts of ATP most cells die quickly. ATP is formed when **adenosine diphosphate (ADP)** and an **inorganic phosphate** are combined. This process of combining these phosphates requires a large amount of energy. For this reason, approximately 60% of the energy from food is converted to thermal energy during the process of ATP formation and only about 40% of the actual energy from food is converted to ATP.



ATP is the muscle's primary energy source, just as gasoline is the energy source for an automobile. How quickly and efficiently a muscle cell produces ATP will be a determining factor of how much work the cell can perform before it fatigues.

By understanding how we get our energy (ATP), we can better understand the benefits we can achieve being properly fueled for physical activity.

While there is some ATP stored within a muscle cell, the supply is limited (enough for 2-4 seconds of muscle action). Therefore, muscle cells must be able to produce more ATP in order to continue working. Energy is released when an ATP molecule is broken into an ADP molecule and an inorganic phosphate.



Since muscle cells can only store a limited supply of ATP, and they require a constant supply of ATP to function, various metabolic pathways must exist to produce ATP quickly or cell death, not just poor functioning, will occur. ATP must be regenerated by reactions that add the phosphate back to ADP (the reverse reaction of the image above). Muscle cells replenish the ATP supply using three distinct biochemical pathways. ATP in muscle cells can be formed through a combination of phosphocreatine (PC) breakdown, glycolysis (glucose or glycogen breakdown), and oxidation (which is inherently aerobic as oxidation requires oxygen).

Anaerobic processes do not require oxygen for reactions while **aerobic** processes utilize oxygen in the processes of breakdown and synthesis. All anaerobic processes occur in the sarcoplasm (the cytoplasm/cell fluid of the muscle cell). All aerobic processes (utilizing the oxidative/aerobic energy system/metabolic pathway) occur in the mitochondria of muscle cells. The *intensity* and *duration* of activity will determine which energy system/metabolic pathway is dominant at any particular time.

The word “aerobic” means “with oxygen” (originally coined by Louis Pasteur, “living only in the presence of oxygen,” 1884, from the Greek, aero- “air” and bios “life”).



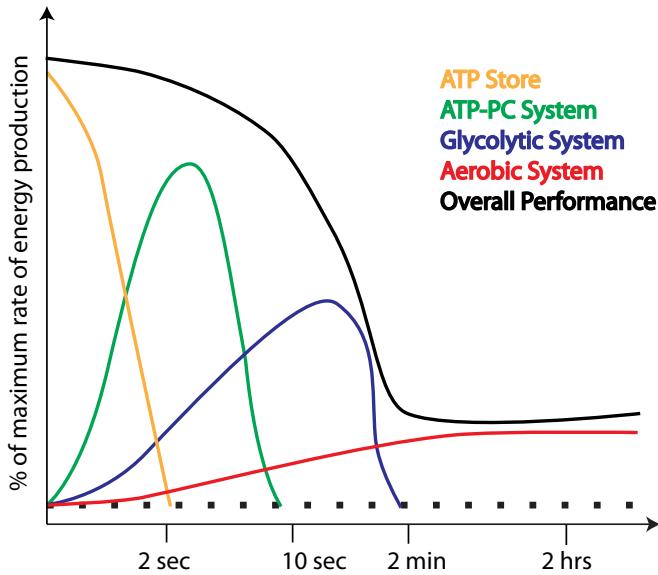
think about it

ATP is the main fuel source for the body, just as gasoline is the main fuel for your car. We do not get 87 octane "straight from the ground", we refine it from "crude oil". ATP is "refined" from food – proteins, carbohydrates, and fats. Muscle fibers cannot directly convert the chemical energy obtained from proteins, carbohydrates or fats into mechanical energy to perform movement.

Aerobic and Anaerobic Energy Systems

When muscles need energy, ATP is **hydrolyzed** (broken down with H_2O) rather quickly to provide the needed energy, and ADP and inorganic phosphate (P_i) are produced. In order to continue to supply muscles with energy, ATP must be reformed by combining ADP and P_i . The following sections explain the various systems whereby the body regenerates ATP. ALL of these systems are working in the body at ALL times. It is important for the personal fitness trainer to understand which system is **dominant** at a particular time.

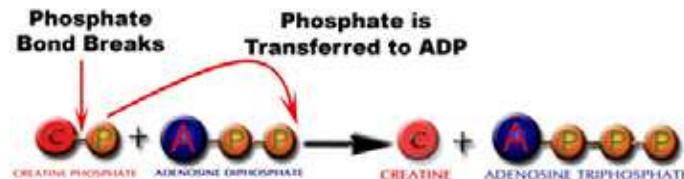
The aerobic energy system for producing ATP is dominant when adequate oxygen is delivered to the cell to meet energy production needs, such as when the muscle is at rest. However, as work



by the body increases (such as during exercise), oxygen cannot be delivered quickly enough to the working muscles. The muscles must then rely on other processes which do not require oxygen (anaerobic) to gain their ATP (energy).

Anaerobic Pathway I: ATP/PCr System (a.k.a. "Phosphagen System")

The first anaerobic ("without oxygen") source of ATP is known as *Phosphocreatine* (PCr, also known as Creatine Phosphate). Phosphocreatine functions as a site of storage of high energy phosphates in muscle (the amount of PCr is proportional to the muscle mass). PCr itself cannot be used as an immediate source of



energy, but can rapidly replenish ATP.

ATP stored in the muscle is the primary provider of energy for muscular contraction at the onset of exercise (for less than 5 seconds) and during short-term, high intensity exercise (for less than 5 seconds at maximal intensities of effort). Like ATP, only a small supply of PC is stored within muscle cells (approximately 80-100 grams of ATP can be stored at one time with concentrations of PC being about 4-6 times greater). PC stores can supply energy at near maximal intensities of effort for up to about 8 seconds. After about 8 seconds of maximal to near maximal effort, the ATP-PC energy production system is no longer the dominant energy system.



This process does not involve oxygen so the ATP-PC energy system provides an anaerobic energy supply. Once PC stores are depleted (ATP cannot be completely depleted or the cell(s) would die), the reformation of PC requires ATP and can only occur during rest.

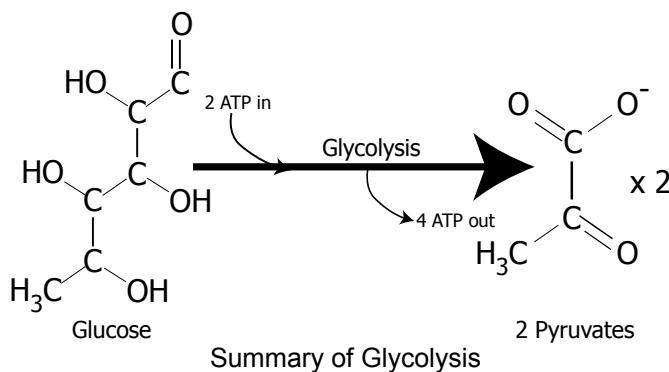
Approximately 70% of ATP is reformed after 45-60 seconds of complete rest from high intensity activity and 100% of ATP is reformed after 2-3 minutes of complete rest. The greater the effort that is required, the more rest is needed between efforts in order to allow time for the reformation of ATP and PC within muscle cells.

As an example, PC provides much of the energy for a 100m sprint or nearly all of the energy during a single explosive jump or burst of speed. The ability to perform repeated exercises or movements at near maximal effort is largely dependent on PCr stores. For some clients, enhancing PCr stores through creatine monohydrate supplementation can increase the amount of work that can be performed in repeated efforts at high intensity.

Beyond the first few seconds of near maximal exertion or after the first few seconds of activity, the phosphagen and glycolysis energy systems share in the energy production process (between 6-45 seconds of intense exertion).

Anaerobic Pathway II: Glycolysis

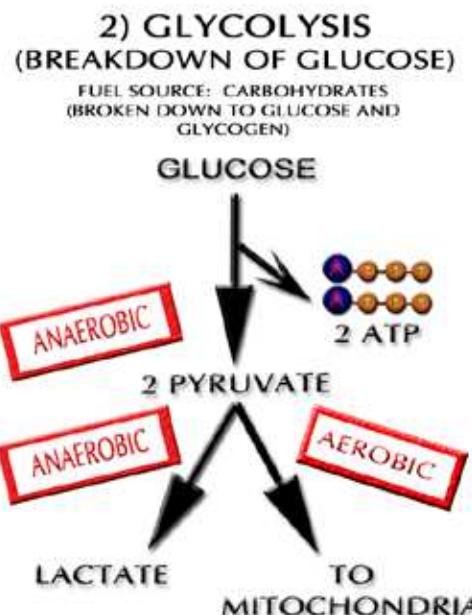
The second metabolic pathway is known as *glycolysis* (anaerobic), and is capable of producing ATP quickly without oxygen (glyco = “relating to sugar”; lysis = “breakdown”). Glycolysis involves the breakdown of glucose (a sugar, specifically a monosaccharide) or glycogen (polysaccharide) in a multi-step process into pyruvate. Pyruvate can then either be converted to lactate for more immediate energy usage at higher intensities or be transferred into the mitochondria of the cell during lower intensities of exercise.



The process of glycolysis actually requires ATP (2 molecules) in order to complete the transfer of energy from glucose to rejoin an inorganic phosphate with ADP and results in more ATP (with a net gain of two more ATP if the conversion involves the simple sugar glucose and three ATP if it involves the starch glycogen) being made available for use.

Glycolysis is the primary provider of energy for muscular contraction during moderately high intensities of effort and moderate duration (from about 45 seconds to about 2 minutes) efforts. The glycolytic energy system becomes involved at about 9-10 seconds into an exercise and will actually have some involvement in energy production until about 10 minutes of exercise duration has elapsed. This is the predominant energy system involved during most strength training workouts, as most sets will last between the 45 seconds to 2 minute time frame.

Glycolysis is sometimes referred to as anaerobic (fast glycolysis) and aerobic (slow glycolysis) to differentiate the fast resynthesis of ATP when pyruvate is converted to lactate (anaerobic or fast glycolysis) from the slow conversion when pyruvate is shuttled into the mitochondria of the cell before undergoing the Krebs Cycle (aerobic glycolysis). However, as glycolysis does not involve oxygen, these terms are not practical for describing the process.

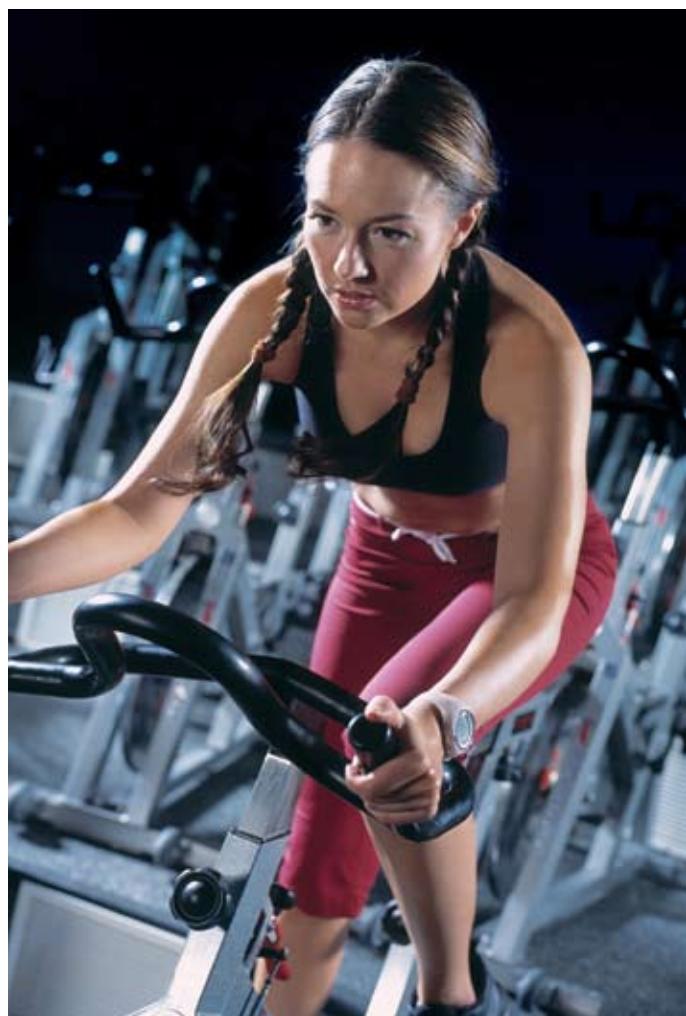


Lactate Threshold and the Onset of Blood Lactate Accumulation during Glycolysis

As the level of intensity of exercise increases, the body reaches a point where the level of oxygen within the cell's mitochondria is not sufficient. Since there is not enough available oxygen, the pyruvate produced by glycolysis cannot be oxidized. Furthermore, since energy production must continue, ATP production from glycolysis must increase.

For glycolysis to continue to produce ATP, certain compounds that were "used up" (i.e. reduced) in glycolysis must be regenerated (i.e. oxidized) so that the process can continue. For this to happen the excess pyruvate is reduced to lactate. Lactate production begins to occur at a rapidly increasing rate (due to maintaining a high level of intensity for either seconds or minutes, depending on conditioning). This point is known as the **Lactate Threshold (LT)**. Note: this is also often referred to as the **Anaerobic Threshold (AT)**. The only essential difference between the lactate and anaerobic threshold is that the lactate threshold is measured through blood concentrations of lactate and the anaerobic threshold is measured by a ventilatory (gas exchange) test.

Lactate accumulation in the blood is signal that there is not enough oxygen getting to the working muscles (i.e. "going anaerobic"). During energy production, there are several reactions that cause a release of a hydrogen ion (H^+). This causes a decrease in blood pH (i.e. making the blood more acidic). Without going into detailed biochemistry, when the body is "aerobic" it uses buffering capabilities so that the pH of the blood does not go down. However, when there is not enough oxygen being supplied to the working muscles, muscle acidosis can begin. The "burning" sensation in muscles is attributed to this muscle acidosis and correlates to the accumulation of lactate. The point where so much lactate accumulates that exercise intensity is forcibly decreased (due to muscle acidosis induced fatigue) is known as the **Onset of Blood Lactate Accumulation (OBLA)**.



Why is this important? These values (LT, AT, OBLA) attempt to find the point where an athlete will "redline". The athlete who can delay acidosis the longest typically wins the race. High lactate values increase injury risk due to the disturbance of coordination capacity because the affected muscle(s) is (are) unable to sufficiently contract.

At rest, it takes about 25 minutes to remove 50% of the accumulated lactate and muscle acid, and about 75 minutes to remove 95% of the buildup. Lactate will either be converted back to glucose in the liver at rest (gluconeogenesis), excreted in urine or metabolized for fuel by other organs (brain, heart or other muscles).

If sufficient rest/recovery between intense workouts is not achieved there may be severe damage to muscle cells. This damage may take days or weeks for full repair, which results in lost performance and training time. More benefits of understanding both AT and LT are described later in this chapter.



Think about it...

So, whatever happened to lactic acid? Science used to attribute the “burning” in muscles to lactic acid. When working at high intensities, scientists saw that there was an accumulation of lactate and hydrogen ions (causing muscle acidosis). The theory was that

pyruvate was reduced to lactic acid (not lactate) and that as soon as it is released in the blood, it separates into lactate and H⁺ (hydrogen) molecules. We now know that lactate does NOT CAUSE muscle acidosis, but the onset of lactate CORRELATES to acidosis.

So how does this fact affect training? Not much. We can still use the lactate threshold to determine when an individual is going “anaerobic” and starting to “redline”.

Aerobic Pathway: Aerobic Glycolysis and Oxidative Phosphorylation

Most cells, including muscle cells, contain structures called **mitochondria**. The mitochondria are the sites of cellular aerobic energy production (also known as **cellular respiration, aerobic oxidation** and **oxidative phosphorylation**). Larger numbers of mitochondria in a cell lead to a greater capability for aerobic energy production. Therefore, cells with larger numbers of mitochondria have a greater aerobic capacity and are more resistant to fatigue.

The third pathway for producing ATP involves oxygen. This oxidative phosphorylation (utilizing oxidation and adding a phosphate) or aerobic metabolic pathway utilizes both the Krebs cycle and the electron transport chain.

The Krebs cycle involves a series of chemical reactions to help convert macronutrients (carbohydrates, proteins, and fats) into usable energy (ATP). Oxygen is not involved in the Krebs cycle but it is involved at the end of the electron transport chain (a chain of molecules involved in the aerobic production of ATP). The Krebs cycle removes hydrogen molecules from the ingested macronutrients so that these hydrogen molecules can be used to complete the electron transport chain along with oxygen, an inorganic

phosphate, and ADP to form ATP. This process will form a net gain of two more ATP molecules to be used for energy (the process also involves two carrier molecules known as NAD and FAD which transport the hydrogen molecules). During the activation of the electron transport chain in the aerobic production of ATP free radicals are formed.

Free radicals are molecules that now have an unpaired electron as a result of the oxidative phosphorylation or from the aerobic production of ATP. Free radicals are highly volatile and reactive and will bind quickly to other molecules and damage the cells they contact. The number of free radicals produced is directly linked to the rate of aerobic metabolism (which is dependent upon the conditioning level of the individual combined with the current exercise intensity and duration).

The breakdown of fat to yield ATP is known as **lipolysis**. Fat is the most abundant energy source available to the muscle, and the predominant energy source used during the aerobic oxidation phase of energy production. Although there is a virtually unlimited supply of fatty acids in humans, the rate at which the body can metabolize them is the limiting factor in obtaining ATP.

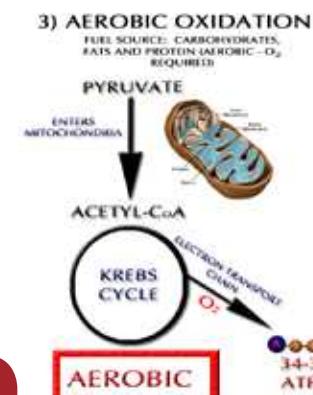
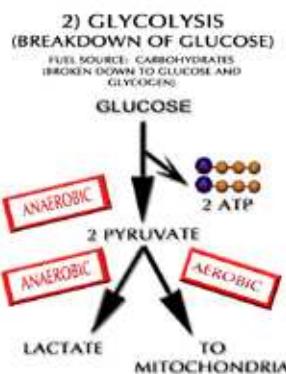
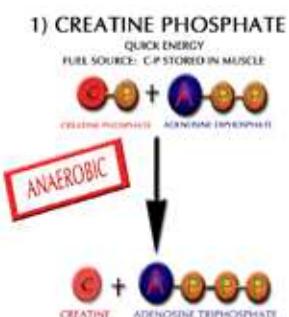
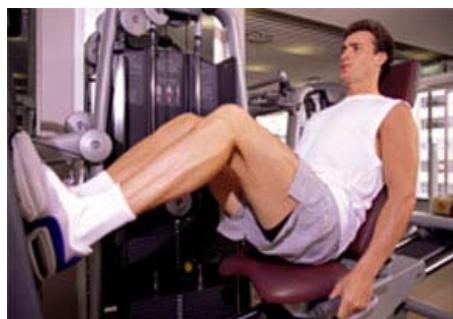
Lipolysis is the primary source for energy production during rest and low level activity. But, its input to the overall muscular energy supply will decrease as the intensity of muscular contraction increases. When lipolysis is unable to meet the increasing energy requirement of exercise (it is too slow to supply enough energy), stored glycogen from both the liver and muscles is used. Once glycogen depletion occurs, exercise intensity will decline.

All exercise intensities (including rest or no activity) that can be maintained for 2 minutes or longer utilizes the oxidative system for energy production. Once approximately 10 minutes of continuous exercise has elapsed, glycolysis is no longer significantly involved in energy production and the oxidative energy system supplies almost all cellular energy for the muscles.

Energy Supply During Varying Intensities and Durations of Muscular Activity

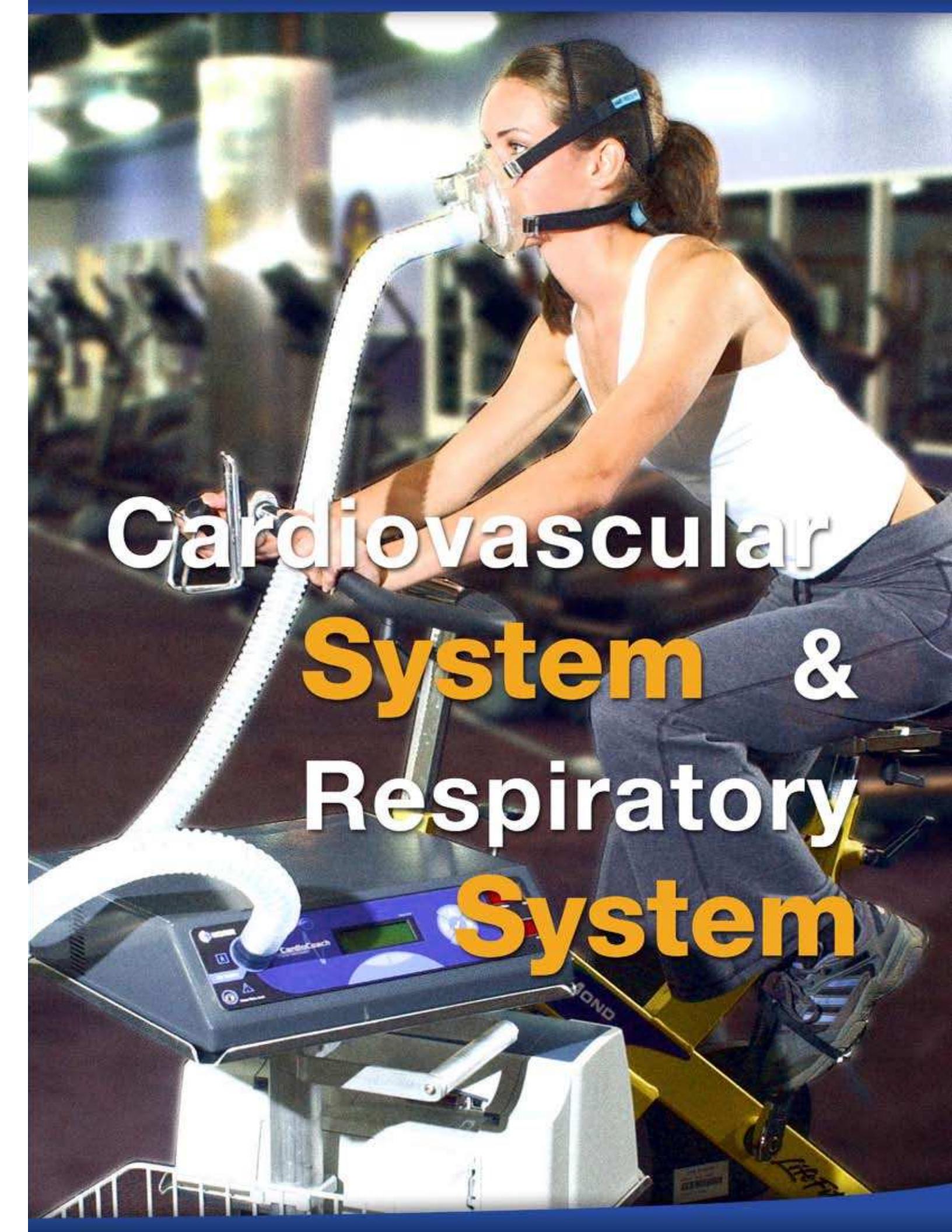
Activity Duration	Aerobic or Anaerobic?	Primary Energy Supply	Secondary Energy Supply	Intensity of Effort (Approximated)
1-5 seconds	Anaerobic	ATP	N/A	Maximal
6-8 seconds	Anaerobic	CP	ATP	Near Maximal
9-45 seconds	Anaerobic	Glycolysis	ATP, CP	High
45-120 seconds	Anaerobic	Glycolysis	N/A	Moderately High
2-4 minutes	Anaerobic + Aerobic	Aerobic Oxidation	Glycolysis	Moderate
4 minutes and beyond	Aerobic	Aerobic Oxidation	N/A	Moderate to Low

* Note: N/A refers to dominance of the primary energy system (other systems are always involved to a lesser degree at all intensities and durations of muscular activity)



EXAM ALERT

What is ATP? What are the 3 different energy systems? Lactate is a byproduct of what energy system? What is “aerobic exercise”?

A woman is exercising on a stationary bike in a gym setting. She is wearing a white tank top and dark leggings. A metabolic gas analyser mask is fitted over her nose and mouth, connected to a device on the bike. The background shows other gym equipment and people working out.

Cardiovascular System & Respiratory System

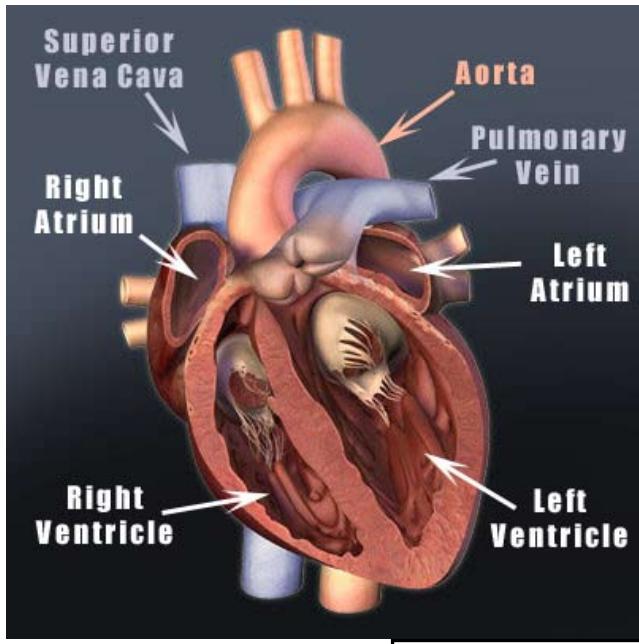
The Cardiovascular System

The cardiovascular (CV) system has many roles in the support of other bodily systems as it transports respiratory gases, nutrients, and wastes to and from cells. It also maintains body temperature, prevents dehydration and infection.

Primary Roles of the CV System	Example
Delivery	O ₂ and nutrients
Removal	CO ₂ and wastes
Transport	Hormones
Maintenance	Body temperature
Prevention	Infection

The components of the cardiovascular system include **blood**, **blood vessels**, and a muscular four-chambered **heart**. These chambers are the right and left **atria (atrium)**, and right and left **ventricles**.

The Heart



The heart is the driving force of the circulatory system (the blood and lymph distribution network) and it functions two separate pumping organs. The right side performs pulmonary circulation (blood flow from the body to the lungs) and the left side performs systemic circulation (blood flow from the lungs to the body). The right side of the heart pumps deoxygenated blood into the

lungs through the pulmonary arteries from the right ventricle, and oxygenated blood returns to the left atrium through pulmonary veins to the heart. Oxygenated blood is then pumped into the aorta, which branches out into the arterial system, to the arterioles and then to the microscopic capillaries. The capillaries come into direct contact with cells of the body for exchange of gases, nutrients, and waste. Capillaries then converge into venules, then into the larger veins to reverse the process. Venous return is the process of bringing deoxygenated blood back to the right atrium of the heart (from the lower body through the inferior vena cava and from the head and neck through the superior vena cava). The heart muscle itself is oxygenated by the coronary arteries, and deoxygenated blood returns to the right atrium through the coronary veins and the coronary sinus.

The atria of the human heart are thin-walled, and ventricles are muscular (the left side more than the right side because it powers systemic circulation). The heart also has two distinct valve systems. The atrioventricular valves are located between the atria and the ventricles to prevent backflow. The right side is the tricuspid valve and the left side is the mitral/bicuspid valve. The semilunar valves (the aortic valve and the pulmonary valve) each have three cusps and are located in the aorta and pulmonary artery, again, to preventing backflow into the heart.

Blood pressure measures the contractions of the heart occurs in two alternating ventricular phases, which make up the heartbeat. The systolic phase is cardiac muscle contraction, whereby the ventricles contract, pushing blood

By understanding the cardiovascular system, we will...

- Understand how and why to monitor heart rate during exercise
- Understand the rationale of proper program design for individuals with cardiovascular risk factors
- Understand the principles of endurance training for various athletes
- Understand how proper heart rate is important for increasing fat loss and decreasing muscle atrophy

away from the heart (1st part of heartbeat). The diastolic phase is cardiac muscle relaxation. When performing a blood pressure reading, this is a measure of the pressure on the arterial walls during ventricular filling (2nd part of heartbeat).

Blood



Blood delivers oxygen and nutrients to the tissues of the body and removes carbon dioxide and waste products. On average, the human body has four to six liters of blood. Blood is 55% liquid (plasma, aqueous mixture of nutrients, salts, respiratory gases, wastes, hormones, and blood proteins) and 45% cellular (erythrocytes, leukocytes and platelets) base.

Blood Vessels

Blood vessels are the “tubes” through which blood circulates in the body. There are three types of blood vessels.

arteries 	Thick-walled, muscular, elastic vessels that conduct oxygenated blood away from the heart (except pulmonary arteries which pump deoxygenated blood).
veins 	Thin-walled, inelastic vessels which conduct deoxygenated blood towards the heart (except pulmonary veins which pump oxygenated blood). Much blood flow within the veins depends upon compression of skeletal muscles during movement.
capillaries 	Very thin walls composed of a single layer of epithelium across which respiratory gases, nutrients, enzymes, hormones and wastes readily diffuse or exchange gases.

Blood Pressure

Blood pressure (BP) is a measure of the force that blood exerts on the walls of the blood vessels (measured with a sphygmomanometer, and expressed by systolic pressure/diastolic pressure). Normal resting blood pressure is considered to be approximately 120/80 mm/hg. High blood pressure is 140/90 mm/hg or higher. If the systolic pressure is high and the diastolic pressure is normal (or vice versa), BP is still considered to be high. As blood flows through the circulatory system, blood pressure gradually drops. During intense exercise, blood flows outward to the periphery (limbs) of the body. When exercise is stopped abruptly, blood can potentially pool in the extremities; it is slow to return to the heart and brain, leaving the individual feeling light-headed or dizzy. These symptoms are suggestive of what is called *venous pooling* and is a dangerous situation. Blood pressure decreases dramatically and oxygen cannot effectively be delivered to the heart and brain. During exercise, an increase in blood pressure occurs when an individual performs an intense exercise or lift and holds their breath by closing the glottis of the throat in an attempt to briefly increase muscular power. In reality, any increase in muscular power is a result of all muscles of the body voluntarily becoming more tense, making it difficult to breathe properly. This is known as the Valsalva maneuver and is not recommended.

EXAM ALERT

What is blood pressure? What are the different phases? What is considered normal? What is considered high? What is the Valsalva maneuver? What happens when exercise is abruptly stopped?

Heart Stimulation

Similar to skeletal muscles in the body, when just one heart muscle cell is activated by the nervous system, the **action potential** (electrical signal from nervous system for muscle contraction) is spread to all of the other heart muscle cells. This process allows the atrial or ventricular muscle

to contract and to then effectively pump blood. Action potentials in cardiac muscle specialize in maximizing the pumping function of the heart. These action potentials last 10 to 30 times as long as those of skeletal muscle and cause a correspondingly increased period of contraction over skeletal muscle.

Heart rate (HR) is determined by the rate of discharge of the autorhythmic pacemaker cells located in the **sinoatrial (SA) node**. The SA node, located in the right atrium is the pacemaker for the heart. The sinoatrial node spreads electrical impulses through both atria making them contract simultaneously. The impulse arrives at the **atrioventricular (AV) node** which conducts slowly (allowing both ventricles to fill with blood). Then the impulse is carried by the AV bundle (Bundle of His) which branches left and right, through the Purkinje Fibers, in the walls of both ventricles, to generate a strong contraction. Normal resting heart rate is in the range of 60-80 bpm (beats per minute).

If the system that either regulates or performs heart stimulation is damaged, it may send unreliable messages to the heart chambers. Symptoms of a damaged heart may include irregular heart rate, tiredness, dizziness, and loss of consciousness. A client with these symptoms may use a pacemaker, which is an implantable device for a severely damaged heart that mimics the actions of the nodes and conducting system, and helps to regulate the heart rate. The good news for clients who may have this condition is that evidence has shown that human heart muscle regenerates, to some degree, by muscle cell replication following cardiac injury.

EXAM ALERT

What is RHR? THR? HRH? MHR? How is each determined? Be able to use the Karvonen equation.

resting heart rate (RHR)	As the term implies, it is the heart rate at rest. Ideally, this is measured first thing in the morning upon waking. However, it can be estimated after at least 5 minutes of quiet rest (as long as there have been no extraneous factors that would increase heart rate such as just completing strenuous activity or consuming a stimulant such as caffeine). A RHR with an increase of more than 8 bpm combined with fatigue and lack of interest in training may indicate the onset of illness. Illness will also raise known exercise HR by 10 bpm or more compared to normal.
maximum heart rate (MHR)	Once again, as the term implies it is the maximum number of contractions the heart will beat in one minute. This is reached through maximum physical exertion. While not measured directly by a personal fitness trainer (only specialized medical personnel can conduct a MHR test), it can be estimated through a variety of methods.
heart rate reserve (HRR)	Heart rate reserve is the difference between MHR and RHR. This is where training takes place. Trained athletes can achieve 4-5x their RHR while untrained individuals only reach 2-3x RHR.
target heart rate (THR)	Ideal heart rate intensity during exercise. This is determined by the personal fitness trainer and based on the client's current abilities and goals. Usually calculated as percentage of VO_{2max} (see aerobic capacity) or percentage of HRR.
recovery heart rate	The post-effort drop in heart rate. The more fit the individual, the quicker the cardiovascular system recovers after effort.

Heart Rate (HR)

Heart rate (HR) is the measure of how many contractions (beats) of the heart are in one minute (calculated as beats per minute, bpm). It is the primary method of measurement that a personal fitness trainer will use to program and monitor exercise intensity. The following is a list of important heart rate measurements (or metrics) that a personal fitness trainer will utilize (either by direct calculation or estimation).

resting heart rate (RHR)

Normally between 60-80 bpm, but this varies and can be much lower in athletes

heart rate reserve (HRR)

Training Heart Rate
(THR) = 50-85% HRR
(50-85% VO₂R)

max heart rate (MHR)

100 bpm

200 bpm

Measuring Heart Rate

In personal training environments, the most accurate and effective way of measuring heart rate is accomplished by using a Polar heart rate monitor. The monitor measures the electrical signals that cause the heart to contract. Hence, it measures heart rate directly and more accurately than that of the pulse method (see below). Furthermore, unlike the pulse method the client does not have to stop their exercise to determine their heart rate

measuring HR with the Polar FT60



- 1.** Wet the electrode areas of the strap under running water (we recommend warm water) and make sure they are well moistened.
- 2.** Attach the connector to the strap. Adjust the strap for a snug and comfortable fit.
- 3.** Wrap the strap around your torso, just below your chest and attach the hook to the other end of the strap.
- 4.** Check that the electrodes are firmly against your skin and that the Polar logo of the connector is upright and in the middle of your chest.
- 5.** Start heart rate measurement by pressing the OK button (middle button on the right of the watch). It is best if there are no other heart rate monitors nearby (within 3ft), to avoid interference.

POLAR
LISTEN TO YOUR BODY



To determine whether the client is exercising within their target heart rate range without a Polar heart rate monitor, exercise must stop briefly in order to properly measure pulse. The pulse (HR) can be taken at the neck, the wrist, or the chest. It is recommended to take the pulse at the wrist (radial artery). Taking the pulse at the chest or neck can be inconsistent. The radial pulse is taken on the artery at the wrist in line with the thumb. Place the tips of the index and middle fingers over the artery and press lightly. Do not use the thumb (it has a pulse of its own). Take a full 60 second count for the most accurate measurement, or count 30 seconds and multiply the measurement by two. Start the count when the first pulse is felt, which is counted as "zero."

What is VO₂max?

In order to understand the concept of VO₂max (aerobic capacity), the personal fitness trainer must understand a few important exercise physiology concepts.

Cardiac Output

Cardiac Output (Q), also sometimes noted as CO, is quite simply a measure of how efficiently the heart is able to deliver oxygen to all tissues. Cardiac Output is the total amount of blood the ventricles pump from the heart per minute. This is equal to the heart rate (HR, rate at which heart works in beats per minute) x stroke volume (SV, amount of blood ejected).

$$Q = HR \times SV$$

At rest, the heart pumps out about 10ml of blood per beat (stroke volume) and about 10 pints per minute (cardiac output). Generally, a high stroke volume and low heart rate are desired.

Arteriovenous Oxygen Difference

Arteriovenous Oxygen Difference (a-vO₂), also sometimes noted as AOD, is the measure of how efficiently tissues extract the oxygen being delivered by the cardiovascular system. a-vO₂ is the difference between the oxygen content of arterial blood versus the oxygen content of venous blood.

Aerobic Capacity

Aerobic capacity, also known as VO₂max, is the most common measurement of cardiopulmonary fitness. VO₂max is a measure of the maximum oxygen consumption (transport and use of oxygen) during maximal effort lasting longer than 2 minutes and shorter than 5 minutes. VO₂max measures how efficiently the cardiopulmonary system is able to *deliver* oxygen to the tissues (Cardiac Output) and how readily the tissues are able to *utilize* the oxygen (Arteriovenous Oxygen Difference).

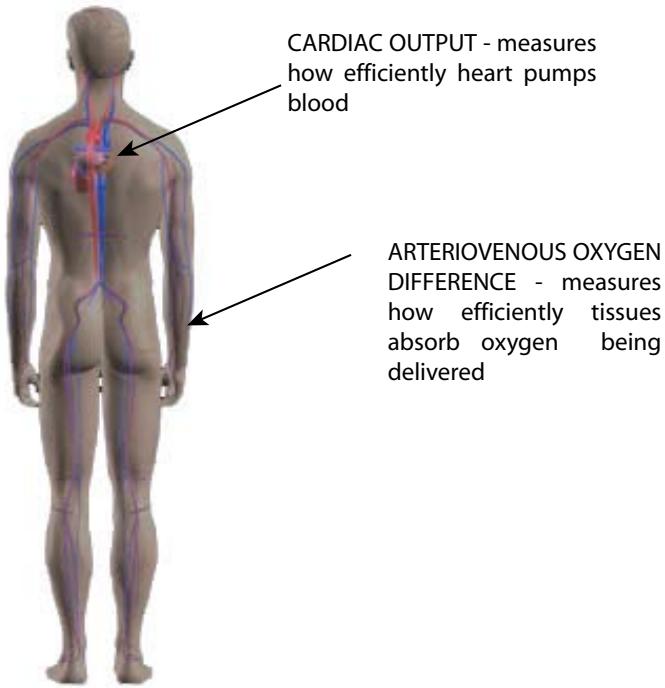
$$VO_2\text{max} = Q \times a-vO_2$$

This is expressed in liters of O₂ per minute. In terms of cardiopulmonary fitness, the greater the VO₂max the better.

During exercise, it is important to work at the appropriate intensity level, according to current ability, conditioning, age, training stage and individual goals. Intensity of cardiovascular exercise should be based on oxygen consumption (VO₂) where both the delivery system (cardiac output) and the oxygen consumption of the muscles (a-vO₂) are challenged when overloaded. This value can be measured using a VO₂max test or a submaximal test. That said, unless you are training in a laboratory, you won't be measuring your client's oxygen consumption. Therefore, NESTA recommends programming cardiovascular intensity based on Heart Rate (HR).

VO₂MAX - measure of cardiopulmonary fitness. It is the maximal amount of oxygen the body can obtain and utilize.

CARDIAC OUTPUT X ARTERIOVENOUS OXYGEN DIFFERENCE



During aerobic exercise, heart rate varies with oxygen consumption in a linear manner. In other words, if a certain intensity of cardiovascular training (VO₂) causes a client's HR to go up by 10 beats per minute (bpm), then something that doubles the VO₂ increase will also double the HR increase (to 20 bpm).

All of these factors must be taken into consideration when determining the ideal Target Heart Rate (THR) range for cardiovascular (CV) exercise. Target Heart Rate is the ideal heart rate maintained while exercising to receive the maximum cardiovascular benefit with minimum risk to healthy tissue.

To accomplish this, the key is to maintain ones' THR (or range) for at least 20-60 minutes, 3-5 times a week. Less than 3 days per week may not be suitable for improving cardiorespiratory fitness (although it may help maintain a moderate level of fitness). More than 5 days per week will usually provide diminishing returns of improvement for the extra time and effort expended and should only be programmed when a specific endurance athletic event or sport specific training of CV exercise is the goal. That said, more than 5 days per week can lead to overtraining and/or orthopedic problems.

Heart Rate Variability

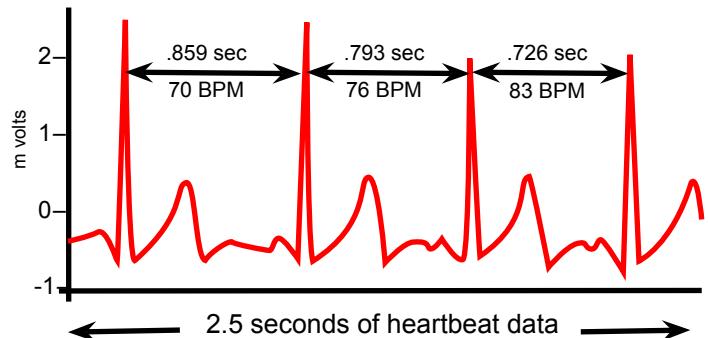
Heart Rate Variability (HRV) is a measurement of heart rate response timing with beat to beat measurement. The HRV provides information about the quality of the body's cardiovascular response.

The heart reacts continuously to signals from the body and the environment. The HRV of a healthy person is strongest at rest. The heart rate for this person may vary considerably. At the start of activity HRV lowers and with intense effort varies very little and becomes quite steady (also known as "steady state"). In other words, the timing between beats of the heart is expected to vary more at rest than while exercising. However, just like the efficient resting heart rate, the exercise heart rate will vary more frequently during exercise with an extremely fit individual. Irregular heartbeats at rest are quite normal and doctors can often pick up on this irregular heartbeat at the doctor's office (especially with well-conditioned athletes). Only when coupled with other cardiovascular risk factors, is an irregular heartbeat considered to be a health risk or concern.



think about it

The heart is constantly getting signals from the body to tell it how much blood it needs to pump. A fit heart is like a fine-tuned sports car. When driving through the city (like at rest), you are constantly shifting gears to adjust for the different needs (like the variability of heart rate). However, when you get on the freeway (intense exercise) you can shift into "high gear" and stay there. This is why athletes show more heart rate variability - they are like the fine-tuned sports car, while untrained individuals show less variability - they need a tune-up (i.e. exercise).



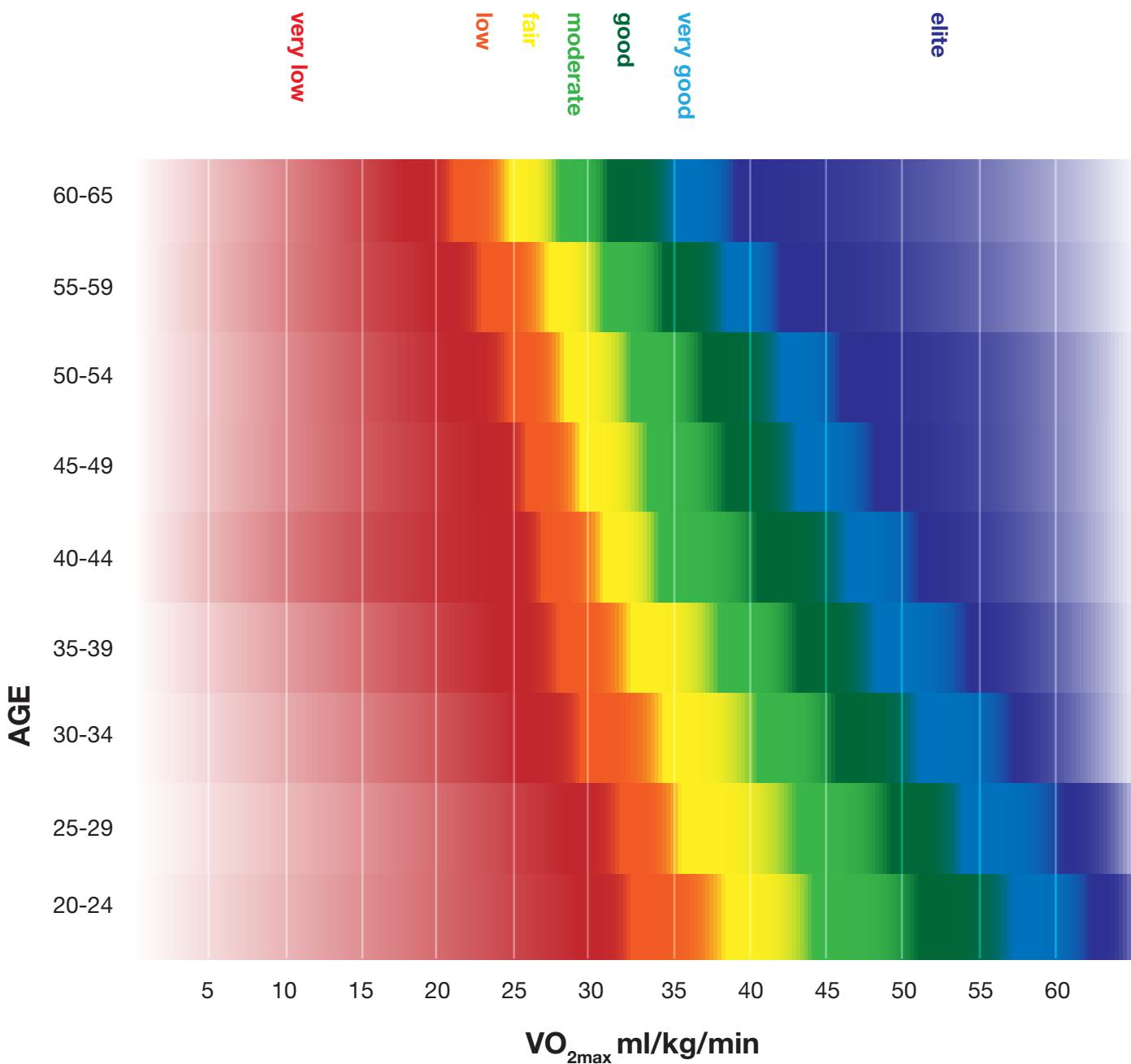
Why do we care? Since you will most likely never measure Heart Rate Variability, why is it important?

Two Reasons:

1. Heart Rate Variability is a benefit and sign of cardiovascular fitness
2. Heart Rate Variability is one of the primary variables used to estimate aerobic capacity by the Polar OwnIndex®

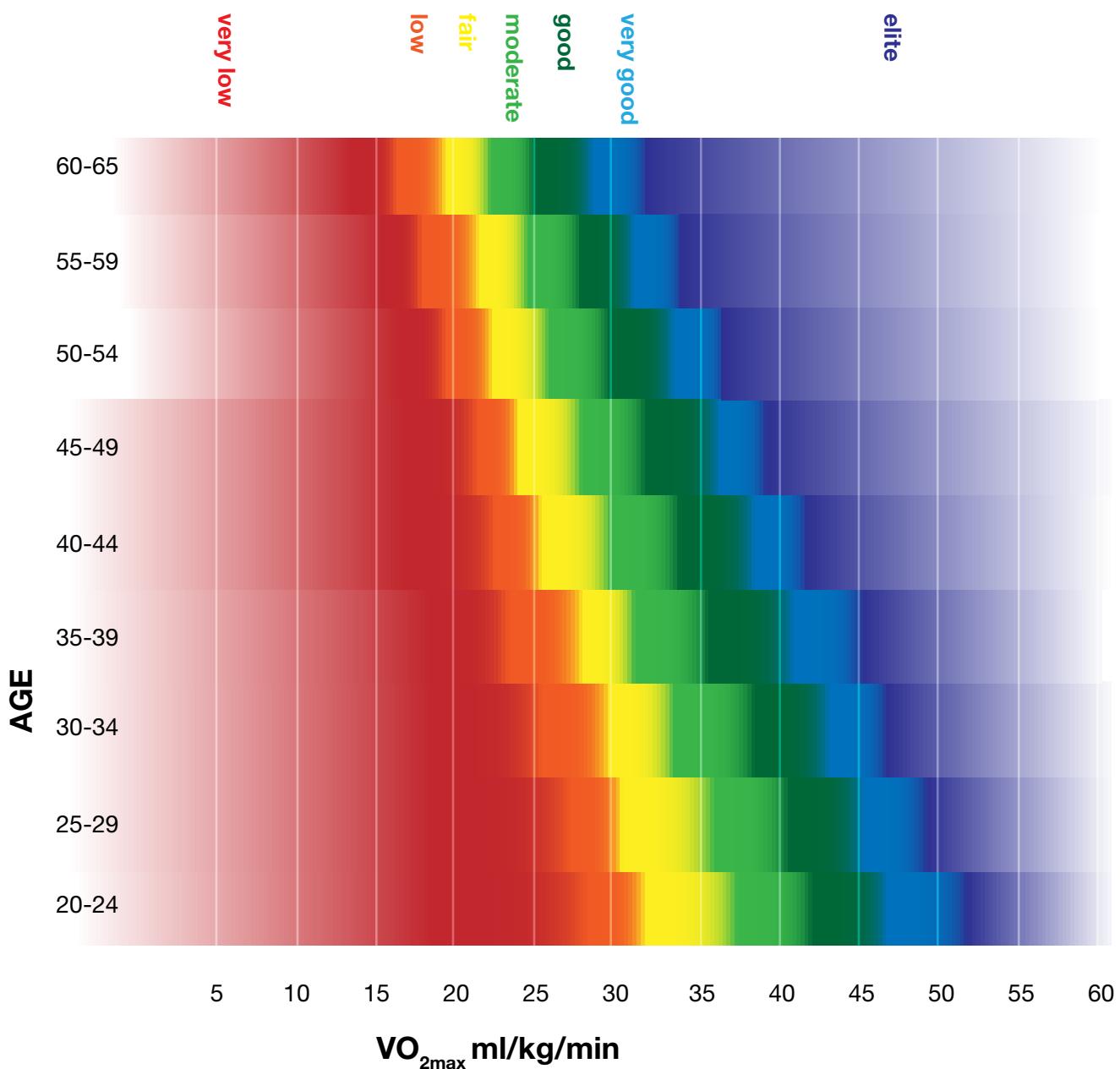
maximal oxygen uptake in adult males

Below: classification of maximal oxygen uptake (Shvartz & Reibold 1990).
Data from adults in USA, Canada and 7 European countries.



maximal oxygen uptake in adult females

Below: classification of maximal oxygen uptake (Shvartz & Reibold 1990).
Data from adults in USA, Canada and 7 European countries.



Calculating Aerobic Capacity and Training Intensity

Polar Fitness Test and OwnIndex®

The easiest and most efficient way to measure VO_2max is to have your client undergo the Polar Fitness Test which predicts results in the VO_2max prediction known as OwnIndex®.

The Polar Fitness Test is based on:

- RHR
- HR variability
- Gender
- Age
- Height
- Body weight
- Self-assessment of the level of long-term physical activity (last 6 months)



Details on how to perform the Polar Fitness Test will be covered in Chapter 8 - Assessments.

Target Heart Rate (THR) and OwnZone®

The Polar FT60 can determine the appropriate training intensity by performing the OwnZone® test. No complicated mathematical analysis is needed, as the heart rate intensities are calculated by the FT60's software. All that is needed is for the client's information (ex: age, weight, gender) to be properly entered into the watch and a brief "warm-up" test performed. OwnZone® is usually calculated after about 2.5 minutes. Details on how to perform the OwnZone® test will be covered in Chapter 9 - Program Design.

THR and % HR_{MAX} Method

The simplest way to calculate Target Heart Rate without using a heart rate monitor is to subtract current age from 220 to find the theoretical maximum heart rate (MHR). Target heart rate can then be determined by multiplying the desired exercise intensity (ex: 70%) with the calculated MHR. However, this age-predicted method has a significant range of error with this formula. Approximately 2/3 of the population will have a maximum heart rates that are within 10 bpm. Therefore, 1/3 of the population will have maximum heart rates more than ± 10 bpm (in fact, 5% of the population will be off by more than 20 bpm).

THR and the Karvonen Equation

The Karvonen equation uses the concept of heart rate reserve to determine target heart rate. Heart rate reserve (HRR) is the difference between Resting Heart Rate (RHR) and maximal heart rate (MHR). Thus, HRR is a person's ability to increase heart rate above resting levels. This accounting for the HRR is believed to make the Karvonen method more accurate when determining THR values, as individual differences are factored in.

karvonen equation

$$\text{HRR} = \text{MHR} - \text{RHR}$$

MHR can be measured during a maximal test, but is commonly calculated using age

$$\text{MHR} = 220 - \text{Age}$$

RHR can be measured at rest using an ECG, auscultation, or palpation.

Once HRR is known, it is multiplied by the desired percentage of VO_2max . This is based on the fact that the %HRR correlates well with the current % VO_2max of the individual. Thus, if a

person exercises at 70% of HRR, we would expect them to be working at approximately 70% of their VO₂max. The target heart rate (THR) for a given %HRR is calculated as follows: THR = RHR + (HRR x %Desired)

The RPE scale should be used throughout an exercise session. Take a client's RPE during intense exercise and during recovery to see if exercise intensity and rest times are appropriate.

For example: A 45 year old who is a beginning exerciser and has a Resting Heart Rate (RHR) of 65 would have an estimated Heart Rate Reserve (HRR) of 110. This is found by first finding their Maximum Heart Rate (MHR = 220 – 45 = 175) and subtracting their RHR (65). Then multiply by the desired % (in this case 60%). $110 \times 60\% = 66$. Lastly, add back in their resting heart rate (RHR) to find their target heart rate (THR) = $66 + 65 = 131$.

RPE (Rate of Perceived Exertion)

Remember, the target heart rate is only a guide. An attentive and aware PFT will pay attention to signs or symptoms of injury or overexertion. If an individual is over 35 or has medical problems, check with a doctor before beginning an exercise program. Use Borg's Scale of Rate of Perceived Exertion (RPE) from 1-10 (1 – minimal effort and strain, 10 – maximal effort and strain) for a more accurate assessment of duress.

The ideal aerobic training zone is between 6 and 8 on the scale of perceived exertion. The individual must be working at this level to be receiving cardiovascular benefit from the exercise. This intensity approximates an intensity of 60-80% of the Target Heart Rate range.

- 0 = nothing at all
- 1 = very light
- 2 = light (weak)
- 3 = moderate
- 4 = somewhat hard
- 5 = heavy (strong)
- 6
- 7 = very heavy
- 8
- 9
- 10 = very, very heavy (maximal)

The “Talk Test”

During an “aerobic” exercise session, one should be able to carry on a conversation (if they are indeed aerobic - with oxygen). If they are gasping for air and unable to talk, they are most likely working at or beyond the anaerobic (without oxygen) threshold - a very high intensity level at or beyond the upper end of their aerobic zone.

While many methods of determining intensity level are somewhat subjective, they tend to be effective ways to help participants judge and adjust their level of exertion according to their fitness goals. With improved fitness levels, RHR heart rate will change to reflect these improvements. The greater the individual level of fitness, the lower the RHR. Using the Karvonen Equation, one would need to recalculate changes in RHR rate after a period of time, to account for adaptations seen in the client. But with perceived exertion (RPE), as CV systems adapt to the demands of physical activity, your clients will tend to judge their level accordingly.

Although these methods tend to be more practical for group fitness settings, it is still the current recommendation to use a variety of methods - including target heart rate (objective) and RPE (subjective) checks - to monitor exercise intensity. HR is a useful tool during exercise and is particularly useful and informative when combined with RPE. The purpose of this information is to answer the many questions we have received about measuring exercise intensity. Although some insight has been offered relevant to the decreased practice of the use of target heart rate checks in group exercise, it is not to be implied that using this standard of measurement is ineffective or inappropriate in all situations... or “wrong!”

Control of Heart Rate from Outside the Heart

The heart muscle is unique. It can generate its own action potential without any external stimulation (remember the SA node, the pacemaker). However, the timing of heart muscle contractions can be altered by external sources. The heart is primarily influenced by 3 extrinsic (external) systems:

- **Parasympathetic Nervous**
- **Sympathetic Nervous**
- **Endocrine**

The Parasympathetic Nervous System

The parasympathetic nervous system (also known as the “Rest and Digest” or vagus response) is a division of the autonomic nervous system and controls involuntary physiological functions. The parasympathetic nervous system conserves energy when action is not needed in the form of decreased blood pressure, decreased heart rate, and beginning the process of digestion. One important parasympathetic nerve that innervates many of the thoracic and abdominal viscera (internal organs) is the **vagus nerve**. The vagus nerve is important because it stimulates involuntary actions of the cardiovascular (breathing and heart rate slowing) and digestive (stomach acid increase) systems.

The Sympathetic Nervous System

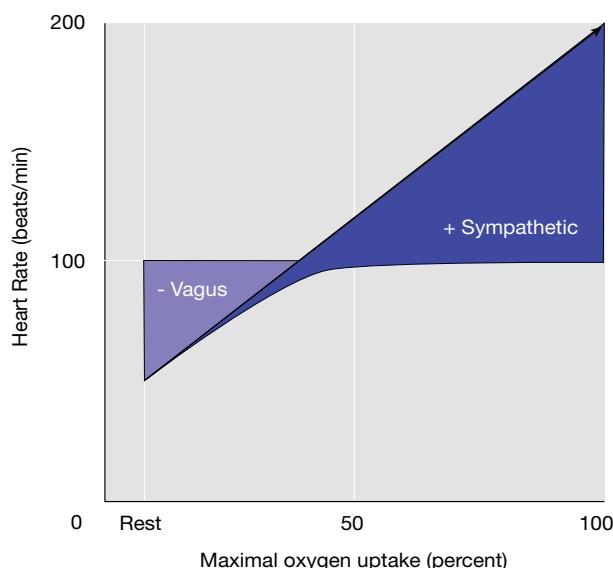
The sympathetic nervous system (also known as the “Fight or Flight” response) is the other division of the autonomic nervous system. The sympathetic nervous system uses energy and prepares the body for action through blood pressure increases, heart rate increases, and digestive slowing.

Notice the figure to the right. At rest, the vagus (parasympathetic) response is dominant with

a corresponding lower heart rate. As intensity increases toward maximum oxygen uptake, the sympathetic response begins to take over and heart rate increases.

The Endocrine System

During sympathetic stimulation, the hormones norepinephrine and epinephrine (a.k.a. adrenaline and noradrenaline) are released by the adrenal medulla, on the superior aspect of the kidneys. These hormones increase heart rate and prepare other organs as a response to stress.



Benefits of Aerobic Training (Why do we do this “Aerobic” stuff?)

It All Comes Down to O_2

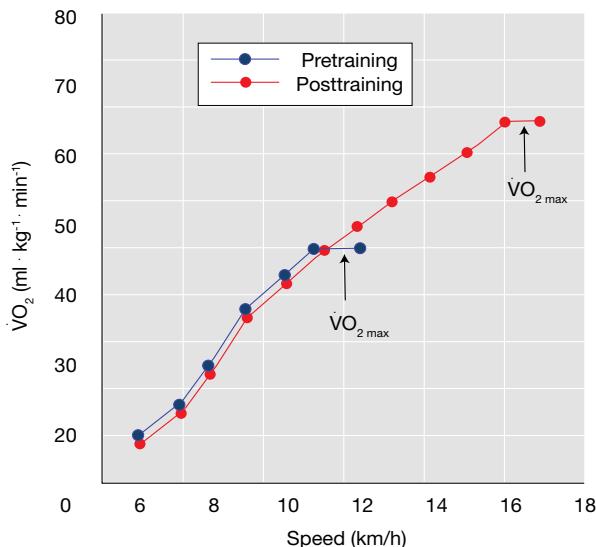
As the body adapts to aerobic (with oxygen) training, the body seeks to work more efficiently with oxygen in three ways:

- **Intake**
- **Delivery**
- **Utilization**

Increase $VO_{2\text{max}}$ and Submaximal Endurance

Remember that $VO_{2\text{max}}$ (aerobic capacity) represents the maximum amount of oxygen that can be delivered AND utilized by the body. Most

researchers use VO_2max as the best indicator of cardiorespiratory endurance. According to the General Adaptation Syndrome (GAS), if the cardiovascular system is stressed through appropriate aerobic exercise the body will both adapt and become more efficient at delivering and utilizing oxygen. This improved oxygen utilization allows for more work to be performed with less effort. There are many factors that affect how much aerobic capacity can be improved, including genetics, gender, and age, to list just a few. A typical sedentary person who trains 3x/week, for 30 minutes a session at 75% of initial VO_2max for 6 months can expect a 15-20% increase in VO_2max .



Utilization vs Presentation: What is the Limiting Factor for Improvement?

Aerobic capacity tends to increase proportionally with increases in training volume. With increased training, aerobic capacity will eventually reach an upper limit and VO_2max will no longer increase even with harder and longer training sessions. Is it the delivery of oxygen (presentation theory) that is the limiting factor or the ability of muscles to process the oxygen (utilization theory)? Both the presentation and utilization of oxygen improve with exercise and there is evidence that supports both theories. However, a majority of studies indicate that it is the presentation of oxygen (delivery) that is the limiting factor in increased endurance performance.

Increases in Muscle Utilization of O_2 (QO_2)

Endurance training increases both the size and number of mitochondria in muscles. With more (and bigger) mitochondria, there are more enzymes to allow for oxidative metabolism. The maximal amount of oxygen that a muscle can use is known as the muscle's maximal respiratory capacity or QO_2 .

Increases in Muscle Presentation of O_2

With endurance training, the amount of blood leaving the heart is increased (cardiac output) and the efficiency of blood flow to the working muscles is improved. The delivery of oxygen is improved in many ways through endurance training such as:

1. Increased Cardiac Output

- Increased left ventricle size, leading to increased stroke volume
- Maximum heart rate stays the same or decreases (because the heart is more efficient)

2. Increased Blood Flow

- Increased capillaries in trained muscles
- Increased capillary openings
- Increased blood volume
- Better blood distribution

Even MORE Benefits of Aerobic Training

Increase in Lactate Threshold/Anaerobic Threshold (whichever name you choose)

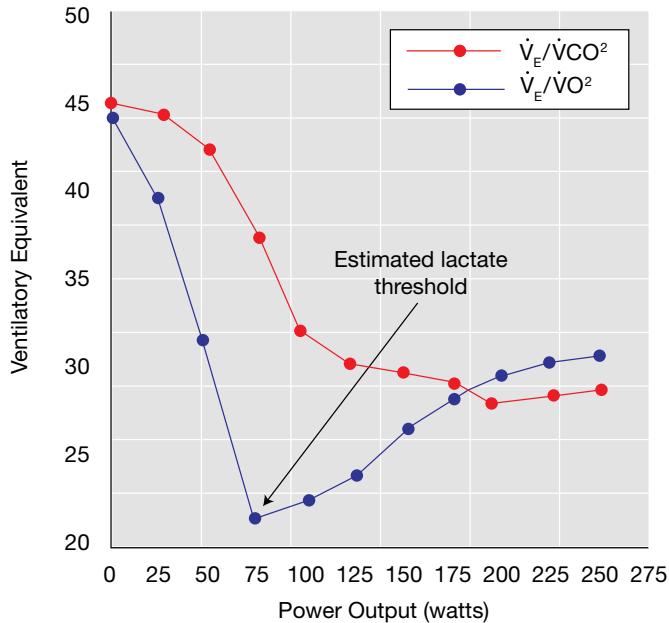
At low intensities, aerobic metabolism dominates. As intensity increases, anaerobic metabolism starts to contribute to the energy needs of the body and acid is produced. The highest level of sustained intensity of exercise for which

measurement of oxygen uptake can account for the entire energy requirement is known as the

Anaerobic Threshold (AT). To review, this is the point there is a substantial increase in blood lactate. Again, this is known as the **Lactate Threshold (LT).**

What's the difference between AT and LT? Mainly, how the information is gathered. LT is objectively found by taking blood samples during various intensities of an incremental exercise test.

AT is determined through a ventilatory test where ventilation, \dot{V}_E , and $\dot{V}CO_2$ are directly measured. It is a noninvasive estimate of lactate threshold. For all practical purposes, AT represents LT.

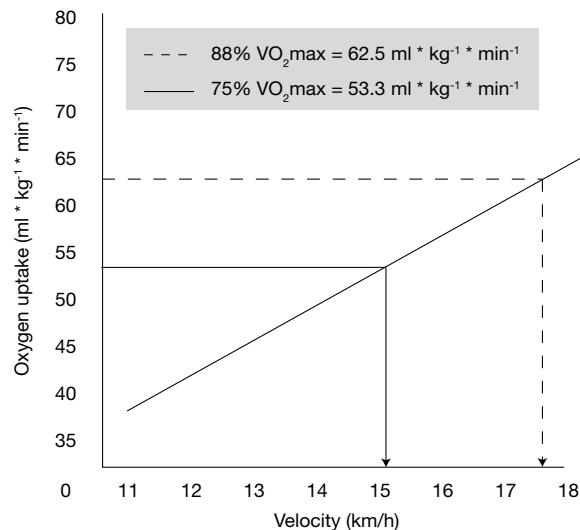


Why Does Anaerobic Threshold Matter?

Anaerobic threshold is a strong indicator of an athlete's performance capability. While aerobic capacity can be increased with exercise, there is a limit to how much it can be improved. Athletes who maximize their genetic capacity for increasing $VO_2\text{max}$ can still increase aerobic performance. Remember that AT/LT is the point when lactate begins to accumulate in the blood. At this point lactate clearance from the blood cannot keep up with lactate production. Accumulation of acid is a major contributor to fatigue. It might be helpful to think of AT as the point at which an athlete begins to "redline". An athlete with a higher AT (as a % of $VO_2\text{max}$) is able to maintain performance at a higher level

than an athlete with the same $VO_2\text{max}$ but a lower AT.

Look at the figure showing two athletes with the same $VO_2\text{max}$. One athlete has an AT of 75% of $VO_2\text{max}$, the other has an AT of 88% of $VO_2\text{max}$. Notice that the athlete that reaches AT at 88% can maintain a higher race pace before "redlining".



Muscle Fiber Adaptations

Aerobic training emphasizes usage of Type I or slow-twitch (ST) muscle fibers. These muscle fibers will adapt to stress through muscle hypertrophy (growth in cross-sectional area). While these fibers have the capacity to grow (by as much as 25%), the fibers will not result in an hypertrophic response as much as Type II (IIa and IIb) or fast-twitch (FT) muscle fibers would, in response to anaerobic strength training. This may be why bodybuilders tend to look **just a little** different than marathon runners (yes, that's just a little sarcasm).

Increased Oxidative Capacity (increased fat metabolism)

Improvements in the muscles' aerobic energy system functioning through aerobic training creates a greater systemic efficiency in the use of fat as a significant (or dominant) energy source during exercise. The improved capacity of aerobically trained muscle fibers to use fat is caused by increased fat storage in the muscle fiber, an enhanced ability to mobilize free fatty

acids (FFAs), and the improved capacity to oxidize fat.

What is RER and Why Should We Care?

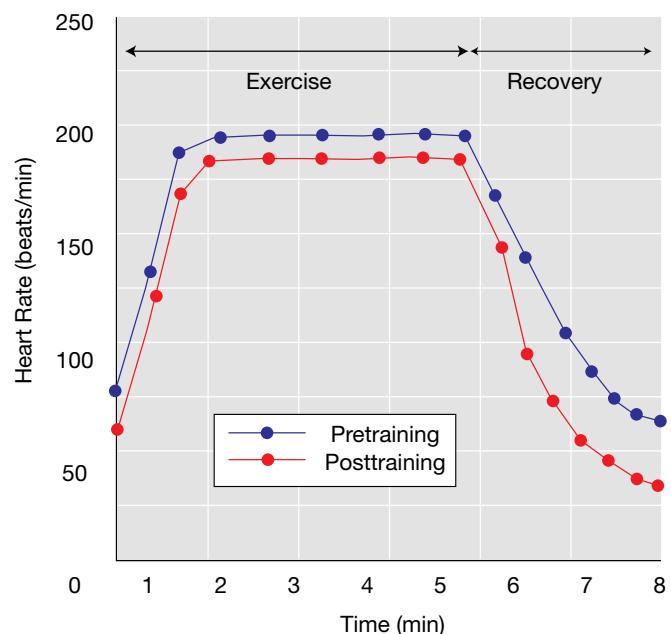
RER (Respiratory Exchange Ratio) is the ratio of CO_2 expired to O_2 consumed. This ratio is an estimate of the type of energy substrate that the body is currently using predominantly (carbohydrates vs fat) for fuel. Without going into too much science (you can thank us later), the lower the RER number, the greater the percentage of fat being utilized for energy. RER testing shows that aerobic training decreases RER at submaximal effort levels (fat is "burned" more efficiently).

RER	% kcal from Carbohydrates	% kcal from Fats
0.71	0.0	100
0.75	15.6	84.4
0.80	33.4	66.6
0.85	50.7	49.3
0.90	67.5	32.5
0.95	84.0	16.0
1.00	100	0.0

Decreased Exercise HR and HR Recovery

One of the biggest myths that still persists in the fitness industry is that the goal of cardiovascular training is to train hard enough to raise the heart rate. In truth, at a constant intensity, exercise heart rate should decrease over time. The true goal of cardiovascular training is to make the cardiovascular system more efficient. With proper training, working (training) heart rate and maximum heart rate may both decrease.

A positive indicator of improved CV fitness is realized when heart rate recovery also decreases (improves) over time. Complete heart rate recovery is the time it takes the heart to return to its normal resting rate. During recovery, the body is transitioning involvement from the sympathetic nervous system back to the



parasympathetic nervous system. In general, a more fit person will recover quicker than an unfit person because the body is becoming more efficient at utilizing available oxygen and more efficient at the transport of nutrients and waste. This is cardiovascular efficiency.

Excess Post-exercise Oxygen Consumption (EPOC)

What is happening during the initial recovery period when oxygen demand (and heart rate) is still high? From rest to the start of an aerobic exercise session, it takes time for the oxygen transport system to meet the new energy demands. Because of this, anaerobic metabolism dominates at the beginning of a workout (ATP-CP, glycolysis). During recovery, anaerobic energy substrates (ATP, CP, and Glucose) must be replenished and by-products (excess H⁺) removed. This is performed aerobically. Energy demands are not just increased during exercise, but immediately after as well. Following light exercise, EPOC may last several minutes. During intense exercise (such as playing in a football game) or prolonged exercise (such as Olympic or longer distance triathlons), EPOC may last up to 36+ hours. The more well-conditioned the athlete, the less time spent in EPOC following intense or prolonged exercise due to a greater capability for faster recovery.

Benefits of Cardiovascular Training - Summary

- Increased stroke volume (increase heart efficiency) due to increased size of left ventricle
- Increased cardiac output, workload and O₂ consumption at maximum effort
- Increased heart rate variability
- Increased oxygen utilization
- Decreased blood pressure
- Decreased resting and exercise heart rate
- Increased number of mitochondria (cells utilize oxygen better)
- Increased plasma volume
- Improved respiratory efficiency
- Increased number of capillaries
- Increased myoglobin in muscle cells
- Increase insulin sensitivity
- Increased lactate threshold (due to increase rate of lactate removal)
- Increased ATP, CP and glycogen stores
- Increased release of fatty acids
- Increased ability to oxidize fat, glycogen-sparing, increased endurance at sub-maximal workload

training begins to occur and performance gains diminish significantly once a frequent exerciser has not exercised for 2-3 weeks. Detraining does not apply to an individual who exercises very infrequently or who has never exercised. If an individual experiences any number of these symptoms following a few days of complete rest or light exercise (active rest), overreaching or overtraining should be considered and a qualified health professional should be contacted. If symptoms are uncontrollable or continue to progress, a medical doctor or general practitioner must be consulted.

overtraining signs

elevated resting heart rate/blood pressure

difficulty sleeping or restlessness

fatigue, irritability

decreased interest in exercising

immune system breakdown (illness or allergies)

failure to progress or improve

excessive weight loss/soreness

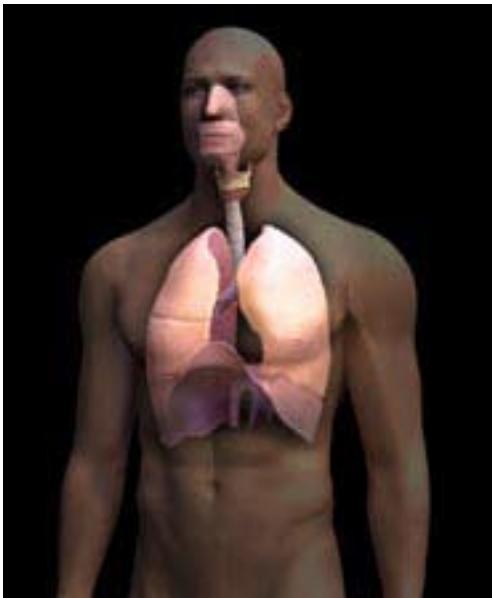
frequent muscle cramps or strains

amenorrhea (lack of menstruation)

EXAM ALERT

What is overreaching? Overtraining? Detraining?

The Respiratory System



Breathing, like the heartbeat, happens automatically (involuntarily). However, respiratory muscles (unlike cardiac muscles) depend on nervous system stimulation for contraction. While voluntary control of breathing is possible, involuntary breathing will dominate (which is why most people cannot hold their breath for more than a minute).

Air enters through the nostrils to the nasal cavities (where it is filtered and provided with heat and moisture through the nasal hairs and mucus). It then passes through the pharynx into the larynx (the opening to the larynx is the glottis which is covered by the epiglottis). From the larynx it moves into the trachea, which divides into two bronchi (one entering each lung). The bronchi repeatedly branch into smaller bronchi where the terminals end at the bronchioles (each leads to several smaller chambers known as alveoli). Gas exchange occurs across the walls of the alveoli.

Ventilation (breathing) is dependent upon pressure changes in the thoracic cavity (body cavity that contains the heart, the lungs, and the upper digestive tract). The thoracic cavity is separated from the abdominal cavity by the diaphragm and is bounded on its sides by the chest wall.

The Inhalation Phase of Respiratory Ventilation

During inhalation (also called inspiration) the diaphragm contracts and arches downward and the external intercostal muscles contract, pushing the ribcage up and out. This causes the thoracic cavity to increase in volume, which reduces the intrapleural (fluid-filled area surrounding the lungs) pressure causing the lungs to expand and fill with air to equalize pressure. This is known as Negative Pressure Breathing (changing the pressure inside the lungs relative to the pressure of the outside atmosphere). While exercising, it is advisable to inhale either between movement phases or during the least exertive phase of movement. Shallow (chest) breathing is known as costal breathing and deep (abdominal) breathing is known as diaphragmatic breathing. Deep diaphragmatic breathing is encouraged whenever possible. Encourage breathing in an even and controlled manner during CV activity to improve utilization of oxygen and delay time to fatigue.

The Exhalation Phase of Respiratory Ventilation

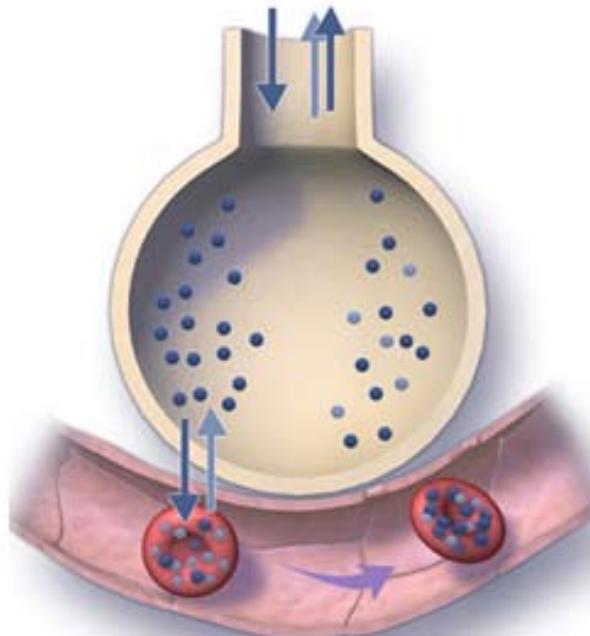
Exhalation (or expiration) is a passive process (since no muscular contraction is involved), whereby the lungs and chest wall recoil to their original positions. The diaphragm and external intercostal muscles relax, and the chest wall pushes inward. A decrease in thoracic cavity volume causes air pressure in the intrapleural space to increase, leading to increased pressure in the lungs. The lungs then deflate, forcing air out of the alveoli. This forced exhalation is due to the contraction of the internal intercostals and transverse abdominus. While exercising, it is advised to exhale on the “exertion” phase of movement. Breaths should be long and even, not short and quick, while exerting effort. An effort should be made to exhale in a 2:1 ratio compared to inhaling to increase oxygen utilization and encourage greater cardiovascular efficiency.

EXAM ALERT

What is the most efficient way to breathe? How does high altitude affect breathing? In most cases, should one exhale or inhale on the exertion phase of an exercise?

Gas Exchange

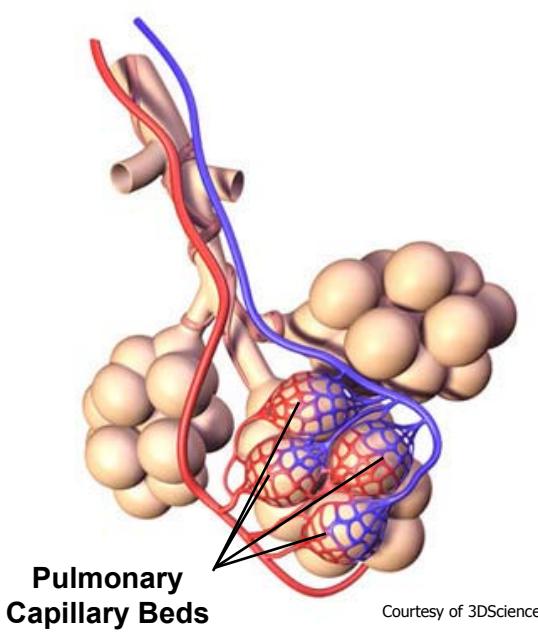
Gas exchange (or respiration) occurs within a dense network of minute blood vessels (pulmonary capillaries) which surround the alveoli. Gas exchange occurs by diffusion (movement from an area of high concentration of a substance to an area of low concentration). At high altitudes, the partial pressure of oxygen in the atmosphere declines, making it more difficult to get sufficient oxygen to diffuse into the capillaries. The body compensates by increasing the rate of ventilation through hyperventilating, increasing the rate of cellular respiration, and decreasing the capacity to do work. People who live at high altitudes do not have higher ventilation rates, they have greater numbers of alveoli, a higher lung vascularization (better blood flow to and from the lungs), produce more red blood cells or RBCs (which carry more O₂ to tissues and CO₂ from the cells following tissue breakdown), and have greater levels of hemoglobin (the oxygen carrying part of the RBCs) with a greater affinity for oxygen.



Pulmonary Capillary

Courtesy of 3DScience.com

During aerobic exercise, both oxygen uptake and carbon dioxide production are increased. Minute ventilation (volume of air breathed per minute) increases by increasing the rate and/or depth of breathing. During exercise, tidal volume (the amount of air inhaled or exhaled in a single breath) can increase to more than 3 times the rate of breathing at rest. Since the respiratory passages (nose, mouth, trachea, bronchi and bronchioles) are not used for gas exchange these areas are called anatomical dead space. With deeper breathing, tidal volume increases to a greater extent than the anatomical dead space. Because of this dead space, deep, slow breaths allow for greater oxygen utilization.



Courtesy of 3DScience.com

Gas exchange between the alveoli and the pulmonary capillaries occurs across the respiratory membrane. This gas exchange happens through means of diffusion (movement from areas of higher to lower concentration of a substance). The rate of diffusion follows Fick's Law (which states that the volume of gas that moves across a tissue is proportional to the area for diffusion and the difference in partial pressure across the membrane, and is inversely proportional to membrane thickness). Gas is circulated through the processes of pulmonary and systemic circulation.

Pulmonary circulation sends oxygenated blood from the lungs to the heart and then back to the lungs. Pulmonary capillaries are responsible for the exchange of gases. Systemic circulation sends oxygenated blood from the left ventricle through the rest of the body and back to the right atrium where it is then sent back to the lungs.

The gas that is exchanged across the membrane is not comprised solely of oxygen, but a mixture of gases. This mixture includes oxygen, nitrogen, and carbon dioxide. Nitrogen is the most abundant gas in the air we breathe and comprises 79.04% of the mixture, while oxygen comprises 20.93%, and carbon dioxide 0.03%. Each gas has a partial pressure within this mix of gases. The pressure from each of the individual gases comprises the total gas that is exchanged.

Because nitrogen is not processed by the body, it is not utilized like carbon dioxide and oxygen. With inhalation, there is a higher percentage of oxygen present in the lungs than carbon dioxide. As the gases travel through the blood, oxygen diffuses into the tissues. Oxygen is then used by the tissues in order to carry out biological functions. The by-product of these reactions is carbon dioxide. The percentage or concentration of oxygen is less than that of carbon dioxide within the skeletal muscle due to the need and use of oxygen within the muscle. After gases are used in the muscle, the gases are passed back to the lungs through the blood. The air is then filtered in the lungs and sent back into the body for the process to begin again.

Oxygen is also transported by the blood for use throughout the body. In order for oxygen to be carried efficiently through the body, it attaches to hemoglobin in the RBC's. Individuals with a high hemoglobin concentration within their blood are more efficient at carrying and distributing oxygen to the tissues in the body.

In order to increase oxygen uptake, it is more efficient to take deeper breaths (increase tidal volume) rather than short, fast breaths.

Types of Lung Capacity and Lung Volume

Key terms regarding lung capacity and lung volume:

- Spirometer: Measures the vital (or aerobic) capacity of the lungs
- Vital Capacity (VC): Maximum amount of air that can be forcibly inhaled and exhaled
- Tidal Volume (TV): Amount of air that is normally inhaled and exhaled
- Residual Volume (RV): Air which always remains in the lungs following a maximal exhale (so they won't collapse!)
- Expiratory Reserve Volume (ERV): The amount of air that can be forcibly exhaled during normal exhalation
- Total Lung Capacity (TLC): The sum of the vital capacity and the residual volume (VC + RV)

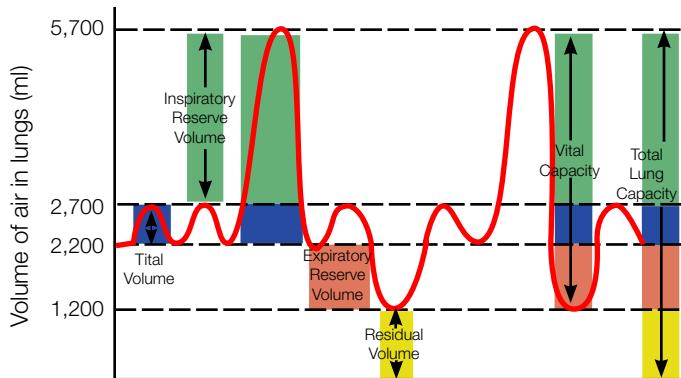
Measuring Lung Capacity

Measurement of actual lung capacity is vital in order to understand an individual's aerobic and endurance performance capabilities. Many factors will play a role in the results of a lung capacity test. Age, sex (gender), weight, height, lifestyle habits (such as smoking or high emotional stress), and conditioning will all have an impact on results. Typically, females have a lower lung capacity than males (20-25% lower). Taller individuals typically have a larger lung capacity than shorter individuals. Individuals who smoke have a much lower total lung capacity than non-smokers. Individuals who are in better aerobic shape and are considered "physically fit" are likely to have better lung capacities than those who are not physically fit.

In order to measure lung capacity and volume, a spirometer is used. A spirometer is a machine/device that measures the amount of air present in an individual and the rate at which ventilation occurs. To conduct the test, the subject takes a deep breath and then exhales as hard as possible into a tube connected to the spirometer. The main part of the spirometer is a large "bell" or drum filled with water. The bell is connected to a pulley and as the subject exhales all air (except for the RV), it displaces the water inside the bell. The bell of the spirometer then rises, and a measurement can be taken (usually in liters).

or milliliters) from the calibrations found on the spirometer.

There are many measurements that can be found from a spirometer test. The most important measurement obtained for training purposes is vital capacity (VC). This measurement is crucial for purposes of determining the objective difference between strenuous or intense training and moderate or light endurance training. The tidal volume will be the normal breathing rate of a person at rest or during very light exercise where the breathing rate is not accelerated. A spirometer can also measure residual volume, expiratory reserve volume, the amount of air that can be forcibly exhaled following normal exhalation, and total lung capacity.



In the graph shown here, the vital capacity is the largest volume the spirometer can directly measure. The largest capacity is total lung capacity, but cannot be measured directly because residual volume is not able to be measured (it always stays in the lungs). Tidal volume is a relatively small measurement and is equal to normal, everyday breathing. From the chart, the tidal volume is observed as the most uniform respiratory measurement without any large fluctuations or changes.

Using the data collected from the spirometer, certain diseases or conditions in breathing can be detected. This data makes it easy to see if an individual has an obstructive or restrictive condition of the respiratory system. Some of the conditions that can be detected using this data include asthma, emphysema, and chronic bronchitis (among others). This information is helpful when training clients who may have

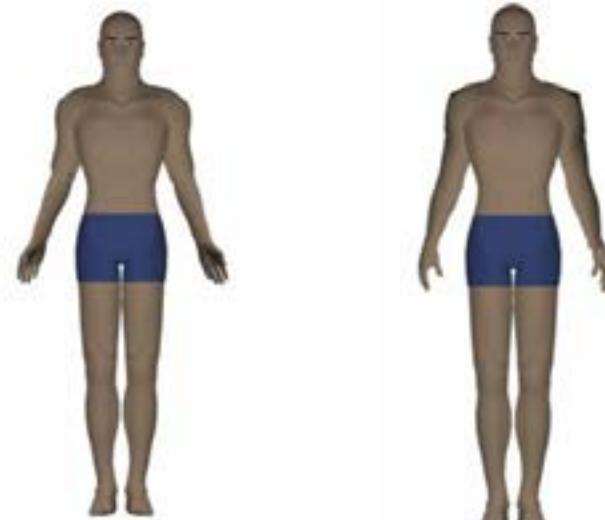
any of these conditions. Modifications must be made in order to aerobically train the client safely (without great risk) and effectively (with progressive results).



Kinesiology and FUNCTIONAL ANATOMY

Kinesiology is the scientific study of human movement. This chapter will present basic concepts in kinesiology, and more specifically, basic movement terminology. It is vital that a personal fitness trainer understand these terms in order to be capable of applying them appropriately. Descriptions that provide a foundation for properly expressing human movement are provided and this chapter also describes the efficient application of exercise techniques. But what is functional anatomy? Traditional anatomy is, in the classic sense, based on the specific location of different bodily structures, whereas *functional* anatomy takes traditional anatomy a step further by considering muscle location, as well as the movement produced by that muscle.

Kinesiology examines the way muscles interact. Therefore, it is essential for personal trainers to study kinesiology to ensure that the exercises they prescribe will help clients achieve their goals while avoiding injury.

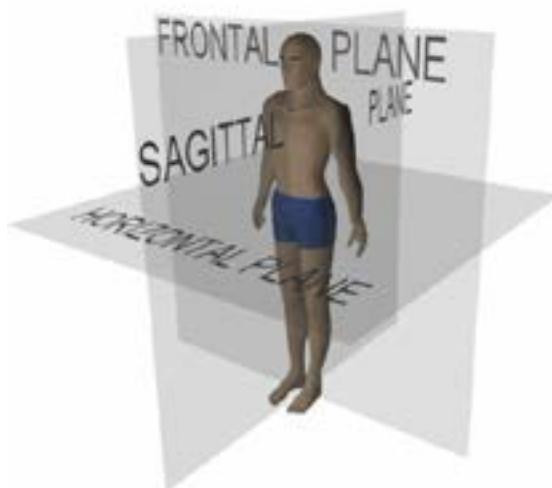


Anatomical Position

Anatomical Neutral

Planes of Motion

We live in a three dimensional (3D) space. In order to describe human movement within three-dimensional space, three **planes of motion** are used. They are as follows:



Describing Motion

Anatomical Position and Anatomical Neutral

In order to describe the movement of the human body, a standardized reference point has been used for centuries known as **anatomical position**. Anatomical Position is a position of standing erect with the palms facing forward or externally rotated. There is another anatomical reference position with the palms facing the body known as **anatomical neutral** (a.k.a. fundamental starting position).

EXAM ALERT

What is anatomical position?

Anatomical neutral?

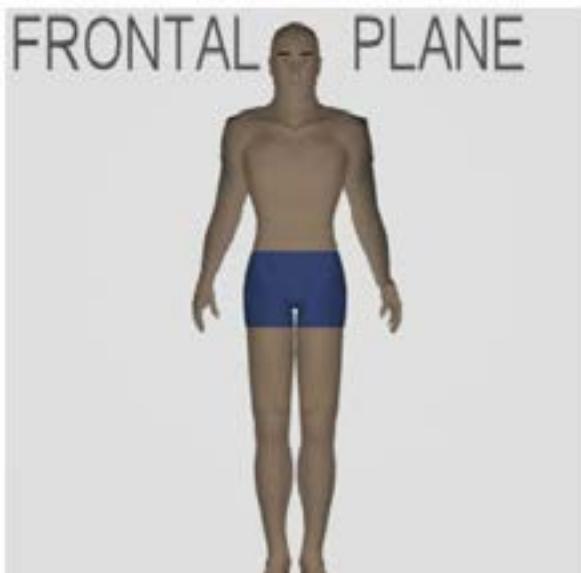
What are the planes of movement?

How do they divide the body?

VIDEO
click here



The **sagittal plane** divides the body into right and left halves



The **frontal plane** divides the body into front and back halves (a.k.a. coronal plane)

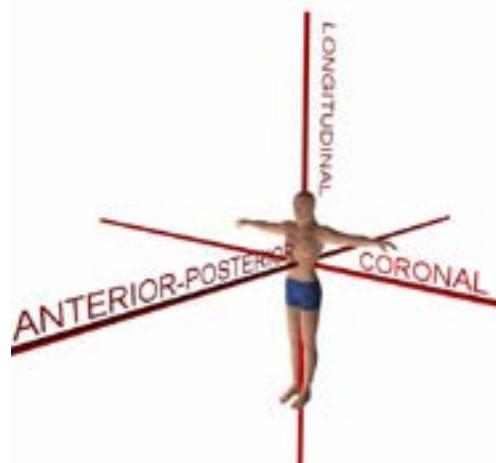


The **horizontal plane** divides the body into top and bottom halves (a.k.a. transverse plane)

With knowledge of the three planes of movement, it is important to recognize that most human movement (outside of traditional weight lifting machines) is multi-planar and involves movement through more than one single plane. It would be insufficient to refer to the body in general terms (i.e., front, back, side, etc.) due to a need for clarity in reference points. A more efficient, scientific listing of basic anatomical movement descriptors is listed on the next page.

Anatomical Axis of Motion

Each anatomical movement is achieved according to its joint structure and is bound by the laws of motion around an axis. The **anatomical axis of motion** describes a movement that occurs in a plane along an axis running perpendicular to the plane.



The **longitudinal axis** contains movements that occur in the horizontal plane along the longitudinal axis. For example, the movement of turning one's neck to look left and right is about the longitudinal axis.

The **anterior-posterior axis** includes movements in the frontal plane occurring along the anterior-posterior axis. For example, the movement of raising one's arm to the side as if completing a lateral raise (shoulder abduction) is about the anterior-posterior axis.

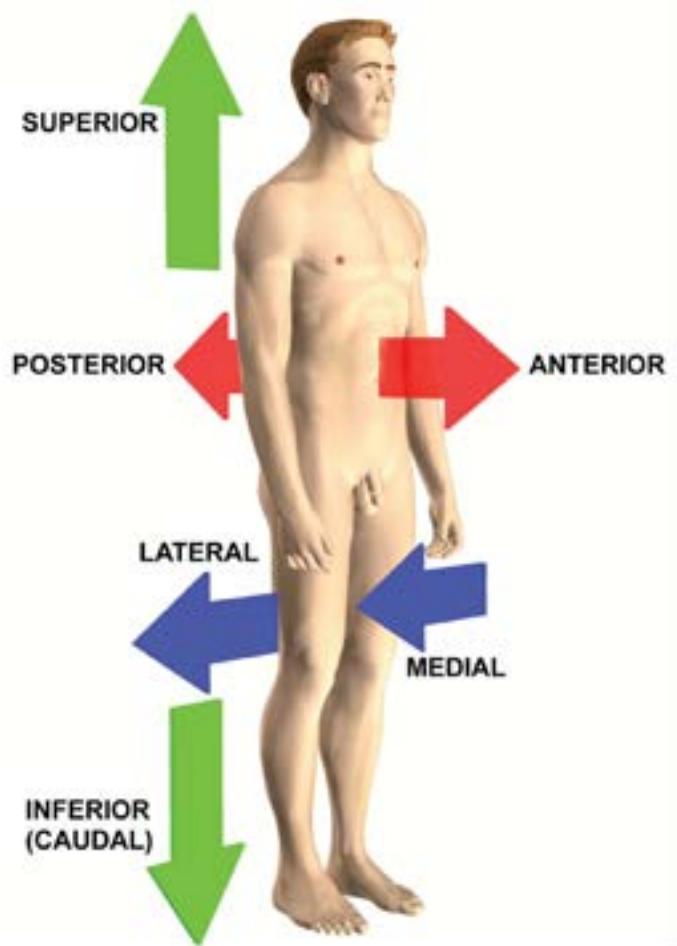
The **coronal axis** describes movements that occur in the sagittal plane along the coronal axis. For example, the movement of kicking a leg forward (hip flexion) is about the coronal axis.

EXAM ALERT

Be able to identify and properly use all the anatomical movement descriptors.

Anatomical Movement Descriptors

anterior (a.k.a. ventral)	The front of the body relative to another reference point
posterior (a.k.a. dorsal)	The back of the body relative to another reference point
superior	Above a reference point
inferior	Below a reference point
medial	A position relatively closer to the midline of the body
lateral	A position relatively farther away from the midline
proximal	A position closer to a reference point
distal	A position farther from the reference point
unilateral	Refers to only one side
superfi- cial	Near the surface
deep	Further beneath the surface
cephalic	Toward the head
caudal	Toward the bottom
supine	Lying on one's backside
prone	Lying face down



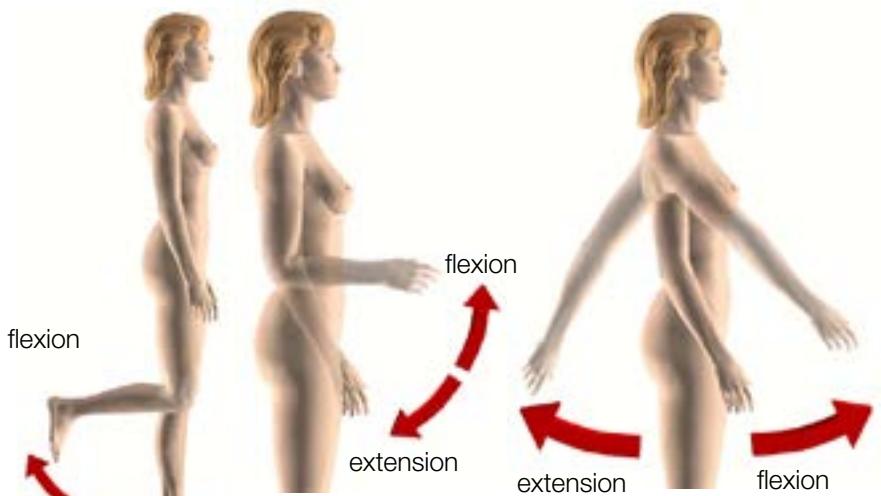
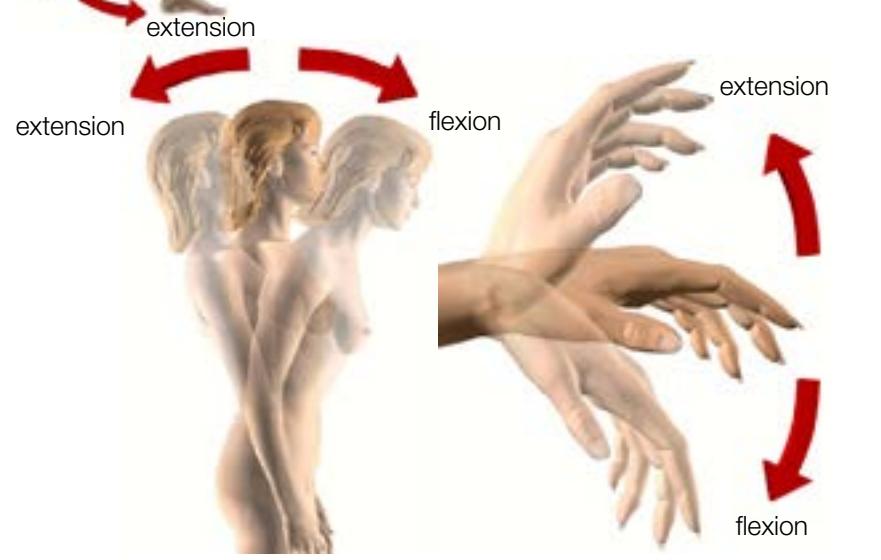
Anatomical movement descriptors, anatomical position and axes of motion are all important facts to know when becoming a fitness professional. These standards have been formulated to allow communication between professionals. Knowing this terminology will help you communicate with physicians, athletic trainers, physical therapists, chiropractors and other personal trainers to ultimately make you a better and more knowledgeable personal trainer.

EXAM ALERT

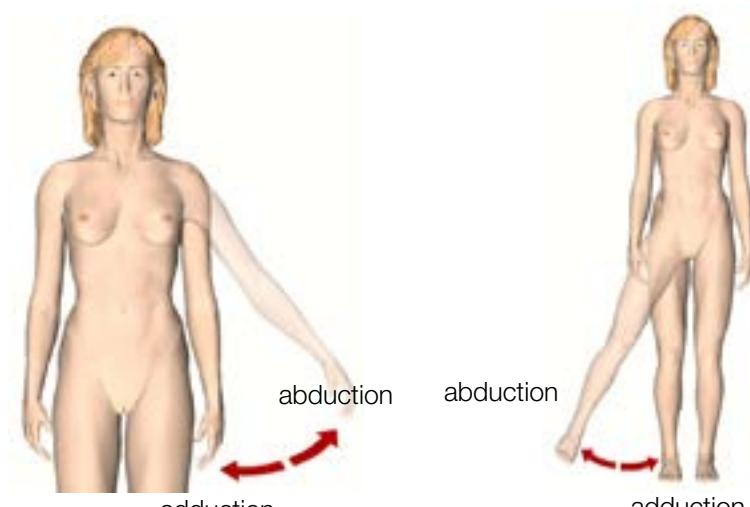
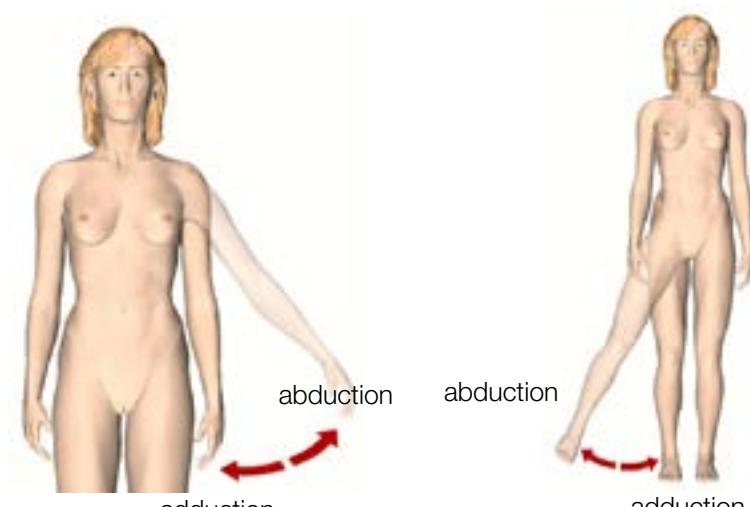
What are the primary movement descriptors? What planes do each move in? If an individual's foot is externally rotated when standing, which parts of the leg will most likely also externally rotate?

VIDEO
[click here](#)

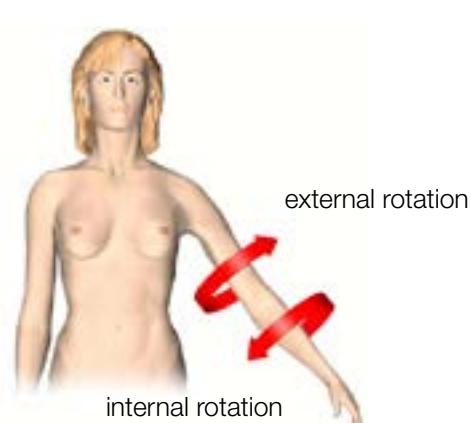
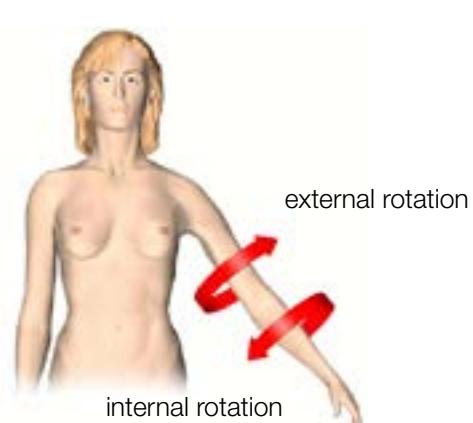
sagittal plane movements (coronal axis)

flexion	A bending movement where the relative angle between two adjacent segments decreases	
extension	A bending movement where the relative angle between two adjacent segments increases	

frontal plane movements (anterior-posterior axis)

abduction	Movement away from the midline of the body	
adduction	Movement towards the midline of the body	

transverse plane movements (longitudinal axis)

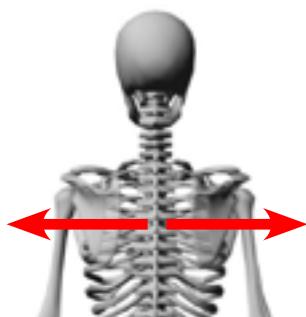
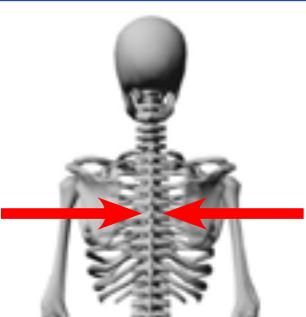
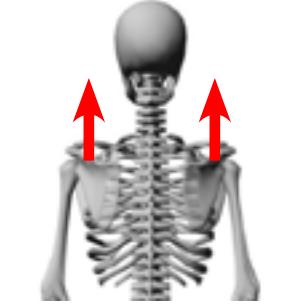
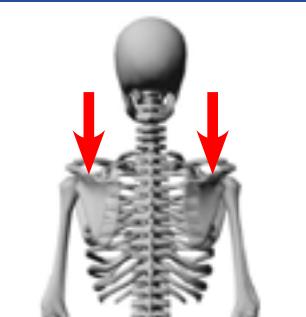
internal/ medial rotation	The rotation of a body part towards the midline (spine, or vertebrae column) of the body	
external/ lateral rotation	The rotation of a body part away from the midline of the body	

EXAM ALERT

What are the 4 main movements of the Scapula?

Xtras4Xperts
[CLICK HERE](#)

Specialized movements of the scapula

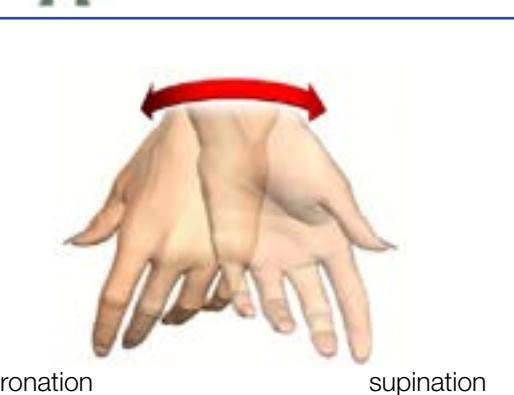
protraction		Abduction of the scapula	
retraction		Adduction of the scapula	
elevation		Raising of the scapula (shrug)	
depression		Lowering of the scapula	

Specialized movements of the ankle-foot

dorsiflexion and plantarflexion	Flexion and Extension of the foot		dorsiflexion
inversion and eversion	<p>inversion: inward movement of the sole of the foot</p> <p>eversion: outward movement of the sole of the foot</p>		plantarflexion



Other specialized movements:

lateral flexion (also known as lateral bending)	spinal movement in the frontal plane	
circumduction	A cone-shaped movement by the body. True circumduction only occurs at the ball and socket joints of the hip and shoulder. Circumduction does not require rotation.	
supination	<p><i>At wrist:</i> Movement of the forearm where the palm rotates to face forward from neutral to anatomical position at the radioulnar joint</p> <p><i>At foot-ankle:</i> Supination is a triplane motion which combines the movements of inversion, adduction, plantarflexion</p>	
pronation	<p><i>At wrist:</i> Movement of the forearm where the palm rotates to face backward</p> <p><i>At foot-ankle:</i> Pronation is a triplane motion consisting of simultaneous movements of eversion, abduction, dorsiflexion</p>	<p style="text-align: center;">EXAM ALERT</p> <p style="text-align: center;">What is pronation and supination at the wrist? At the ankle?</p> <p style="background-color: #ffffcc; padding: 10px;"> When trying to remember the motion of supination in the hand, there are a few tricks to help you remember the position. Since the palm is up in a cupped position, you can think of supination as holding a cup of “soup.” Also, the word “up” is in supination, so your palm is up. </p>

Functional Muscular Anatomy

All About Muscles

There are three general types of muscular tissue. These types can be designated by location, appearance, and control. There are three main parts to a muscle:

- Belly:** the bulging part of a muscle
- Origin (or head):** the less moveable attachment (there can be more than one origin).
- Insertion:** the moveable attachment

A list of simplified origins, insertions and actions:

muscle	origin	insertion	action
masseter	zygomatic arch	mandible	close mouth
temporalis	temporal bone	mandible	close mouth
sternocleido-mastoid	sternum, clavicle	temporal bone	flex head
deltoid	scapula, clavicle	humerus	abduct humerus
pectoralis major	sternum	humerus	flex and adduct humerus
biceps brachii	scapula	radius	flex radius and ulna
rectus abdominus	pubis	sternum	flex spinal column
sartorius	ilium	tibia	cross legs
quadriceps femoris	femur, ilium	tibia	flex femur and extend tibia and fibula
tibialis anterior	tibia	foot	dorsiflexion of foot
trapezius	vertebrae	scapula	elevates, depresses, adducts and upwardly rotates scapula
triceps brachii	scapula, humerus	ulna	extend ulna and radius
gluteus maximus	sacrum	femur	extend femur
adductor group	pubis	femur	adduct femur
hamstrings	ischium	tibia, fibula	extend femur and flex tibia and fibula
gastrocnemius	femur	calcaneous	plantarflexion of foot

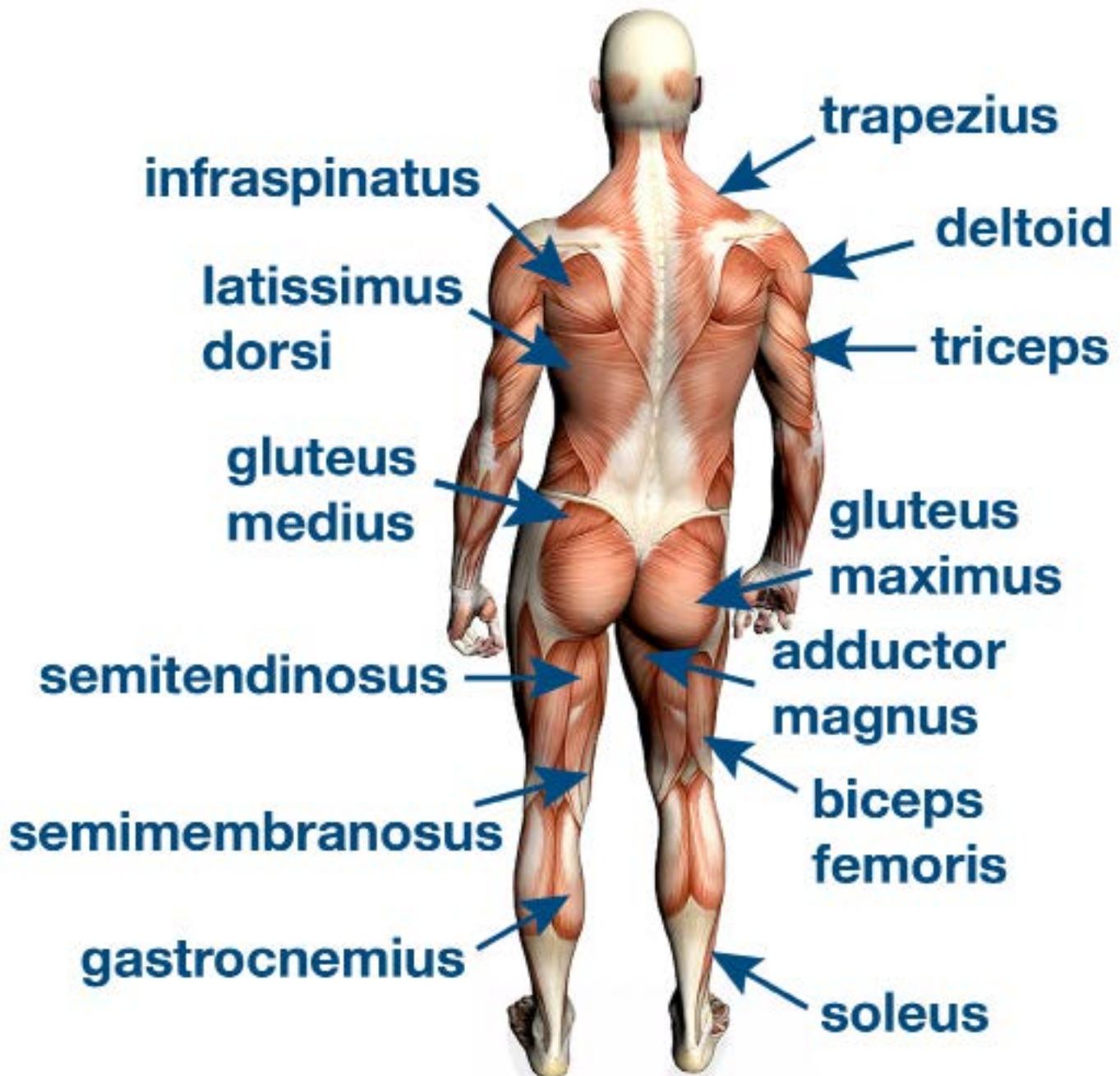
EXAM ALERT

What are the 3 main parts of a muscle? What is the job of the sternocleidomastoid?

muscular anatomy



muscular anatomy



Below is a list of the major muscles of the human body which are the primary concern of a personal trainer. **REMEMBER**, this is not an all-inclusive list and every trainer should have a high-quality anatomy book in their library.

In addition, the “primary functions” listed are the actions of the muscles when they contract concentrically (shorten under load). **REMEMBER**, muscles do not just work concentrically to “lift a load!!” Muscles can also act eccentrically to decelerate the opposite motion as well as statically (isometrically) in order to stabilize the joints that they cross over. In other words, when you read “PRIMARY FUNCTION” – remember that the muscle will also fire to “lower the load” (the opposite motion) and stabilize motion (or lack of motion).**

lower extremity musculature	
soleus	
gastrocnemius	
peroneus longus	
anterior tibialis	



think about it

While the location of muscles is important in determining their action, remember that muscles that work in opposite movements don't have to be located opposite of each other. For example, the peroneus longus and anterior tibialis are antagonists (they work in opposite movements), but their muscle bellies are both located on the lateral aspect of the lower leg.

Fun Fact: The two heads of the gastrocnemius and the single head of the soleus come together to form the “triceps surae complex.” Make sure you differentiate this from the “triceps brachii” muscle in your arm!

EXAM ALERT

What is the primary function of the gastrocnemius and soleus during a calf raise?

thigh muscles (quadriceps)

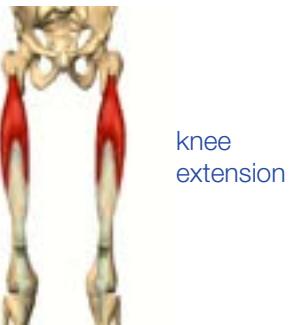
rectus femoris



knee extension, hip flexion

vastus intermedius

(deep to rectus femoris)



knee extension

vastus lateralis



knee extension

vastus medialis



knee extension and medial glide of patella

EXAM ALERT

What are the 4 muscles of the Quadriceps group? What are the 3 muscles of the Hamstrings group?

thigh muscles (hamstrings)

biceps femoris



knee flexion, hip extension and external rotation

semi-tendinosus



knee flexion, hip extension and internal rotation

semimembranosus



knee flexion, hip extension and internal rotation



think about it

Although muscle groups such as the quadriceps and hamstrings work together to complete the same movement, they also have different actions, independent of each other. While the vastus medialis primarily works to extend the knee, it also has an important role in stabilizing the patella on the medial side, where it attaches. This is why understanding both the origins and insertions of muscles are important, in addi-

hip muscles (gluteal)

gluteus
maximus



external rotation, hip extension
upper-half - hip abduction
lower-half - hip adduction

gluteus
medius



abduction, assists in hip flexion
anterior fibers - internal rotation
posterior fibers - external rotation

gluteus
minimus



abduction, internal rotation and
assists in hip flexion

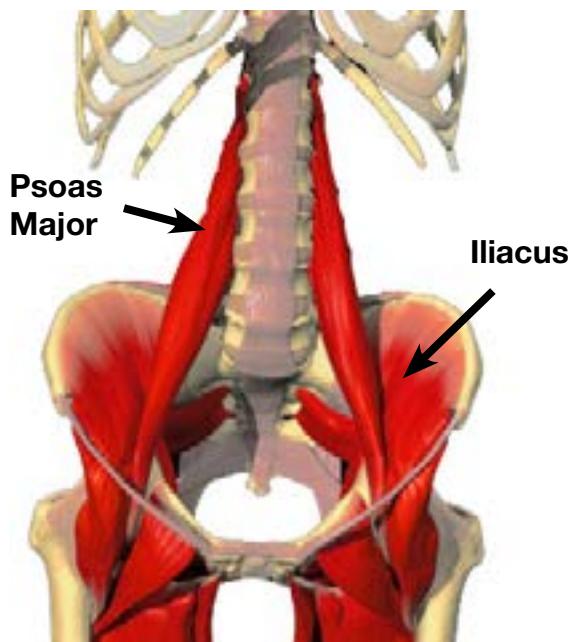
hip muscles (hip flexors)

psoas
major

hip flexion, lumbar flexion, external
rotation and slight hip abduction

Iliacus

hip flexion, lumbar flexion and external
rotation



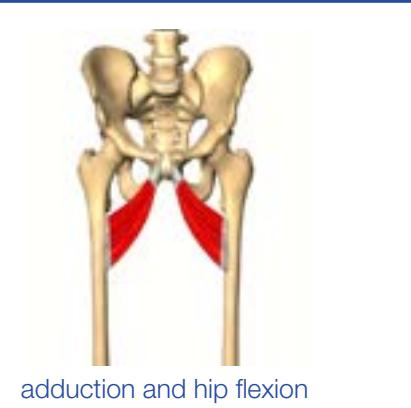
When combined, the Iliacus and Psoas Major are also known as the Iliopsoas.

EXAM ALERT

Which muscles would perform hip flexion during a hanging knee raise?
Which muscle has the primary function of standing hip abduction?

hip muscles (adductors)

**adductor
brevis**



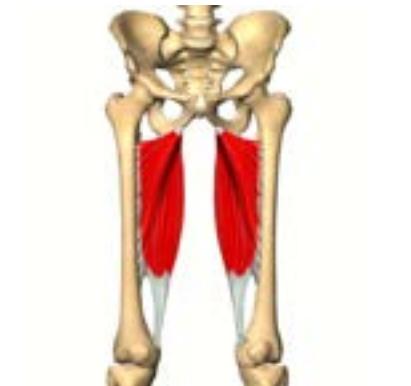
adduction and hip flexion

**adductor
longus**



adduction and hip flexion

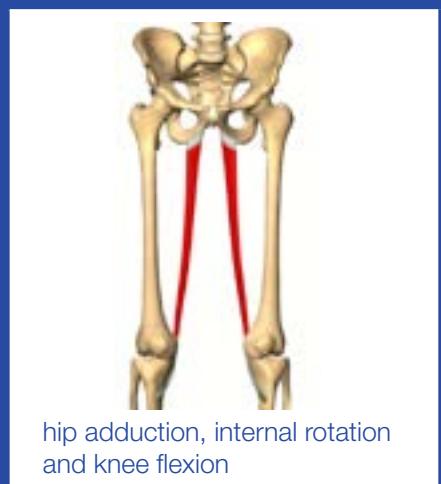
**adductor
magnus**



adduction (some fibers contribute to both internal and external rotation as well as hip flexion and extension)

hip muscles

gracilis



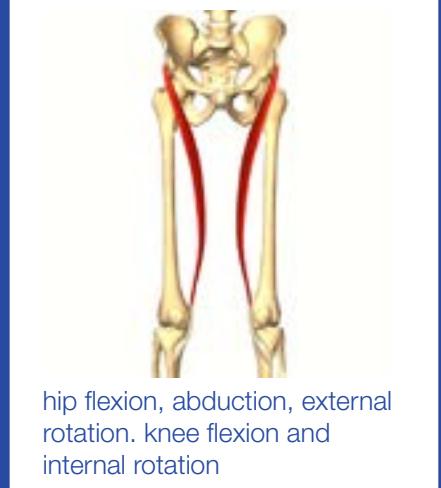
hip adduction, internal rotation and knee flexion

**tensor
fascia latae**



hip flexion, abduction, internal rotation

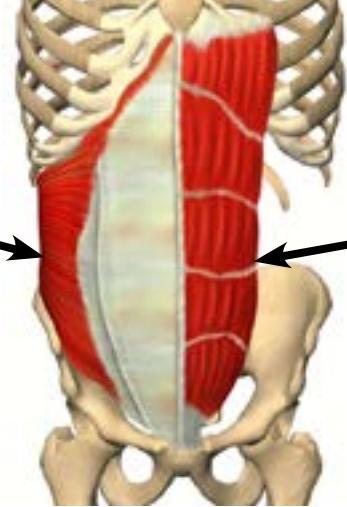
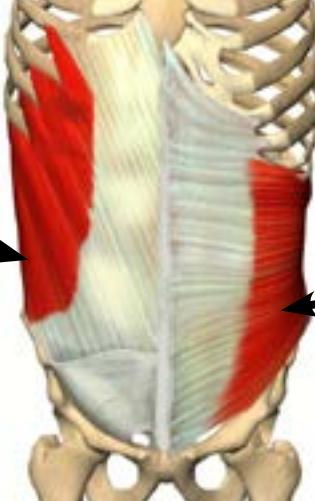
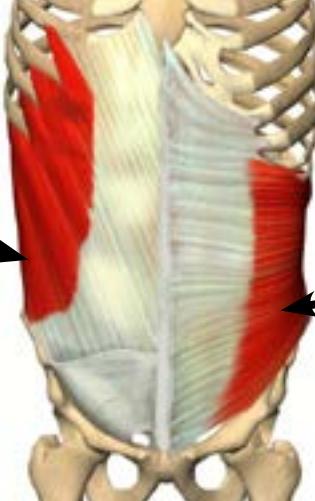
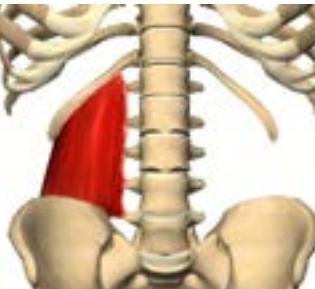
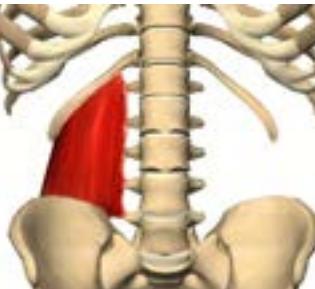
sartorius



hip flexion, abduction, external rotation, knee flexion and internal rotation

Fun Fact: The sartorius is the longest muscle in the human body. It is also known as the “tailor’s muscle,” for the crossed leg position that a tailor often sits in.

vertebral column muscles

transverse abdominus	forced expiration and increased intra-abdominal pressure (stiffens the trunk to prevent the spine from buckling under compressive loads)	
rectus abdominis	Flexion, posteriorly tilts pelvis and increases intra-abdominal pressure. Although the rectus abdominis is responsible for flexing the “spine,” it does not actually attach to the vertebrae. The rectus abdominis attaches to the pubis and sternum.	
internal oblique	flexion, ipsilateral (same side) spinal rotation and increased intra-abdominal pressure <i>Fiber direction - run down and out</i>	
external oblique	flexion, contralateral (opposite side) spinal rotation, tilts pelvis posteriorly and increased intra-abdominal pressure. <i>Fiber direction - think of hands in pockets (i.e. down and in)</i>	
quadratus lumborum	lateral flexion of the vertebral column and laterally tilts pelvis	

EXAM ALERT

There is a quick way to remember your abdominal muscles. If you have too much fat around your waist, you have a “spare TIRE.” Deep to superficial: Transverse Abdominis, Internal Oblique, Rectus Abdominis, External Oblique.

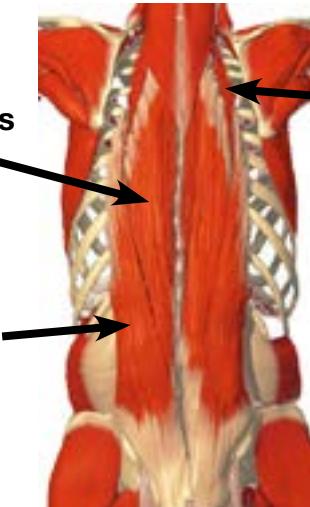
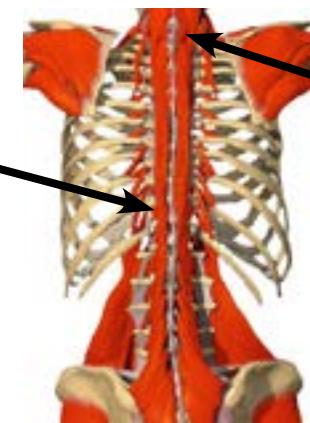
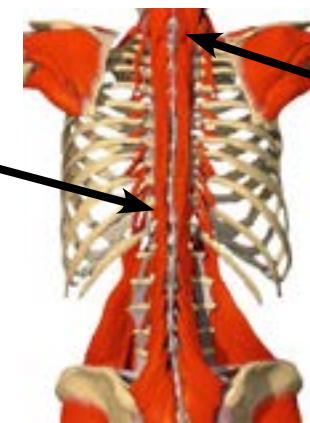
Which muscles both flex and rotate the spine? What muscle stabilizes via intra-abdominal pressure? What are the muscles that stabilize the hips and the spine?

A word about the transverse abdominus

The transverse abdominus muscle connects directly to the spine and the pelvis on all sides. The location and design of this muscle makes it the biggest stabilizer of the spine, acting like a corset that wraps around the midsection to maintain vertebral alignment. The transverse abdominus muscle is the first muscle to contract, or “fire,” with any movement of the body. For example, if you lift your arm to pick up a pen, the transverse abdominus fires before there is any movement in the arm. If this did not occur, the spine would not be supported and excess force may be placed on the vertebrae.

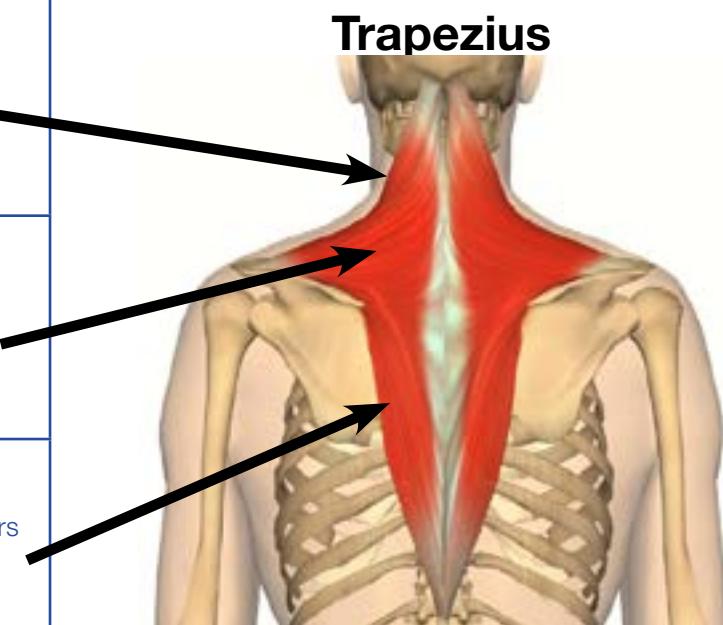
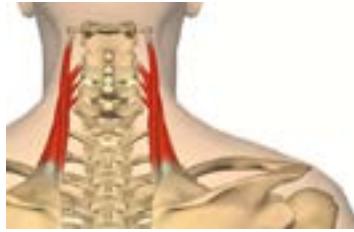
It is very important to help a client strengthen their transverse abdominus. Because this muscle has such a significant role in the stabilization of every movement of the body, strengthening this muscle will improve posture and overall muscular efficiency. A client should contract, or tighten, the transverse abdominus in every exercise he/she does. Cues for contracting the transverse abdominus include “bracing your midsection” and “stiffen the spine.” After practicing this, it will become habit and there will be a noticeable difference in total body strength and stability. The more one performs functional exercises, the more the transverse abdominus must fire, and the stronger it becomes. This is a considerable argument for utilizing functional exercises when training clients.

vertebral column muscles (posterior)

iliocostalis lumborum, thoracis, cervicis	extend the vertebral column and bend it laterally.	 The diagram shows a lateral view of the human spine from the neck down to the lower back. The iliocostalis cervicis muscle is visible on the upper part of the spine, and the iliocostalis lumborum muscle is visible on the lower part. Arrows point from the muscle names to their respective locations on the spine.
longissimus capitis, thoracis, cervicis	extend the vertebral column and head, rotate head.	 The diagram shows a lateral view of the human spine. The longissimus thoracis muscle is shown originating from the sacrum and running upwards along the spine. The iliocostalis lumborum muscle is also visible. Arrows point from the muscle names to their respective locations on the spine.
spinalis thoracis and cervicis	extend the vertebral column.	 The diagram shows a lateral view of the human spine. The spinalis thoracis muscle is shown originating from the sacrum and running upwards along the spine. The spinalis cervicis muscle is also visible. Arrows point from the muscle names to their respective locations on the spine.

Upper Extremity Musculature

shoulder girdle muscles

upper fibers	scapular elevation	
middle fibers	scapular retraction	
lower fibers	scapular depression (upward rotation occurs in conjunction with serratus anterior)	
rhomboid major and minor	scapular retraction (adduction)	
levator scapulae	downward or medial rotation of the scapula and scapular retraction	
serratus anterior	protraction and upward rotation of the scapula	

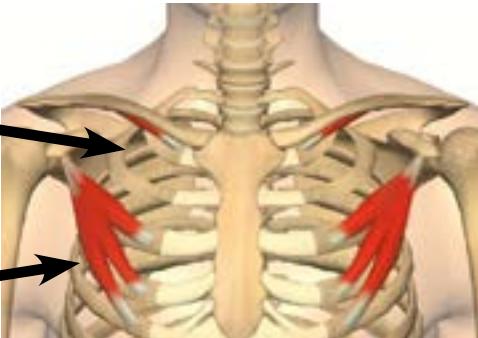
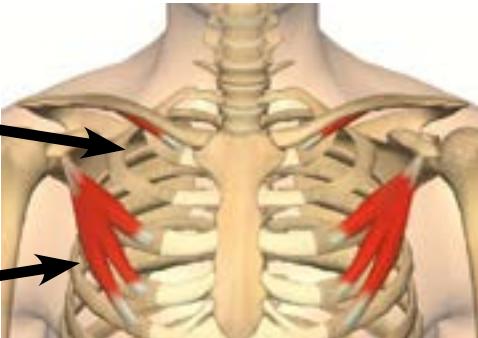
EXAM ALERT

What are the functions of each section of the trapezius?

EXAM ALERT

Which is the primary job of the rotator cuff?

...shoulder girdle muscles

subclavius	stabilizes and depresses the shoulder girdle	
pectoralis minor	depresses the scapula and pulls it anteriorly	
latissimus dorsi	 extends, adducts, and internally rotates the humerus	rotator cuff They work together to maintain integrity and alignment of the glenohumeral joint supra-spinatus  Stability of the shoulder joint during swimming and throwing movements. Some abduction/external rotation.
teres major	 extends, adducts, and internally rotates the humerus	infra-spinatus  External rotation of the humerus. In extension, helps move the humerus posteriorly.
coracobrachialis	 flexes and adducts the arm	teres minor  External rotation of the humerus. In extension, it helps move the humerus posteriorly.
There is a quick way to remember your rotator cuff muscles. They are your “SITS” muscles: Supraspinatus, Infraspinatus, Teres minor and Subscapularis.		sub-scapularis  Internal rotation of the humerus. In extension it helps move the humerus posteriorly. In adduction, it helps move the arm toward the body.

...shoulder girdle

deltoid

anterior
fibers



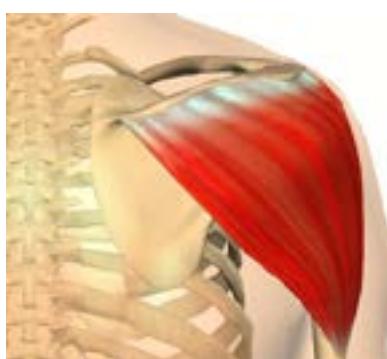
Flexion and internal rotation
of the humerus. Horizontal
adduction.

lateral
fibers



abduction

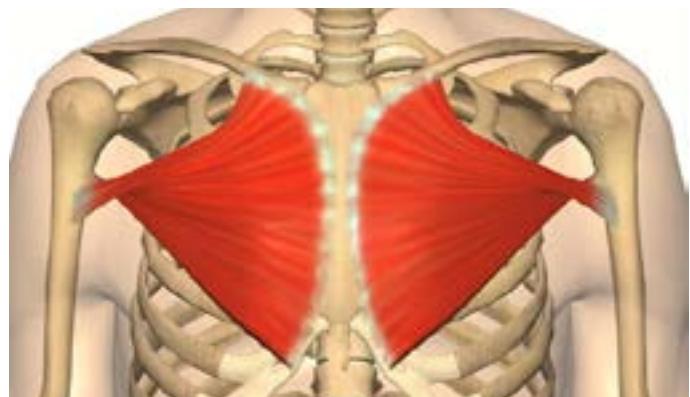
posterior
fibers



Extension and external rotation
of the humerus. Horizontal
abduction.

pectoralis
major

Flexion, adduction, internal
rotation, horizontal adduction of
the shoulder.



EXAM ALERT

During horizontal adduction, the pectoralis major acts in what fashion (i.e. agonist, antagonist, stabilizer, etc.)?



think about it

The word **deltoid** comes from “**delta**,” which means triangle. This can help you remember that the deltoid muscle has three parts. There is also a **deltoid ligament** located on the medial ankle. This ligament also has three parts, positioned in a triangular shape.

upper arm muscles

biceps
brachii



Elbow flexion and
supination of the
forearm.

brachialis



Elbow flexion

triceps
brachii



Extension of the
elbow. Long
head extends
the shoulder.

forearm muscles

brachio-
radialis



Elbow flexion

supinator



Forearm
(radioulnar joint)
supination

pronator
teres



Pronation of
radioulnar joint,
slight elbow
flexion

pronator
quadratus



Pronation of
radioulnar joint

Xtras
4
xperts

CLICK HERE



think about it

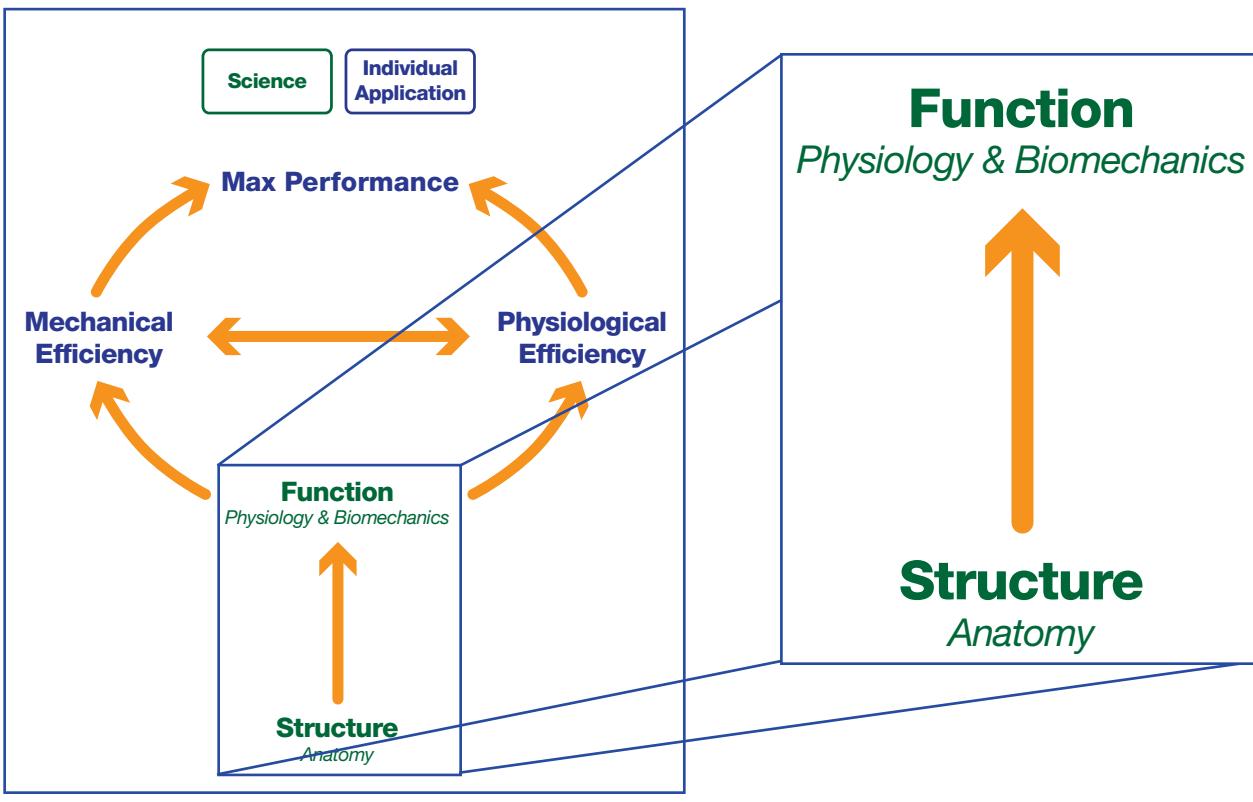
The names of muscles are developed from different word roots. For example, the “Bi” in biceps brachii means two, and the biceps muscle has two parts. The “Tri” in triceps means three, and the triceps muscle has three heads.

Remember that memorizing the anatomy and functions of the major muscle groups of the body is important, but it is even more important to be able to apply this knowledge. The personal trainer or fitness professional cannot rely simply upon information found in books; they must be able to apply this knowledge in “real world” situations to be considered a true professional and worthy of high consumer demand.

STOP!

Biomechanics is the last of the foundational sciences we will cover. While the science of biomechanics is very complex, this chapter is intended to be a basic introduction. The goal of this chapter is to give you an overview of biomechanics and how understanding and properly applying basic biomechanical principles is essential to successfully carry out the three primary tasks of a trainer (the “assess, design and instruct” model).

Knowledge of biomechanics will empower you with the ability to understand **WHAT** the best exercises are for your client or athlete, **WHY** an exercise works (or doesn’t work) for its intended goals, and **HOW** to implement the technique properly.



Biomechanics

Introduction to Biomechanics

What is Biomechanics?

Biomechanics evaluates the motion of a living organism and the action of forces upon it. In the personal fitness training field, biomechanics can be looked at as the study of how the body moves and what causes movement either internally (via muscles) or externally (via external load or added weight bearing activities). Biomechanics is simply the application of the Laws of Physics to the human body.

Why are we concerned about Biomechanics?

If you were to pick up a sports biomechanics textbook, it would most likely say there are two primary goals for biomechanics: **performance enhancement** and **injury prevention/rehabilitation**. Biomechanics enhances performance by utilizing mechanical principles to improve an individual's technique, the equipment they use and to modify specific training protocols that the trainer implements to help an individual achieve their goals. Similarly, for injury prevention and rehabilitation, biomechanics is used to develop techniques that reduce the chance of injury as well as changes in equipment design to reduce injury.

Consider the “Job of a Trainer” from chapter 1. What is the goal of a personal fitness trainer? “Help clients reach their goals the most efficient, effective and safest way possible.” Now compare that with the goals of biomechanics. They are virtually the same! To reach goals (performance enhancement) the most efficient, effective and safest (injury prevention) way possible.

Think about what we've learned so far. When we move, our nervous system instructs our muscles to contract. These contractions cause bones to move around the axes of joints. For this reason, our bodies can be viewed as a series of **levers** (bones) which rotate around an **axis** (joints) under the direction of a **force** (muscular contraction). When working with a client, we have a responsibility to not only guide them to their goals, but to do so in a safe and effective manner. It is vital to have some understanding of how the human body is meant to move and more importantly, which movements to avoid and why. If a trainer does not understand these fundamental principles, their workouts will be inefficient and potentially dangerous. Our primary concern as trainers should always be to give clients the greatest benefit with the least amount of risk.

Biomechanics - a NEW way of looking at exercise

One of the primary goals of this chapter is to empower you with a solid foundation in biomechanics. Another is to introduce you to a new way of looking at exercise in general. This new perspective is simply this:

Exercise is simply a mechanical stress placed on the body to which the body will adapt.

In order to understand this new perspective and its importance, one must be willing to accept several premises.

Premise #1

The primary physiological effects of exercise (both good and bad) are in direct response to the mechanical stress placed on the body.

Remember the GAS Theory from chapter 2? The GAS Theory shows us that the body will undergo adaptations when it is stressed. Exercise can be seen as a mechanical stress (Force/Area), placed on the body where the body must accept forces from external sources and respond by creating the appropriate internal forces (from the muscles and connective tissue) to create the appropriate movement. The stimulus of these stressors (both externally and internally), stimulate the physiological adaptations within the body. These physiological adaptations may be **structural** (adaptations to connective tissue such as muscle, bone and fascia) or **functional** (neuromuscular adaptations - i.e. motor learning).

Premise #2

In order to facilitate the proper adaptations for our clients we have to understand forces, how they are applied (how much, in what direction, over what range of motion and at what speed), and how the tissues of the body will adapt to those forces.

Put simply, understanding forces and their effects is at the core of personal fitness training. Remember, there are forces on us all the time (whether something is moving or not). And if there is movement, there's a force that caused that movement.

Premise #3

Proper understanding and implementation of biomechanics is essential in all aspects of training (Assess - Design - Instruct).

When you reach the assessment section, you will find that much of the assessment process consists of postural and movement assessments. Put simply, these are biomechanical assessments (looking at how the client's body has adapted to the forces through the years). These assessments might indicate certain kinetic chain imbalances (short/tight muscles on one side of a joint) that need to be addressed.

As previously stated, understanding how the body is going to adapt to the biomechanical stress you place upon it is essential to program

design. The exercises chosen (and how they will be implemented) are based on the client's goals and needs and your knowledge of how to make them adapt safely and efficiently.

Lastly, exercise instruction - the area where most personal trainers associate the importance of biomechanics. Put simply, understanding basic biomechanics is the basis of instructing proper technique.

How do we use Biomechanics to Maximize Performance and Minimize Chance of Injury?

There is a systematic thought process that every trainer must utilize in order to ensure that their clients are getting the most of every rep in every set.

Analyze (movement)
Optimize (movement)
in order to...
Maximize (performance)
Minimize (injury)

What do we Analyze?

When we evaluate the client's technique, we are doing a biomechanical analysis (and remember, every rep of every set is an assessment). You should be able to distinguish between what is important and what is unimportant, what is correct and what is incorrect, what is possible and what is impossible, what is effective and what is ineffective, what is safe and what is unsafe, etc.

The first thing to evaluate and understand is the movement itself, without regard to the forces that caused it. In physics, this is known as **kinematics**. This would be analyzing such details as the osteokinematics (planes of motion) you learned in chapter 3, the direction of motion, the path of motion, and the range of motion. Furthermore, a kinematic analysis might include basic kinematic variables such as distance, speed and acceleration (which you will learn shortly).

Only after you analyze the kinematics to you look at the forces that cause the movement (as well as other forces on the body). In physics, this is known as **kinetics**.

Another way of looking at the analysis process is to look at joints first (both moving and not moving, describing them kinematically), then the external and internal forces on the body (kinetics). Note, muscles are engineered to move joints in a particular fashion (based on the structure of the joint). So a basic understanding of joint structure and function is essential for proper muscle activation (i.e. if we are moving the joints properly, then the muscles must be working properly). Furthermore, we don't really know which internal forces are developed without first looking at the external forces that caused it.

Basic Definitions

Kinematics - The study of motion without regard to its causes (forces)

Kinetics - The study of forces acting on a system

Kinesiology - The scientific and artistic study of human movement

Force - A "push" or a "pull". Based on Newton's Second Law of Motion, Force = Mass x Acceleration

Step 1: Describe the Ideal Technique

In order to train anyone a particular movement, you must have a fundamental knowledge of the skill. This begs the question, how do we know the "ideal" technique? If it's a performance movement, such as pitching a fastball, you'll want to watch successful pitchers, read coaching journals and textbooks, and find any other sources that discusses how successful individuals apply their skill.

More likely, you'll be describing some sort of exercise or drill. Once again, you'll use the same strategy of researching what the "ideal" technique is. That said, whether your describing a sports-specific skill or an exercise, you must think critically and be skeptical of the "experts". Just because one person is successful doing a bench press in a particular fashion doesn't mean everyone should use the same technique. Please remember that your job is to individualize the technique to the individual. It should be customized to their current abilities, their genetics and their goals.

The bottom line is when you are researching to describe the ideal technique, you are really attempting to find the common characteristics of the most efficient technique and to appropriately modify this characteristics with your clients.

How do we Analyze?

DOE-I: The practical way to Analyze and

Optimize

While it is unlikely that you will be using advanced biomechanical analysis tools with your clients, there is a step-by-step process to do a qualitative biomechanical analysis recommended by McGinnis (2005).

DOE-I		
Step 1	D	Describe (the ideal technique)
Step 2	O	Observe (the client perform the technique)
Step 3	E	Evaluate (the performance)
Step 4	I	Instruct (the client)

Step 2: Observe the Client Performing the Technique

When observing a client perform a particular technique, we have to ask ourselves several questions.

- Who are we observing? What is their current skill level? What are their current limitations?
- Under what conditions?
- Where to observe?
- What to look for?

The answers to these questions will determine your ability to successfully evaluate the client.

Step 3: Evaluate the Performance

When evaluating the performance, we are simply comparing the “ideal” with the actual performance of the client. We are identifying errors and evaluating those errors to determine the focus of your correction efforts. As the old expression goes, “you have to pick and choose your battles.” Is the error actually dangerous and there is risk of injury. Or, is it a new client learning a new skill that will take time to develop the proper motor pattern?

How do we Optimize?

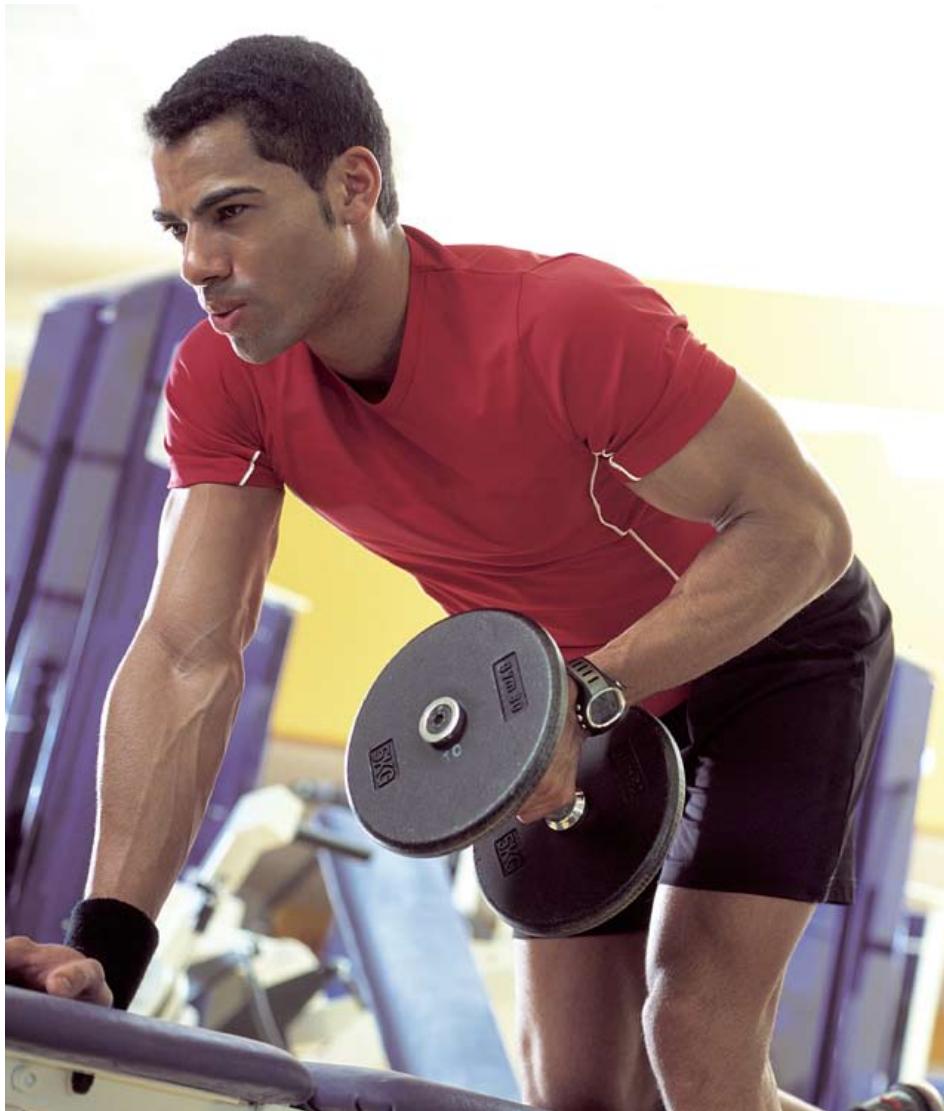
Step 4: Instruct the Client

This is where proper communication skills are vital so you can successfully communicate with

the client and correct the errors in technique. This will be discussed in greater detail in Chapter 10: Exercise Instruction.

What to we Optimize?

Again, we focus on both the movement (kinematics) and the forces that cause the movement (kinetics). We take into account the structure of the body (specifically, the anatomy of the joints first), its intended function and the goal of the exercise. We need to understand the ideal movement and instruct accordingly. Our goal is to get our clients as close to the ideal technique (which may be unique to them) in order to Maximize Performance and to Minimize Injury.



Dumbbell Row

Analyze

Goal?

- muscle hypertrophy (ex: latissimus dorsi)?
- “pulling” strength?
- “pulling” endurance?
- other?

Kinematics?

- start position?
- plane of motion?
- path of motion?
- range of motion
- speed of motion?
- other?

Kinetics?

- external forces (ex: dumbbell)
- internal forces (ex: muscles involved)

Analyze (Kinematics and Kinetics)	Describe (the “ideal”)	Goal
		Start (Position)
	Observe	Motion (Kinematics and Kinetics)
		Start (Position)
Evaluate	Motion (Kinematics and Kinetics)	Start (Position)
		Motion (Kinematics and Kinetics)
Instruct	Motion (Kinematics and Kinetics)	Start (Position)
		Motion (Kinematics and Kinetics)

Maximize Performance & Minimize Injury



Dont Panic! Physics concepts are coming !

The following pages will have a basic physics review. You are not expected to memorize kinematic formulas and definitions. However, you will be expected to understand kinetic concepts such as force, torque and power and how they apply to safe and effective training. In order to understand forces and their effects, we must first review the basics of movement description. If it becomes confusing, just remember - first we look at movement (specifically joint movement), then forces (external forces, then internal forces).

Movement -> Outside Forces -> Inside Forces

Kinematics - Analyzing Motion (How far? How fast? In what direction?)

Scalars and Vectors

In order to analyze motion, one first needs to be able to describe motion. One needs to be able to answer kinematic questions such as:

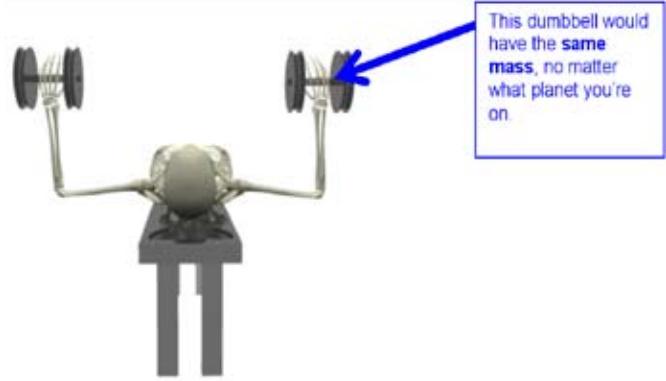
- What type(s) of motion is(are) occurring.
- What is the start positioning?
- What is the goal of the motion?
- How much motion is there (range of motion)?
- What direction is the motion (path of motion)?
- How fast is the motion?

The following section will introduce basic kinematic concepts that are important to the questions above (as well as many other questions we haven't considered yet). But before we start showing how to answer the questions above, it is important to designate two classifications of quantities used in mechanics - **vectors** and **scalars**. Anything that can be measured in physics is classified as either a scalar or a vector.

Scalars

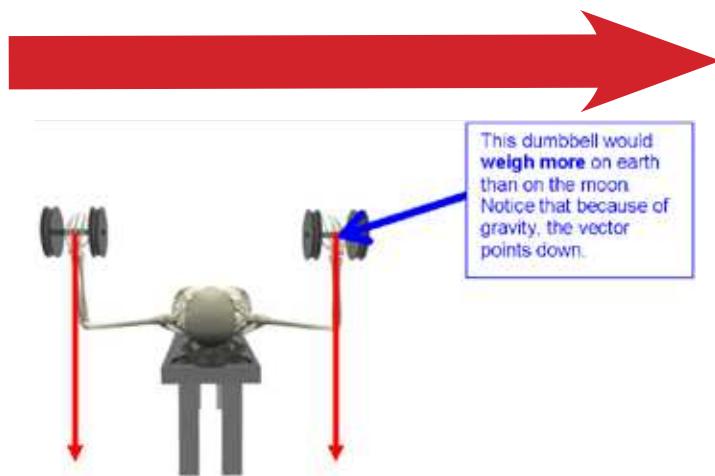
A term describing distance, speed or mass which has magnitude but no direction. In other words, it is a quantity that can be fully described by its magnitude.

For example: Mass (m) - a scalar quantity measuring an object's inertia (resistance of an object to motion). The mass of the dumbbells in the picture below would be the same on the moon as it would be on earth (even though its weight is very different).



Vectors

A term describing something that has both magnitude and direction (i.e., displacement, velocity, force). Vectors are represented by an arrow. The direction and length of the arrow demonstrates the equivalent of a force and how it is applied to an object.



Types of Motion

What is motion? Movement is a change in position from one point to another over a period of time. We classify movements as either **linear**, **angular**, or both (**general**).

Linear motion (i.e. translatory motion) is when all the points on an object move together - the same distance, the same direction and at the same time. There are two types of linear motion, **rectilinear** motion and **curvilinear** motion. Rectilinear motion is what is most commonly associated with the idea of "linear" motion - it is movement in a straight line. Curvilinear motion, on the other hand is movement on a curved path.

Rotary movement is the movement of an object or segment around a fixed axis in a curved path. Each point on the object or segment moves through the same angle, at the same time, at a constant rate. An example would be a door with the hinge as the axis and the door which moves around it. There are few, if any joints in the human body which move around a truly fixed axis. However, for simplicity's sake, joint motions are often described as being rotary movements.

General plane motion is a special case of curvilinear motion where the object is segmented and free to move rather than rigid or fixed. In general plane motion, an object rotates about an axis while the axis is translated in space by motion of an adjacent segment.

VIDEO
click here

types of motion

linear motion	rectilinear motion	
	curvilinear motion	
	rotary (angular) motion	
	general plane motion	

Describing Motion

Linear Motion

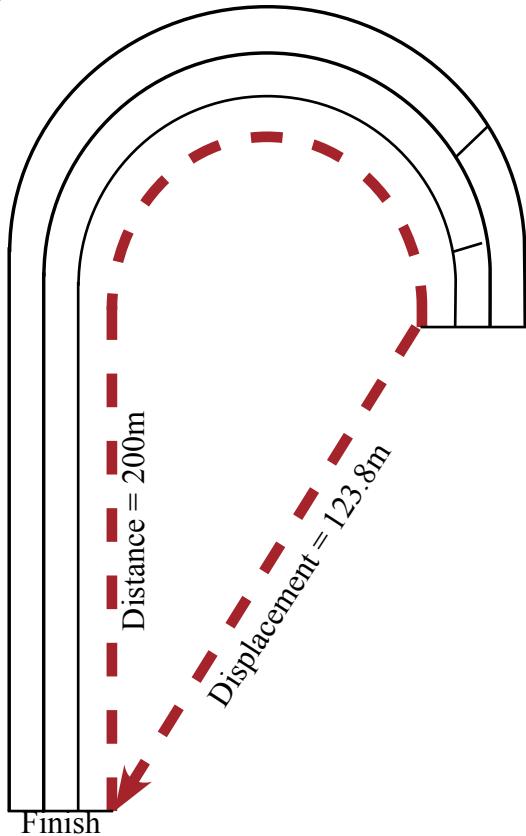
Linear motion is measured in linear distance (i.e. inches or centimeters).

How high is this weight lifted?



Distance and Displacement

Linear motion is quantified either as distance or displacement. Distance is simply a measure of the path followed of an object, from it's initial position to it's final position. Displacement on the other hand is a vector quantity describing a change in position, a straight line from initial position (no regard to path taken). For example, let's look at a runner on the inside lane of a track for a 200m sprint. The distance covered is 200m, but the runner's displacement is approximately 123.8m.



Velocity and Speed

Velocity and speed both measure the rate in change of the position of an object. In other words, "how fast" something is moving. Average velocity is a vector and is total displacement over time.

$$\text{average velocity} = \frac{\Delta \text{displacement}}{\Delta \text{time}}$$

Speed is a scalar and is the total distance covered over time.

$$\text{average speed} = \frac{\Delta \text{distance}}{\Delta \text{time}}$$

Acceleration

A vector quantity demonstrating the rate of change of an object's velocity. In other words, it is how quickly something "speeds up" or "slows down."

$$a = v/t$$

Note: acceleration is a very important concept. In a sense, it bridges the two branches of mechanics - kinematics (motion) and kinetics (forces). This is because as we are going to find out shortly, if there is an acceleration, there is a force that caused it.

Momentum

A vector (symbol = p , since "m" was already taken for mass) which measures the motion of an object. It is an object's mass multiplied by it's velocity.

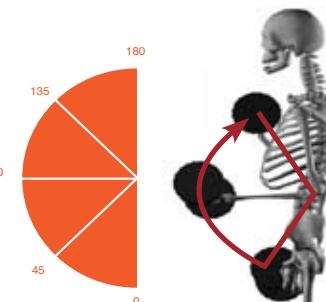
$$p = mv$$

Notice two things about momentum. First, momentum truly is the measurement of an object's motion. So when you think motion, think momentum. Second, notice that momentum is a constant. In other words, an object will maintain it's motion (momentum) unless acted upon by an outside force. This is known as Newton's First Law of Motion. So an object will maintain it's motion (or lack of motion) unless an outside force speeds it up (accelerates it) or slows it down (negative acceleration, "deceleration").

Rotary/Angular Motion

Rotary/Angular motion is measured in degrees or radians.

How many degrees were completed in this ROM (Range of Motion)?



What Kinematic Descriptors are important to Personal Fitness Trainers?

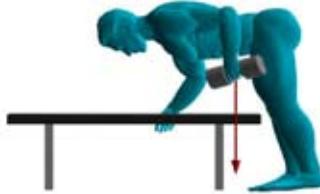
While the above kinematic variables are important in those who study sports biomechanics, personal fitness trainers will primarily describe movement using osteokinematics (planes of motion) and the human movement descriptors

discussed in chapter 3. In addition, personal fitness trainers will describe movement as it pertains to joints moving together.

Compound v. Single Joint Movements

Compound Movement

(Multi-joint): Overall movement is due to several joints working together. (i.e., single-arm row (shown) squat or bench press).



Single Joint Movement:

Overall movement is due to one joint moving about its axis. (i.e., Bicep curl (shown) knee extension or lateral raise)



VIDEO
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Closed Chain v. Open Chain

Closed Chain is an engineering term and is used in kinesiology to describe compound movements where the movement of one joint will produce predictable motion at another joint. (i.e., barbell squat (if knee joint moves, hip must move)). It is a kinematic interdependence - the chain is “closed” when both ends are fixed to a common object.



Open Chain is an engineering term which will be used to refer to a compound or single joint movement where the movement of one joint does not require the movement of another joint. (i.e., dumbbell bench press (movement of the shoulder does not dictate movement of the elbow)). The chain is “opened” because one end is not fixed and hence interrupts the kinematic interdependence.



VIDEO
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Kinetics - Analyzing Forces

Force - (this is important so pay attention!)

Force is a vector quantity, exerted between two bodies in contact.

$$F = ma$$

(Force = mass x acceleration, unit = Newton).

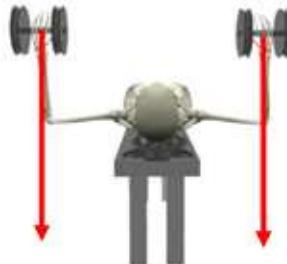
Also see Newton's second law)

More simply put, a force acts as a PUSH or a PULL. It is represented by an arrow. The direction of the arrow is the direction of the force. The origin of the arrow is the site of application of the force and the length of the arrow represents its magnitude.

Weight

Weight is a type of force, measuring an object's gravitational attraction to the earth or another object.

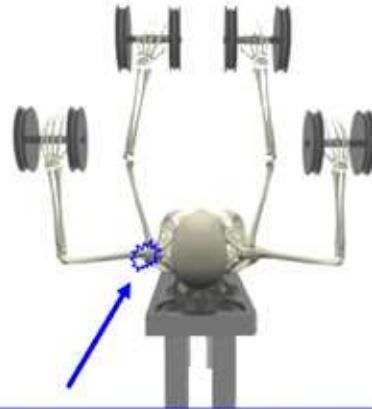
$$\text{Symbol} = w = g * m$$



The weight of the dumbbell is due to its mass and the acceleration due to gravity. This is the primary force our muscles must work against. Notice once again that the force (weight) of the dumbbells is straight down (because of the pull of gravity).

Impulse (J)

A force applied to an object over time that causes momentum to change. In other words, Force is equal to the rate of change of momentum. If you increase momentum (either by increasing the velocity or increasing the mass) it will take more Force to stop the momentum. This is where potential injuries can occur. If momentum is increased (commonly done by increasing velocity and “throwing the weight”), it is not the “throw” of the weight that is typically dangerous, but having to stop and “catch” the weight. If this Impulse (Force) needed to stop the motion (momentum) is uncontrolled, it can cause damage to the connective tissues. This ability to “decelerate” an object is important in developing explosive power that is often used in sports. However, these are skills that must first be developed through the use of controlled movements which challenge coordination and proprioception



Uncontrolled momentum on the down phase of the chest press can result in injuries to the glenohumeral ligaments.

Work (W)

Work is defined as the product of the force on an object and the distance it moves in the direction of the force.

$$\text{Work} = \text{Force} * \text{Distance}$$

Work performed is associated with energy. Energy is defined as the capacity of a physical system to do work. As an oversimplification, just remember that the more work is performed, the more energy is needed and hence calories consumed.

Power (P)

Power is defined as the rate of doing work (i.e. how quickly work is done).

$$\text{Power} = \text{Work}/\text{Time}$$

Power is also defined as the product of the force of an object and the velocity of the object in the direction of the force.

$$\text{Power} = \text{Force} * \text{Velocity}$$

Power is often highly sought after in training for performance.

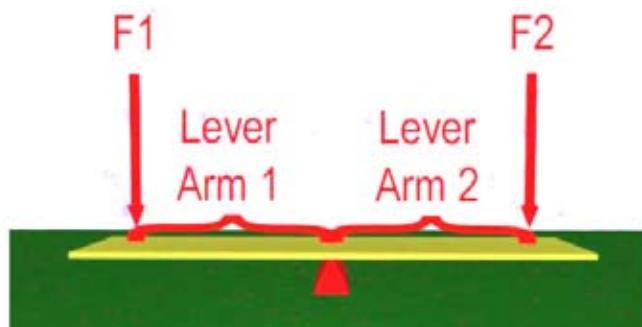
Think about it...

“There was no point telling an athlete to perform a certain type of training if I didn’t understand how much force they had to produce, in what direction, over what range of motion it needed to be produced and at what speed. I also realised that, instead of spending months giving an already good athlete lots of physical training to make them just a little bit fitter, I could spend a few weeks altering their technique to make them staggeringly more efficient ... and the world of sports performance seemed to open.” (Dr. Anthony Blazevich, Sports Biomechanics - The Basics: Optimising Human Performance 2007)

Forces and Rotation

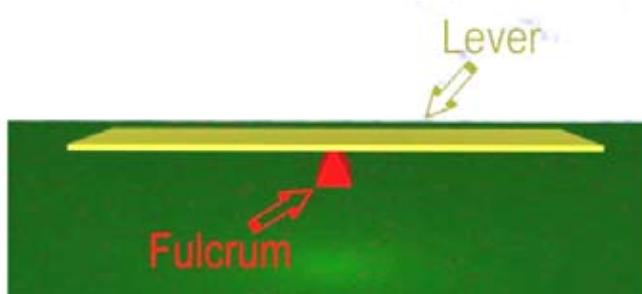
Levers

A rigid object that transmits and modifies force or motion when forces are applied at two points of the object and it turns about a third point.



Axis (Fulcrum)

The point which a lever rotates around due to an applied force.



Lever Arm (LA)

The portion of the lever that is a fixed distance from the axis to the point of application of force.

Effort/Force arm (FA)

A type of lever arm which is measured from the distance of the axis to the force causing movement on the lever.

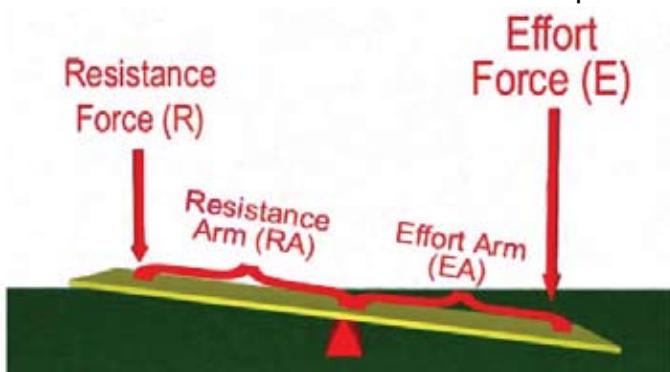
Resistance arm (RA)

A type of lever arm which is the distance from the axis to the force (resistance force) that resists the effort force.

Lever Classes

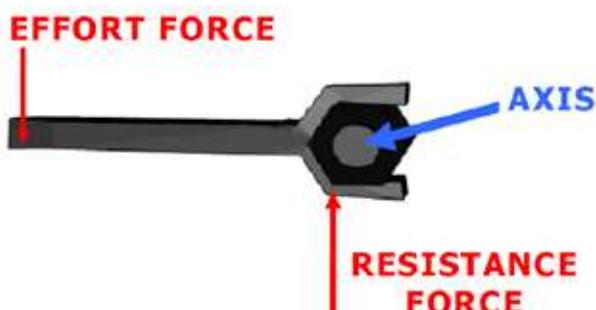
A First Class Lever

A lever in which the axis lies between the effort force and the resistance force. For example . . .



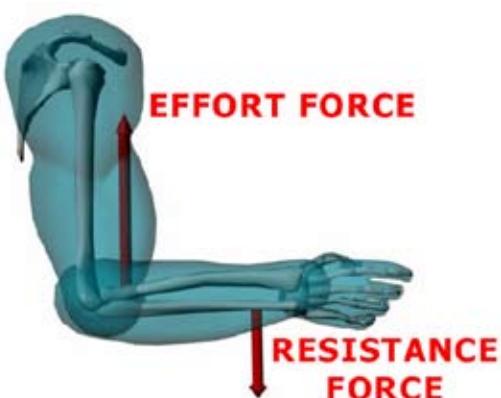
A Second Class Lever

A lever in which the resistance force acts between the axis and the effort force. For example



A Third Class Lever

A lever in which the effort force acts between the axis and the resistance force (*This is how the majority of joints in the human body work!*). For example . . .



Torque

Torque is the ability of a Force to cause rotation around an axis. It depends not only on magnitude and direction, but also the distance from the axis of rotation. The greater the distance from the axis, the greater the change in rotational motion that will be produced by a given Force

$$\text{torque} = r * F * \sin \theta \quad \text{or torque} = F * \text{perp. dist.} \\ \text{perp. dist.} = \text{Moment Arm (MA)}$$

There are 3 elements that make up torque:

1. The amount of Force applied to the lever (F)
2. The distance of the application of force is to the lever (r = lever arm)
3. The angle the force is being applied to the lever (sin theta or force angle)

Notice if the force is being applied perpendicular to the axis ($\sin 90^\circ = 1$) all the force is being applied as torque. If sin is greater or less than 90° , some of the force will be applied as either compression or distraction (see below).

Force Angle (FA)/ Resistance Angle

- The angle between the force vector and the lever, on the side of the joint axis
- FA is simply the $\sin \theta$ from the formula for torque above
- FA is not directly related to the joint angle
- FA changes as the muscle's relationship to the bone changes during motion

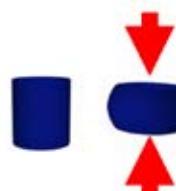
Moment Arm (MA)

- The shortest distance between the force vector and the joint axis
- MA is simply the $r * \sin \theta$ from the formula for torque above
- MA is measured by drawing a line perpendicular from the force vector to the axis of rotation

Forces and Linear Motion

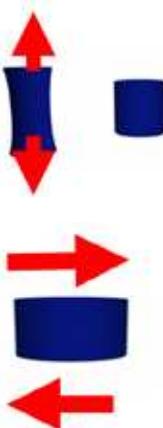
Compression

Force upon the lever is directed toward the contact surfaces



Distraction

Force upon the lever is directed away from the contact surfaces



Shear

Force that lies parallel to the contact surface. If two forces are present and are in opposite directions. Think friction or a rubbing force



Internal Forces - Mechanical Characteristics of Muscle

Length-Tension Relationship

The relationship between the length of the muscle and the tension produced by the muscle. The highest tensions are developed slightly past resting length, this is primarily due to optimal actin-myosin overlap.

Passive and Active Insufficiency

The diminished ability of a muscle to produce muscle tension due to length-tension relationship. Often occurs when the muscle is elongated to a point where there is little actin-myosin overlap (Passive) or where the muscle is excessively shortened and no more actin-myosin sliding can take place (Active)

Active and Passive Components

When a muscle contracts, the duration of the contraction depends on both active (active) and passive (elastic) components. Here is a three component mechanical model developed to describe this:

Contractile (Active) Component

Found in myofibrils where cross-bridging of actin and myosin take place

Series Elastic (Passive) Component

Found in the tendon and the actin-myosin cross-bridges. Since this component lies in series with the contractile component, it acts like a spring, slowing down muscle force build-up and increases mechanical energy.

Parallel Elastic (Passive) Component

Found in the sarcolemma and the connective tissue around muscle (endomysium, perimysium, epimysium). As the muscle is lengthened, the parallel elastic component prevents external forces from pulling the contractile elements apart.

Hand-Off System

Often a muscle loses mechanical efficiency through a range of motion and another muscle gains mechanical efficiency and takes over. In other words, as one muscle can no longer do its job, the job is "handed-off" to another.

Multi-Joint Muscles

When a muscle crosses two joints and cause seemingly opposing motions through a movement, the joint which is more mechanically favorable (i.e. has a greater moment arm to the action line) will dominate. In most situations, these muscles act as belt-like stabilizers in the chain. When training these two-joint muscles, often best to allow only one joint to move and keep the other stabilized



Forget the Definitions, Forget the Math - “Feel the Force”

Exercise Analysis 1

So what is it you have to know?

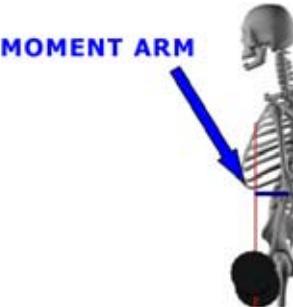
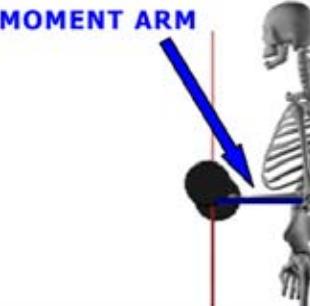
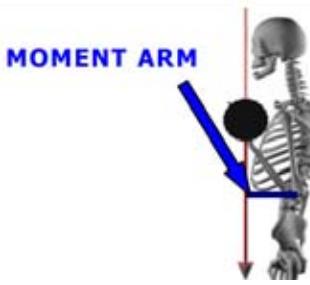
First, you must recognize that there are forces acting on and within the body at all times. As a trainer, you must be able to “see” forces both Externally (ex: gravity - external weight and body weight) and Internally (ex: muscles, connective tissue, etc.).

Secondly, realize that while human movement is fairly complicated, it can most often be broken down into “rotatory” movements at each joint. Therefore, TORQUE must be understood.

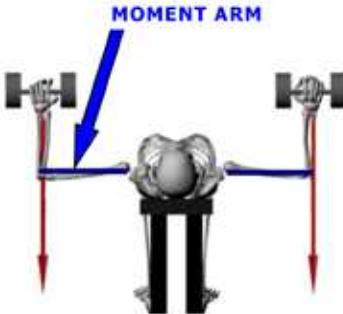
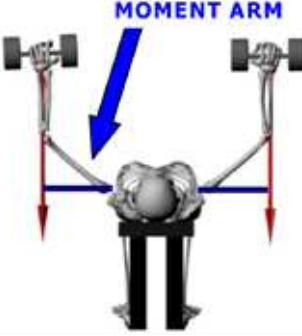
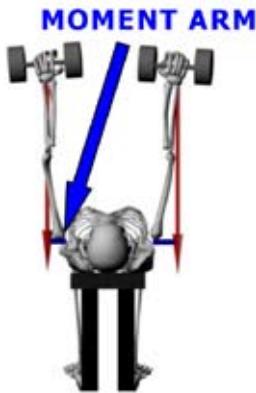
Thirdly, realize that the amount of torque generated at each joint due to external and internal force is a function of the force applied, the distance from the axis and the direction of the force.

Finally, realize that if the direction of force is not applied at 90 degrees to the lever (i.e. force angle $\neq 90^\circ$), then some force will become translatory and will affect the joint in a distractive or compressive manner.

***Note, we are looking only at the force due to the dumbbell! In reality, the weight of the forearm would need to be considered!*

stage 1	If we extend the force vector created by gravity up (in order to visualize the moment arm), we can see a very small moment arm when the elbow is slightly flexed. That means very little of the force created by the dumbbell is creating torque (elbow extension). Therefore, since the weight is pulling down, away from the elbow, it is also creating distraction.	
stage 2	When the force vector is at 90° to the lever, the moment arm = the lever arm and all the force of the dumbbell is creating torque (look at the angle between the force vector and the lever, NOT the angle at the elbow joint!).	
stage 3	When the elbow is fully flexed the moment arm is smaller than stage 2, but still significant. Since the weight is pulling down, into the elbow joint, it is also creating compression. The resistance profile on the elbow would be: Stage 1: easy; Stage 2: hardest; Stage 3 moderate.	

Exercise Analysis 2

stage 1	<p>The moment arm is created by drawing a perpendicular line from the Force Vector created by the dumbbell (gravity is pulling straight down), to the axis of rotation we are interested in (the glenohumeral or shoulder joint). In this case the weight is causing a lot of torque (rotation) at the shoulder joint. Specifically, the force is causing horizontal abduction of the humerus. Therefore, the muscles which oppose that rotation (primarily the pectoralis major shortens to cause horizontal adduction of the humerus) will be working.</p>	
stage 2	<p>Now the moment arm at the shoulder joint has become smaller. There is now less torque (rotation) being created by the external force (dumbbell). Therefore, less internal force is needed to move the joint (i.e. the exercise gets easier).</p>	
stage 3	<p>In this stage, the moment arm is almost non-existent. When the dumbbells are raised high enough so that the force vector goes through joint, the moment arm is gone and no torque is created (the chest muscles are not actively opposing movement and can rest).</p> <p>Therefore the resistance profile of the exercise (on the shoulder joint) goes from: Stage 1: Hard; Stage 2: Moderate; Stage 3: Easy-rest.</p>	

[Click here for exercise analysis 1](#)

VIDEO
click here

[Click here for exercise analysis 2](#)

VIDEO
click here



think about it

What is the resistance profile on the elbow joint? If this exercise were changed from a dumbbell press to a dumbbell fly, would the moment arms change at the 3 stages? Would the resistance profile change?

Chapter Summary

Before administering or utilizing any exercise, it is crucial to be able to understand and apply the laws of physics through the application of biomechanics to human movement. Movement itself is greatly altered when forces are applied to the body and it is the job of the personal trainer or fitness professional to recognize the direction and effects of those forces by assigning appropriate exercise and resistance. A body weight squat is dramatically different than a loaded barbell squat in terms of loading to the shoulder girdle, spine, hips, knees and ankles. When rotation AND loading are added to movement (such as a one legged squat with unilateral arm cable pull or making a decision to lift heavy weights off the floor at the sides of the body while sitting on a bench) the amplification of forces and increasing risk is intensified dramatically. The trainer must be sure that the implementation of external loading (i.e. the angle of force application, direction of resistance, joint position and range of motion) for each exercise fits the ability and goal of the individual performing the exercise.

Should a client perform a push-up, machine fly or a barbell bench press? How much external load (if any) should be applied? Where should the load be placed during a movement? Should the client press with hands wide, close together, or somewhere in between? What stresses occur at the wrist, elbow and shoulder as a result of hand placement during movement? How will joint positioning throughout the press affect not only strength gains and conditioning, but wear and tear on the joints? These are the many questions a professional trainer must ask when designing a program in order to properly apply the principles of biomechanics to exercise. Only then will the client reach their true potential and obtain the greatest benefits for their efforts. Only then is the personal trainer giving the client the professional instruction for which they have paid.

It is not important that the trainer SEE EVERYTHING, but that they progress clients carefully, and give sufficient thought to exercise programming and application decisions. A trainer must continue to learn and seek to understand how movement changes the intensity of an exercise and the forces which act upon the body at different phases of movement. No one said this was easy. Great success never is.

Flexibility

Foundations

Flexibility is the ability for a joint to achieve a full range of motion (ROM) with the proper balance of *elasticity* and *plasticity*. In order to fully understand flexibility, we also have to be familiar with the properties of both elasticity and plasticity. Elasticity is the ability of both muscular and connective tissue to return to normal length after being stretched. Plasticity is the ability of connective tissue to achieve a new and greater length, after a stretch, without return to normal length. There are two main elastic components of connective tissue which either impede or allow the joint to achieve its full ROM. These components act in a manner similar to a spring and are known as the *parallel elastic* and *series elastic components*.

Parallel Elastic Components

Muscle Connective Tissue:

- Epimysium
- Perimysium
- Endomysium

Series Elastic Component

- Tendon

When a muscle is stretched too far or too quickly, the *muscle spindle* causes the muscle to contract as a protective mechanism. The muscle spindle is a sensory receptor that lies within the muscle fibers and detects muscle length and change in rate of lengthening. The resulting muscular contraction created by the muscle spindle serves to protect the muscle from overlengthening. It does so with an excessively quick contraction (more than the current musculotendinous conditioning will allow), and is known as the stretch or myotatic reflex. In order to achieve significant benefit from stretching to and avoid in-

jury, it is imperative that the muscle spindle be overridden by gradually lengthening the muscle through a proper warm-up, or stretch, that gives the Golgi tendon organ (GTO - another sensory receptor) sufficient time to override the muscle spindle (20-30 seconds). The Golgi tendon organ protects the muscle by causing it to relax when the muscle develops too much tension or incurs a change in tension too quickly. The GTO monitors tendon length and is found in the tendons at the ends of the muscular fibers, where they attach to bone.

The act of causing the muscle to relax in this manner is known as autogenic (self-generating) inhibition. An example of autogenic inhibition, bringing the pectoralis major through its full range of motion (horizontal abduction) where it contracts to protect itself and is then allowed to relax when the GTO overrides the muscle spindle. Reciprocal (inverse) inhibition occurs when the antagonist relaxes due to contraction by the agonist. For example, the hip flexors will be reciprocally inhibited and forced to relax when their antagonist, the gluteus maximus, contracts.

Sensory Receptors	Role(s)
Muscle Spindle	Proprioception and Protection (protects the muscle from over-lengthening by quickly contracting the muscle - the stretch reflex)
Golgi Tendon Organ	Proprioception and Protection (acts like a strain-gauge and protects the muscle from over contracting - autogenic inhibition reflex)



think about it

The muscle spindle is responsible for detecting the length of a muscle, and the golgi tendon organ is responsible for monitoring the tension of a muscle.

Autogenic and reciprocal inhibition occurs every time you move, but you mostly feel it when you stretch. Try touching your toes to stretch your hamstrings. Notice that after about 20 seconds, your muscle seems to relax and you can stretch a little further? The initial tightness is caused by the muscle spindles detecting a change in length. The golgi tendon organs then kick in and release the tension – allowing you to stretch further.

There are numerous ways to achieve increased flexibility or joint ROM. Younger people tend to be more flexible than their older counterparts and women tend to be more flexible than men. This may be due to both structural and anatomical differences as well as the extent and types of activities which individuals perform. When older individuals stop exercising or become hypokinetic, fibrosis can set in, and fibrous connective tissue starts to replace degenerating muscle fibers. Research shows that inactivity and a decreased use of full ROM leads to accelerated fibrosis. This concept emphasizes the need to both stretch and utilize a full ROM when exercising. The concept of “use it or lose it” now applies and in terms of flexibility, it applies to each muscle group. For example, stretching the hamstrings will not improve your shoulder flexibility. In general, an active individual tends to be more flexible than an inactive one, due to more consistent muscle activation and ROM actions.

EXAM ALERT

What is ROM? What are the characteristics of tendons? What does the muscle spindle do? What is the GTO? What does it do? What is reciprocal inhibition?

While we want to promote the benefits of flexibility, it is still important to keep in mind that tendons are not meant to be stretched and that stretching beyond a safe range can damage tendons. This can also increase chance of injury when ROM and flexibility are not monitored properly. Ligaments are a little different in that they are meant to allow more movement with respect to the bones or joints that they stabilize, but can be overstretched and may create excessive joint laxity or a hyper-mobile joint. Joint integrity and stability rely upon sufficient muscular strength of all affected muscles crossing a particular joint in order to prevent damage and injury. Again, this is why knowledge of functional anatomy is a primary consideration for any trainer who includes components of flexibility into a clients' program design.

EXAM ALERT

What are the various types of stretching? Be able to give examples of each. What is the importance of a warm-up? A cool-down?

Flexibility and Stretching

There are various forms of stretching and means of achieving flexibility. Depending upon the goal of the individual and their current level of conditioning, certain forms of stretching may be more appropriate than others.



CLICK HERE

types of stretching

static stretching	Static stretching requires a gradual lengthening of the muscle by holding a position at the first point of resistance for 20-30 seconds to allow the GTO to override the muscle spindle and allow the muscle to relax and reach a greater ROM.
dynamic stretching	Dynamic stretching involves constant, controlled motion through a full ROM to stimulate blood flow and warm-up the desired muscle group. <i>Don't over-think the word "dynamic." Dynamic stretching is just a form of functional stretching that includes movement. Skipping, lunging, high knees and butt kicks are all examples of dynamic stretching.</i>
ballistic stretching	Ballistic stretching is a quick, explosive movement that usually involves bobbing, bouncing, and jerking to prepare muscles for an explosive maximal lift or sport related movement.
PNF	PNF or Proprioceptive Neuromuscular Facilitation involves the use of a partner-assisted stretch involving both passive and active muscle actions. PNF utilizes the principles of autogenic and reciprocal inhibition by contracting the agonist against a partner while the antagonist relaxes, allowing the antagonist to reach a new ROM. For example, in a lying hamstring stretch, the partner would be used as a wall (not applying force) while the person being stretched contracts their hamstrings against the partner for 6-10 seconds to enable the muscle to relax (autogenic inhibition) then gains an increased ROM by contracting the quadricep to raise the leg higher as the hamstrings relax (reciprocal inhibition). This should only be performed by experienced and trained fitness professionals.
SMFR	Self-myofascial release or SMFR utilizes the principle of autogenic inhibition as the muscle contracts due to the pressure from a Styrofoam roller (active release due to external pressure on muscle or connective tissue). The individual maintains their position until the GTO overrides the muscle spindle and continues rolling along the length (perpendicular to the roller) of the muscle in the same fashion.

Application: Remember “cherry pickers,” the classic hamstring stretch from grade school? This exercise, where the feet are spread shoulder-width apart and one bounces up and down attempting to touch the ground, is a perfect example of a ballistic stretch. However, hamstrings can easily be strained with this “stretch,” and it is therefore not recommended.

Appropriate Stretching Times

Pre-exercise or Competition

Prior to exercise, the most efficient form of stretching is the use of either dynamic, proprioceptive neuromuscular facilitation (PNF), or self-myofascial release (SMFR). Dynamic stretching requires that the individual has no significant muscular imbalances or overly tight muscles.

Attempting a dynamic stretch with significant imbalances or tightness will lead to increasing tightness and imbalance.

Ballistic stretching is only useful as a pre-exercise form of stretching for an athlete involved in more explosive movements or advanced weightlifters who are preparing for maximal effort. Bobbing and jerking motions should be avoided. The use of quick movements that allow muscles and connective tissues to warm-up prior to intense effort or production of force, should be incorporated into the type of stretch mode or routine used. Most individuals will never need to stretch ballistically since the risk (damage to muscle, connective tissue and joint surfaces) may outweigh the benefit (improved circulation and explosive warm-up).

The use of PNF stretching is a partner-assisted stretch and requires a qualified professional versed in both muscular functions and stretching techniques. Without significant experience and education, a PFT should not attempt PNF stretching. There is a great risk of muscle or connective tissue strain, sprain or pull, without the skills of a qualified professional. PNF stretching is otherwise very useful prior to exercise, due to its ability to excite agonist muscles to then perform the necessary functions required.

SMFR can be used as a warm-up much like a treadmill or bike, as it can focus on specific muscles. This mode of stretching is especially useful if your assessments or observations reveal muscles that are imbalanced or overly tight. SMFR only requires that the trainer recognize approximate origins and insertions of muscles and apply only enough pressure to receive contraction by the muscle (perceived by the client as a feeling of slight discomfort or tension) as muscle first contracts in response). The principle of autogenic inhibition must be recognized and pressure must be applied to tight areas for at least 20-30 seconds to allow for autogenic inhibition.

Application: SMFR is often performed with a foam roll or tennis ball. Using one's body weight, lie the sore muscle area (IT band, scapula, etc.) on top of the foam roll or tennis ball. Remain in this position for at least 20 seconds to help release the tension within the muscle. This is particularly helpful for small and chronically tight areas.

Static stretching can be used prior to exercise but should only be utilized when the need to stretch an overly tight muscle exceeds the benefit that can be gained from obtaining contraction through resistance exercise. In other words, if the pectoralis major is so tight that it is difficult to perform horizontal adduction (full ROM chest press) without pain to the shoulder, then static stretching of the pectoralis major may be a greater need. The reason static stretching is not recommended before exercise/competition or between sets is because it causes the muscle to completely relax. It would then be counterproductive to attempt to immediately contract

that same muscle and then expect satisfactory results. It is similar to taking valium to keep yourself awake while studying. It is not so much dangerous as it is counterproductive to the goal of achieving maximal benefit from exercise. Why make it harder, or more risky, to lift the weight or perform the exercise?

For SMFR or static stretching to be truly effective in improving flexibility, joint mobility and ROM, SMFR must immediately be followed by exercises that strengthen antagonist muscles. If an individual uses SMFR or static stretching on the calf muscles (plantarflexors), the anterior tibialis (dorsiflexor) must be strengthened in the same exercise session. As another example, if the hip flexors and the rectus femoris (hip flexors) are the focus for SMFR or static stretching due to excessive tightness, the gluteus maximus (hip extensors) must be strengthened in the same exercise session. It is up to the personal trainer to determine muscles that are functionally antagonistic to muscles being stretched. If proper strengthening does not follow SMFR or ANY other form of achieving flexibility, there may be too little joint stability, due to excessive tissue laxity and muscle weakness at a joint, to maintain proper movement or to handle increasing loads and intensities. The result may be increasingly tighter muscles, new injuries or even dysfunction in adjacent areas. A lack of flexibility or muscle strength in one area is not isolated to that area alone, the varying stresses can impede function elsewhere along the kinetic chain (i.e. dysfunction at the knee is likely to affect knee, hip and spinal function, due to the interconnect-edness of the kinetic chain).

Post-exercise or competition

Static stretching is most useful as a post exercise form of stretching because it allows blood flow and circulation to the areas where metabolic waste products from intense exercise have accumulated. Here is where the most benefit can be gained from static stretching. This will help decrease muscle soreness and decrease muscle tightness in the hours and days to follow.

If not specifically contraindicated, SMFR or PNF can also be used. Research shows that ballistic and dynamic stretching have little usefulness as forms of post-exercise stretching. Stretching is not meant to be painful and should only be taken to the point of first resistance or the onset of tension and is a skill only learned with experience. If a sharp pain occurs or prior injury is present, stretching of the specific area should be modified or avoided altogether.

Warm-up and Cool-down

Warm-Up

A 5-10 minute sport-specific or general warm-up is advised prior to exercise or competition. This will allow time for an appropriate increase in body temperature and encourage blood circulation to musculotendinous tissue. Consequently, work capacity and force production output will increase if time is taken to gradually warm-up and allow the kinetic chain enough time to respond to the demands made from exercise.

Cool-Down

Taking 10-15 minutes to perform light continuous activity (between 40-55% of max heart rate or overall maximal intensity) following a workout or competition, has been shown to decrease soreness dramatically and increase blood flow to rid the muscular system of metabolic waste products.

Although both the warm-up and cool down aspects are seen to be overlooked in many program designs, the benefit to both trainer and client are clear.

Because a warm-up and cool-down must be performed with any workout, make them fun and mix up your exercises. Perform different forms of stretching, and try to avoid a strict routine. This will be much more enjoyable for you and your client, and will motivate your client to perform warm-ups and cool-downs when working out on their own.



normal joint ROM

ankle/foot	Dorsiflexion	10-20°
	Plantarflexion	45°
	Inversion	30°
	Eversion	20°
hip	Hip external rotation	45°
	Hip internal rotation	35-40°
	Hip flexion	90-120°
	Hip extension	15-30°
	Hip abduction	30-45°
	Hip adduction	30°
spine	Lumbar flexion/extension	12-20° between each vertebrae (total with thoracic - approx 75-90° flexion and 30° extension)
	Lumbar lateral flexion	3-8° between each vertebrae (total with thoracic - approx 35° each side)
	Lumbar rotation	1-5° between each vertebrae (total with thoracic - approx 30° each side)
	Thoracic flexion/extension	3-12° between each vertebrae
	Thoracic lateral flexion	5-8° between each vertebrae
	Thoracic rotation	2-9° between each vertebrae
	Cervical flexion/extension	3-12° between each vertebrae (approx 45° flexion and 55° extension)
	Cervical lateral flexion	0-9° between each vertebrae (approx 40° each side)
	Cervical rotation	0-47° between each vertebrae (approx 70° each side)
shoulder	Shoulder flexion	160-180°
	Horizontal flexion	135°
	Shoulder extension	40-60°
	Horizontal extension	45°
	Shoulder abduction	160-180°
	Shoulder adduction	50-75°
	Shoulder internal rotation	90°
	Shoulder external rotation	90°
wrist	Supination (radioulnar)	90°
	Pronation (radioulnar)	90°

Remember! These are only approximations and the range of motion of each client will differ according to their anatomical limits. These include the shape of joint surfaces, the joint capsule, ligament length, and/or tissue bulk.*

EXAM ALERT

What is the ideal ROM for the rotator cuff? For plantarflexion/dorsiflexion? For shoulder abduction? For hip abduction/extension?

Stretching and Warm-up Examples

This is not meant to be an all-inclusive list. This is meant to show some basic stretches for various body parts. Remember, it is the responsibility of the personal trainer to design a flexibility program for the client that is safe and goal specific.

type of stretch	SMFR
areas affected	Gastrocnemius
points to remember	<ul style="list-style-type: none"> • Apply gentle pressure • Breathe relaxed and evenly • Roll along length of muscle with roller perpendicular to area of focus • Move slowly and controlled from knee to ankle and include slight lateral and medial rotation as needed • Hold for 20-30 seconds or more on tight spots or areas of discomfort • Continue until area and entire muscle is at least 25% improved from initial tightness or discomfort



type of stretch	SMFR
areas affected	Hip Flexors (iliacus and psoas major)
points to remember	<ul style="list-style-type: none"> • Apply gentle pressure • Breathe relaxed and evenly • Roll along length of muscle with roller perpendicular to area of focus • Move slowly and controlled from just above anterior sacroiliac spine (where spine and pelvis meet) to knee joint and include slight lateral and medial rotation as needed • Hold for 20-30 seconds or more on tight spots or areas of discomfort • Continue until area and entire muscle is at least 25% improved from initial tightness or discomfort



type of stretch	SMFR	
areas affected	IT band	
points to remember	<ul style="list-style-type: none"> • Apply gentle pressure • Breathe relaxed and evenly • Roll along length of muscle with roller perpendicular to area of focus • Move slowly and controlled from greater trochanter of hip to knee joint and include slight lateral and medial rotation as needed • Hold for 20-30 seconds or more on tight spots or areas of discomfort • Continue until area and entire muscle is at least 25% improved from initial tightness or discomfort 	

type of stretch	SMFR	
areas affected	Latissimus Dorsi	
points to remember	<ul style="list-style-type: none"> • Apply gentle pressure • Breathe relaxed and evenly • Roll along length of muscle with roller perpendicular to area of focus • Move slowly and controlled from just above shoulder into triceps (with shoulder abducted and elbow extended) to approximately midway down the side and include slight lateral and medial rotation as needed • Hold for 20-30 seconds or more on tight spots or areas of discomfort • Continue until area and entire muscle is at least 25% improved from initial tightness or discomfort 	

type of stretch	SMFR
areas affected	Pectoralis major and minor
points to remember	<ul style="list-style-type: none"> • Apply gentle pressure • Breathe relaxed and evenly • Roll along length of muscle with roller perpendicular to area of focus • Move slowly and controlled from shoulder to sternum in diagonal motion and include slight lateral and medial rotation as needed • Hold for 20-30 seconds or more on tight spots or areas of discomfort • Continue until area and entire muscle is at least 25% improved from initial tightness or discomfort



type of stretch	SMFR
areas affected	Back musculature (Trapezius, rhomboids, spinal erectors, latissimus dorsi, thoracolumbar fascia, and quadratus lumborum)
points to remember	<ul style="list-style-type: none"> • Apply gentle pressure • Breathe relaxed and evenly • Roll along length of muscle with roller perpendicular to area of focus • Move slowly and controlled from upper back/lower neck region (be very cautious in rolling on the cervical spine, or avoid altogether) to post sacroiliac spine (where spine and pelvis meet) and include slight lateral and medial rotation as needed • Hold for 20-30 seconds or more on tight spots or areas of discomfort • Continue until area and entire muscle is at least 25% improved from initial tightness or discomfort



type of stretch	Static	
areas affected	Gastrocnemius	
points to remember	<ul style="list-style-type: none"> • Place foot on flat surface at comfortable distance between feet. Stretching off stair or step may create excessive strain on fascia and connective tissue of the foot. • Place slightly greater emphasis of weight on lateral aspect of foot to maintain arch • Press heel into ground with knee extended and move hip into slight extension • Hold for 20-30 seconds or more at point of first resistance (never force a stretch) • Breathe relaxed and exhale when moving into stretch • Rotate hip/knee/ankle externally or internally as needed (maintain arch of foot) • Repeat 2-4 times as needed 	



type of stretch	Static	
areas affected	Soleus	
points to remember	<ul style="list-style-type: none"> • Place foot on flat surface (stretching off stair or step may create excessive strain on fascia and connective tissue of the foot) at comfortable distance between feet • Place slightly greater emphasis of weight on lateral aspect of foot to maintain arch • Press heel into ground with knee slightly flexed and move hip into slight extension • Hold for 20-30 seconds or more at point of first resistance (never force a stretch) • Breathe relaxed and exhale when moving into stretch • Rotate hip/knee/ankle externally or internally as needed (maintain arch of foot) • Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility) 	



type of stretch	Static
areas affected	Hip flexors and quadriceps
points to remember	<ul style="list-style-type: none"> Maintain balance while standing and utilize external support as needed Grasp ankle (not foot) if possible or place foot on chair or other support Focus on extension of hip and flexion of knee while performing an abdominal drawing-in maneuver (transverse abdominus activation) Stretching leg (thigh) should remain in line with opposite leg with knees in close proximity to one another (do not pull on ankle - utilize hip extension and knee flexion with hand as support, not as the main initiator of the stretch) Hold for 20-30 seconds or more at point of first resistance (never force a stretch) Breathe relaxed and exhale when moving into stretch Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility)



type of stretch	Static	
areas affected	Hip flexors (iliacus and psoas major)	
points to remember	<ul style="list-style-type: none"> • Maintain balance while standing or kneeling and utilize external support as needed • Place feet a few inches apart in width and 2-3 feet apart in length • Externally rotate stretching hip and foot slightly (TFL - Tensor Facia Latae) or internally rotate hip and foot slightly (Psoas) as needed • Focus on extension of hip while performing an abdominal drawing-in maneuver (transverse abdominus activation) • Abduct shoulder and extend elbow on side of stretching leg • Extend spine backward slightly to increase stretch • Laterally flex spine slightly away from stretching leg to increase stretch • Rotate spine slightly medially (TFL) or laterally (Psoas) from stretching leg to increase stretch • Stretching leg (thigh) should remain in line with opposite leg with knees in close proximity to one another (do not pull on ankle, utilize hip extension and knee flexion with hand as support, not as the main initiator of the stretch) • Hold for 20-30 seconds or more at point of first resistance (never force a stretch) • Breathe relaxed and exhale when moving into stretch • Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility) 	

EXAM ALERT

What muscles are being stretched in the picture above? Would the above stretch be most appropriate for someone who normally stands with an anterior pelvic tilt or a posterior pelvic tilt?

type of stretch	Static	
areas affected	Hamstrings	
points to remember	<ul style="list-style-type: none"> • Lay on ground while maintaining a neutral arch in lower back • Draw abs in and flex hip approximately 90 degrees • Grasp behind leg to support thigh and knee avoid activating hip flexors as much as possible) • Extend knee to point of first resistance • Externally rotate stretching hip and foot slightly (semitendinosus and semimembranosus emphasized) or internally rotate hip and foot slightly (biceps femoris emphasized) as needed • Focus on dorsiflexion of ankle (increased gastrocnemius stretch) while performing an abdominal drawing-in maneuver (transverse abdominus activation) as knee extends with hands as support • Hold for 20-30 seconds or more at point of first resistance (never force a stretch) • Breathe relaxed and exhale when moving into stretch • Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility) 	

EXAM ALERT

**What thigh muscles are being stretched in the picture above?
What thigh muscles are NOT being stretched?**

type of stretch	Static	
areas affected	Hip Extensors	
points to remember	<ul style="list-style-type: none"> • Lay on ground while maintaining a neutral arch in lower back • Draw abs in and flex hip as far as possible to point of first resistance • Grasp leg to support thigh and knee (behind knee preferred) • Extend knee to point of first resistance while keeping knee, hip and ankle in alignment with each other • Hold for 20-30 seconds or more at point of first resistance (never force a stretch) • Breathe relaxed and exhale when moving into stretch • Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility) 	

type of stretch	Static	
areas affected	Piriformis and Hip External Rotators and Abductors	
points to remember	<ul style="list-style-type: none"> • Lay on ground while maintaining a neutral arch in lower back • Draw abs in and flex hip as far as possible to point of first resistance • Grasp leg to support thigh and knee • Place foot of stretching leg on opposite thigh • Lightly pull knee internally toward opposite shoulder while keeping foot resting on opposite leg and performing abdominal drawing-in maneuver • Hold for 20-30 seconds or more as needed at point of first resistance (never force a stretch) • Breathe relaxed and exhale into stretch • Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility) 	

type of stretch	Static	
areas affected	Hip adductors	
points to remember	<ul style="list-style-type: none"> • Lay on ground or sit upright while maintaining a neutral spine • Flex knees and bring soles of feet together • Draw abs in and abduct hips as far as possible to point of first resistance • Place hands lightly on inside of thighs to assist self-stretch • Hold for 20-30 seconds or more as needed at point of first resistance (never force a stretch) • Breathe relaxed and exhale into stretch • Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility) 	

type of stretch	Static	
areas affected	Latissimus Dorsi	
points to remember	<ul style="list-style-type: none"> • Kneel on ground with hips, knees and ankles parallel to each other • Maintain neutral spine with shoulders parallel to ground • Draw abs in and maintain cervical spinal position • Place hand or wrist on chair or similar level object • Extend elbow while externally rotating and flexing at the shoulder (radioulnar supination is an independent movement but may assist in reinforcing shoulder external rotation) • Keep arm in line of direction with spine • Hold for 20-30 seconds or more as needed at point of first resistance (never force a stretch) • Breathe relaxed and exhale into stretch • Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility) 	

type of stretch	Static	
areas affected	Pectoralis Major	
points to remember	<ul style="list-style-type: none"> • Kneel on ground with hips, knees and ankles parallel to each other • Maintain neutral spine with shoulders parallel to ground • Draw abs in and maintain cervical spinal position • Place hand or wrist on chair or similar level object at between approximately 90-135 degrees of shoulder abduction • Extend elbow while externally rotating and flexing at the shoulder (radioulnar supination is an independent movement but may assist in reinforcing shoulder external rotation) • Keep arm at similar level to rest of the body • Hold for 20-30 seconds or more as needed at point of first resistance (never force a stretch) • Breathe relaxed and exhale into stretch • Repeat 2-4 times as needed (stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility) 	

type of stretch	Dynamic
areas affected	Muscles of the lower leg (calves and shin muscles)
points to remember	<ul style="list-style-type: none"> • Utilize external balance support as needed (wall, chair or railing) • Stand with feet hip width apart (approximately 4-8 inches between feet) • Place slightly greater emphasis of weight on lateral aspect of foot to maintain arch • Move slowly (at first) and controlled (always) • Dorsiflex and plantarflex feet through controlled full range of motion to accentuate stretch of gastrocnemius and soleus and activate anterior tibialis • Breathe relaxed and evenly and exhale when moving into increasing ranges of motion • Repeat for 1-2 sets of 10-15 full ROM repetitions (within individual limitations). • Stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility



type of stretch	Dynamic
areas affected	Calves (with emphasis on muscles that cause inversion and eversion)
points to remember	<ul style="list-style-type: none"> • Utilize external balance support as needed (wall, chair or railing) • Place foot on flat surface at comfortable distance between feet. Stretching off stair or step may create excessive strain on fascia and connective tissue of the foot • Place slightly greater emphasis of weight on lateral aspect of foot to maintain arch • Press heel into ground with knee slightly flexed and move hip into slight extension • Move slowly (at first) and controlled (always) into approximately 45-60 degrees of hip flexion • Abduct and adduct hip through controlled range of motion to accentuate calf stretch, statically stretch hip flexor of back leg, and activate hip adductors, abductors and flexors of moving leg • Incorporate controlled hip and spinal rotation as needed without movement in rear foot • Breathe relaxed and evenly and exhale when moving into increasing ranges of motion • Repeat 1-2 sets of 8-12 full ROM repetitions (within individual limitations). Stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility



type of stretch	Dynamic
areas affected	Shoulder Horizontal Abductors and Adductors
points to remember	<ul style="list-style-type: none"> • Stand upright with feet hip width apart (4-8 inches) • Utilize drawing-in maneuver to reinforce spinal stability • Abduct arms to 90 degrees from neutral • Move slowly (at first) and controlled (always) through full range of motion of horizontal shoulder abduction and adduction • Incorporate slight internal and external rotation of shoulder throughout movement to loosen and activate pectorals, biceps, triceps, rhomboids and shoulder internal (subscapularis and latissium dorsi) and external rotators (teres minor, infraspinatus, supraspinatus) • Breathe relaxed and evenly and exhale when moving into increasing ranges of motion • Repeat for 1-2 sets of 10-15 full ROM repetitions (within individual limitations). Stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility



EXAM ALERT

What muscles are being stretched in the bottom picture?

type of stretch	Dynamic	
areas affected	Lateral Flexors of the Spine	
points to remember	<ul style="list-style-type: none"> • Stand upright with feet hip width apart (4-8 inches) • Utilize drawing-in maneuver to reinforce spinal stability • Move slowly (at first) and controlled (always) through full range of motion of shoulder adduction and abduction while laterally flexing the spine and reaching over side to side • Breathe relaxed and evenly and exhale when moving into increasing ranges of motion • Repeat for 1-2 sets of 10-15 full ROM repetitions (within individual limitations). Stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility 	

type of stretch	Dynamic
areas affected	Spinal Rotators
points to remember	<ul style="list-style-type: none"> • Stand upright with feet hip width apart (4-8 inches) • Utilize drawing-in maneuver to reinforce spinal stability • Abduct arms to 90 degrees from neutral • Move slowly (at first) and controlled (always) through full range of motion of hip and spinal rotation medially and laterally • Breathe relaxed and evenly and exhale when moving into increasing ranges of motion • Repeat for 1-2 sets of 10-15 full ROM repetitions (within individual limitations). Stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility



type of stretch	Dynamic
areas affected	Hip, Trunk and Shoulder Extensors and Flexors
points to remember	<ul style="list-style-type: none"> • Stand upright with feet hip width apart (4-8 inches) • Utilize drawing-in maneuver to reinforce spinal stability • Move slowly (at first) and controlled (always) through full range of motion of shoulder, spinal and hip flexion and extension • Goal is to loosen and activate spinal flexors and extensors and incorporate efficient glenohumeral and hip movement • Avoid rocking back and forth (excessive lower back extension and pelvic rocking) • Breathe relaxed and evenly and exhale when moving into increasing ranges of motion • Repeat for 1-2 sets of 10-15 full ROM repetitions (within individual limitations). Stretching too little or too quickly may create increased tightness, counter to goal of increased flexibility



NUTRITION and METABOLISM

chapter 6

Foundations of a Healthful Diet

The term nutrition is the overall process of ingestion, digestion, absorption, and metabolism of food. All of these processes allow the nutrients from food to be assimilated and utilized by the tissues of the body. The guidelines for healthy nutrition apply to both physically active and sedentary individuals alike. The needs of athletes and physically active individuals are primarily different from sedentary individuals in the fact that physical activity boosts caloric needs. With an increase in caloric intake, the macro- and micro-nutrients typically follow suit (assuming the additional calories don't come solely from soft drinks, candy, and desserts). However, certain guidelines and recommendations that differ from sedentary populations may apply to athletic populations (i.e., timing of nutrient intake, increase carbohydrate consumption, etc). Therefore, it is important to understand the basic, underlying principles of nutrition and nutrients, so this information can be applied in practice.

Nutrients

The foods we eat provide nutrients. There are six categories of nutrients and each provides a different function in the body. Nutrients do not act independent of one another; they all work synergistically.

EXAM ALERT

How many calories of energy do each of the macronutrients provide per gram?

macronutrients

carbohydrates	Provide energy for the body
proteins	Help build and repair tissues
fats	Necessary part of every cell, help protect internal organs, and provide fat-soluble vitamins.
water	Comprises about 60 percent of the body, is the most important nutrient, and is crucial for various chemical reactions in the body.

micronutrients

vitamins	Regulate various body processes, but do not provide energy.
minerals	Regulate various body processes, but do not provide energy.

Energy Equivalent of Macronutrients

Carbohydrate: 4 kcal/g

Protein: 4 kcal/g

Fat: 9 kcal/g

Alcohol: 7 kcal/g

Carbohydrates

The Basics

Carbohydrates play a number of roles in the body. Two of the primary functions of carbohydrates are to provide glucose for the brain and energy for working muscles. Carbohydrates are stored in the muscles and liver as glycogen. Glycogen allows individuals to perform exercise for a sustained period of time, ride a bike, go for a run, etc.

While there are no essential carbohydrates, per se (meaning the body can make glucose from non glucose sources during extreme situations, such as in times of fasting), carbohydrates play a crucial role during exercise. Energy levels will decrease if carbohydrate intake is limited or carbohydrate stores in the body are low. Some individuals need higher levels of carbohydrates than others (e.g., endurance athletes vs. purely strength trained athletes), but no one should eliminate or drastically reduce carbohydrates for non-medical reasons. Doing so will hurt mental and physical performance and there are two nutrients that cannot be obtained by any other food aside from carbohydrates: fiber and vitamin C.

There is much confusion about this wholesome nutrient. Popular diets recommend avoiding them; they are often blamed for “fattening America” and nearly every food product on the shelf has a low-carbohydrate alternative. Individuals often follow what they hear in the media and questions arise: “Should I stop eating carbohydrates after 4 PM? If I have too many carbs, will it make me fat? I can’t eat fruit, it contains too many carbohydrates, right?” So what is the truth? The truth is that carbohydrates are great for you; it is the type of carbohydrates that should be of concern, rather than carbohydrates themselves.

EXAM ALERT

What is meant by the term “essential” nutrient? Where in the body is glycogen stored for energy use?

According to the recently released dietary guidelines, adults should get 45 percent to 65 percent of their calories from carbohydrates (for those who prefer calculation in grams, follow the guidelines later in this chapter). This range accounts for differences in lifestyles, activities, and goals. It also correlates to the Food Guide Pyramid which allows for some variation among food groups depending on activity level and preferences. A description of the Food Guide Pyramid also comes later in this chapter.

carbohydrates

There are 3 major types:

1. sugar
2. starch
3. fiber

Simple Carbohydrates

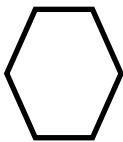
When used at proper times throughout the day, simple carbohydrates can also play an important role in an athlete’s diet. However, they should comprise very little of the overall diet because they offer very little to nothing in terms of nutrients. Simple carbohydrates are more technically known as monosaccharides (mono means one) and disaccharide (di means two), which are single and double sugar molecules, respectively.

mono-saccharides

They are the simplest form of carbohydrate and include:

1. fructose (fruit sugar)
2. glucose
3. galactose

Monosaccharides are symbolized like this:

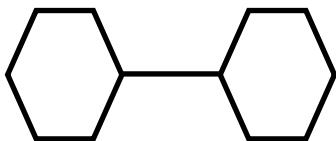


disaccharides

They are made up of two monosaccharides and include:

1. Sucrose, which is a combination of glucose and fructose
2. Lactose, which is milk sugar, a combination of glucose and galactose
3. Maltose, which is two units of glucose

Disaccharides can be symbolized like this:



EXAM ALERT

What nutrients should be consumed after a workout to enhance recovery?

These are all forms of simple carbohydrates. Some real food examples of simple sugars include honey (glucose + fructose), table sugar (glucose and fructose), and soft drinks (fructose and glucose, often listed as high fructose corn syrup). All of the above mentioned simple carbohydrates rapidly convert to glucose, so the body can use them for fuel. This is appealing for many athletes because they each provide a quick source of energy; however, with that quick “pick me up” there also comes a quick fall of energy levels. The only time that quick acting, simple carbohydrates should be the focus of the meal is during and after a workout, when the muscles are hungry for glycogen (again, the stored form of carbohydrate). At this time, it is recommended to consume a rapidly absorbed carbohydrate source, such as a carbohydrate

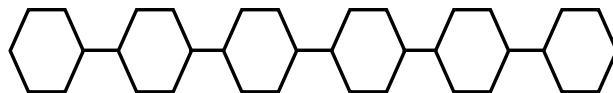
drink (e.g., Gatorade or Powerade) or 100% fruit juice along with some protein. Eating the proper nutrients soon after a workout will help replenish glycogen stores and enhance protein building (anabolism). Real food works well too, but be sure to focus on foods that are high in the glycemic index chart (which is discussed in detail in subsequent pages). Sugar also goes incognito on food labels and often “hides” under the following disguises; don’t be fooled, these are all essentially simple carbohydrates.

common names of sugar found on food labels

Brown Sugar	Turbinado
Sugar Honey	Maple syrup
Sucrose	Glucose
Corn Syrup	Dextrin
Sugar	Lactose
Molasses	Fructose
Confectioner's Sugar	Honey
Date Sugar	Caramel
High fructose corn syrup	Fruit sugar
Brown rice syrup	Maple sugar
Maltodextrin	Dextrose
Molasses powder	Chicory syrup

Complex Carbohydrates

Starches and dietary fiber constitute the complex carbohydrates. These are known as polysaccharides (poly, meaning “many”). Polysaccharides are many sugar molecules linked together to make a complex structure, as seen below.



Only plant foods that contain starch and dietary fiber (such as grains, oats, fruits, vegetables, potatoes, dried beans, etc.) are considered complex carbohydrates. There is very little carbohydrate available in animal products. Complex carbohydrates should constitute the majority of the diet. They provide a large amount of vitamins and minerals, in addition to fiber. Aside from providing a more sustained source of energy, complex carbohydrates also reduce the risk of heart disease and some cancers.

Like simple carbohydrates, complex carbohydrates are also broken down into glucose and ultimately used for energy. However, because they contain more sugar molecules linked together (as depicted above), this is a more laborious process for the body, and it requires more work to digest complex carbohydrates. Thus an individual will often feel “fuller” for a longer period of time when eating complex carbohydrates compared with simple carbohydrates.

How to Pick a Whole Grain

Whole grains are intact kernels loaded with health-promoting bran, fiber, vitamins and minerals (particularly the B vitamins, Vitamin E, magnesium, and zinc) and various antioxidants. The general rule of thumb is to pick carbohydrates where the first ingredient on the label has the word “whole” in it (100% whole wheat, whole oats, etc).

Fiber

Fiber is crucial for optimal health. Total fiber intake among adults in the U.S. is well below the recommended amount. This is unfortunate because fiber provides no calories, may lower the risk of heart disease, obesity, certain cancers, and diabetes. Fiber is also important to help slow the digestion of foods. With athletes or active individuals, this slowing of digestion helps provide sustained energy over a longer period of time, rather than a quick burst of energy that would come from a high sugar intake. This is also why it's important to recommend to clients “think fiber, not carbs.”

EXAM ALERT

**Which type of foods are considered to be complex carbohydrates?
Simple carbohydrates?**

Within the overall classification of fiber, there are three subgroups:

functional fiber	Performs specific, beneficial functions in the body, such as decreasing food intake by providing a feeling of fullness, maintaining stable blood sugar (glucose) levels, preventing constipation, decreasing fat and cholesterol absorption. The types of fibers specifically are psyllium, pectin, gels, cellulose, seed and plant gums. Some common foods these types of functional fibers are found in include: the bran component of oats (oatmeal, oat bran), wheat, vegetables, fruits, and dried beans.
dietary fiber	Consists of nondigestible carbohydrates and lignins that are within plants.
total fiber	The sum of functional plus dietary fiber

Average and Recommended Daily Intakes of Fiber for Adults

Men 19-50 years	Recommended	38.0 g
	Average	13.7 g
Women 19-50 years	Recommended	25.0 g
	Average	13.2 g

carbohydrate grams		
moderate intensity	2.3-3.2 g per pound of bodyweight	5.0-7.0 g per kilogram of bodyweight
vigorous training	3.2-4.5 g per pound of bodyweight	7.0-10.0 g per kilogram of bodyweight
extreme endurance	4.5-6.0 g per pound of bodyweight	10.0-13.0 g per kilogram of bodyweight

(Note: To convert pounds to kilograms, divide the number in pounds by 2.2)

carbohydrate choices

Select most often	Select moderately	Select least often
Amaranth Barley Beans Brown rice Buckwheat Bulgur (cracked wheat) Millet Oatmeal Quinoa Sorghum Triticale Wheat berries Whole grain barley Whole grain cornmeal Whole rye Whole grain bread Whole wheat crackers Whole wheat pasta Whole wheat tortillas Wild rice	Cornbread Corn tortillas Couscous Crackers Flour tortillas Grits Noodles Spaghetti Macaroni Most ready-to-eat breakfast cereals Pitas Pretzels White bread White sandwich buns and rolls White rice	Brown sugar Brown rice syrup Chicory syrup Confectioner's sugar Corn syrup Dextrose Evaporated cane juice Glucose High fructose corn syrup Honey Malt Syrup Maltodextrin Molasses Raw sugar

Eating Your Colors (Fruits and Vegetables). Eat a variety of fruits and vegetables from every column daily to ensure adequate variety and intake of vitamins and minerals

green	yellow/orange	blue/purple	white	red
Artichoke Arugula Asparagus Bean sprouts Bok choy Broccoli Brussels sprouts Cabbage Celery Collard greens Cucumber Green bean Green grapes Green pepper Kale Kiwi Mesclun Mustard greens Okra Peas Romaine lettuce Spinach Turnip greens Watercress Zucchini	Acorn squash Apricots Butternut squash Cantaloupe Carrots Corn Grapefruit Lemon Mango Nectarine Orange Papaya Peach Pineapple Pumpkin Sweet potato Yellow squash	Blackberry Black grape Blueberry Cabbage Eggplant Elderberry Figs Plums	Banana Cauliflower Garlic Kohlrabi Mushroom Onion Parsnip Rutabaga Shallots Turnips Wax bean	Apple Corn Green peas Lima beans Potatoes Pomegranate Red pepper Tomatoes Radish Raspberry Red onion Strawberry Tomato juice Watermelon

Note: while fairly comprehensive, this is not a complete list of all food choices

Clearing up Carbohydrate Confusion

Carbohydrates have been demonized in the popular press and media. The problem is not carbohydrates themselves, but the types of carbohydrates. It is best to instruct clients to understand the different types of carbohydrates. As discussed earlier, both simple and complex carbohydrates ultimately breakdown into glucose and are used by the brain, muscles, and organs for energy. The rate of breakdown is different, however, and is dependent on a variety of factors. One of those factors is something called the glycemic index.

Glycemic Index

The glycemic index is a ranking of carbohydrates based on their immediate effect on blood glucose (blood sugar) levels. The blood glucose response is called the glycemic response and is determined after ingesting a food containing 50 g of carbohydrate. This value is then compared to the glucose response of a “standard” carbohydrate, with a known value. White bread is typically used for the “standard” carbohydrate because it has an “assigned” value of 100.

The table on the right lists a variety of popular foods and their associated placement on the glycemic index chart. High glycemic carbohydrates quickly enter the blood stream and are best used during and after exercise because the body needs to replenish glucose as quickly as possible. The remainder of the diet should focus on foods that are low to moderate on the glycemic index chart (and, subsequently, are high in fiber because fiber slows the glycemic response).

EXAM ALERT

What is the Glycemic Index? Why is it important to weight loss or fat gain?

*Note: GI values may vary slightly. The GI list has limitations and should only be used as a guide.

categorization of glycemic index (GI) of common food sources

high GI (>70)	GI value
glucose	100
corn flake	92
honey	87
potato, baked	85
rice cakes	78
jelly beans	74
watermelon	72
bagel, white	72
moderate GI (40-70)	
white sugar	68
Snickers	68
oatmeal	65
raisins	64
beets	64
corn	60
sucrose	59
white pasta	50
whole wheat pasta	42
chickpeas	42
strawberries	40
low GI (<40)	
all-bran cereal	38
apple	38
chocolate milk	34
yogurt, low-fat	33
skim milk	32
kidney beans	29
lentils	29
peach	28
whole milk	27
grapefruit	25
peanuts	13

Protein

The Basics

There has always (and probably will always) be debate over the protein requirements of athletes. Muscle contains about 40% of the protein in the human body, which has led people to believe that eating dietary protein correlates directly to large muscles. The truth is that eating protein does not build muscle; it is the stimulus of exercise (resistance training) that ultimately builds muscles. Yes, dietary protein is crucial in the rebuilding and recovery process, but in and of itself, protein does not build muscle. This misguided belief is particularly true among strength athletes, who regularly consume an abundance of dietary protein, protein supplements, and amino acids, but many other athletes follow this mantra too.

EXAM ALERT

What are proteins made of? What is the primary function of protein?

Amino Acids

Amino acids are called the “building blocks” of protein. This is because every single protein is made up of various amino acids, uniquely linked together by something called peptide bonds. The linkage is what makes a protein unique (e.g., steak and tofu will have different amino acid combinations and structures). While there are 20 different amino acids required by the body, the combination of more than 100 amino acids makes a protein (the 20 amino acids will repeat in a protein when linked together, getting to the minimum of 100 amino acids needed).

An essential amino acid (also called indispensable) is one that cannot be synthesized by the body. It therefore must be consumed via the diet. Notice there are eight (and sometimes nine, depending on the population) essential amino acids. A non-essential amino acid does not mean it is unimportant. It means it can be produced by the body and, therefore, is not required to come from the diet. Foods do provide both essential

and nonessential amino acids, though. If a person does not consume enough food to provide a sufficient supply of essential amino acids, the body first struggles to conserve what it can. It slows production of new proteins (muscles, organs, hair, nails, etc) until, at some point, it breaks down protein faster than it can be made. The results of this can be seen during starvation and extremely low calorie diets.

There are eight essential amino acids (nine in children and some adults) and 11 non-essential amino acids:

essential amino acids	nonessential amino acids
Histidine ¹ Isoleucine ² Leucine ² Lysine Methionine Phenylalanine Threonine Tryptophan Valine ²	Alanine Arginine Asparagine Aspartic acid Cysteine Glutamine Glutamic acid Glycine Proline Serine Tyrosine

¹ histidine cannot be synthesized by children and some older adults, so it is essential in these populations. It can be synthesized by most adults, however, so it is considered non-essential or sometimes, conditionally essential.
² A branched-chain amino acid (notice there are 3)

Protein Quality

Animal vs. Plant Proteins

Animal and plant proteins can differ considerably in proportions of essential and nonessential amino acids. Animal proteins contain very high amounts of the essential amino acids. On the contrary, plant proteins (legumes, rice, etc) are low in one or more essential amino acid (called the limiting amino acid). Some say that soybeans contain all essential amino acids in sufficient quantities, but while higher than some beans, they are still much lower in the limiting amino acid (methionine).

Proteins that offer a complete amino acid profile are sometimes referred to as complete proteins, whereas ones that do not provide all the essential amino acids are referred to as incomplete proteins. However, this is not really a concern in developed countries. Assuming individuals are consuming adequate levels of calories and these calories come from a variety of foods, there is little concern for meeting protein needs. This is because eating a variety of foods offers the ability to consume "complementary proteins." Complementary proteins are when two or more proteins combine to compensate for deficiencies in essential amino acid content in each protein. For example, rice and beans alone are each limited in different amino acids; when combined, however, all amino acid requirements are met. If someone was to live solely on corn as their protein source, for example, they would not obtain sufficient quantities of all essential amino acids. If all essential amino acids are not consumed in sufficient quantities, none of them can be used in the body, and it limits the amount of protein the body can synthesize.

The take home message is that it is very possible to consume adequate sources of high quality proteins if one is a vegetarian. However, it is crucial to ensure that:

1. Enough calories are consumed on a daily basis
2. There is sufficient variety in the diet
3. Diets must be sufficiently planned to ensure protein adequacy

If dealing with a vegetarian client, it is recommended to work with a registered dietitian who can design and implement a healthy diet to ensure all nutrient needs are met.

If one is considering protein supplementation (i.e. for a vegetarian), 100% whey protein hydrolyzates have the most bioavailability.

Protein Needs

It is well established that endurance, strength, and strength-endurance trained athletes have higher protein needs than sedentary individuals. Similarly, growing teenage athletes, and those just beginning exercise programs have higher needs. However, current debate focuses on the specific requirements for each group of athletes or individuals. What is understood, is that all of the aforementioned athletes need only slightly more protein than other people. It comes down to essentially the amount found in a piece of chicken, a few cups of milk, or other high quality protein sources. Furthermore, there is no evidence that eating more than the requirements provides additional benefit. Although many believe that if some is good, more must be better, this is not true because additional protein will not be of benefit in and of itself. It will, however, provide additional calories, and for some, higher calorie content associated with a rigorous training schedule would be the only benefit. Of course, if extra calories are needed, these should come from whole grain, high fiber foods.

Requirements for Endurance Athletes

Contrary to popular belief, training actually may have a protein sparing effect. In fact, the more seasoned an athlete (or better trained an individual), the lower the protein breakdown and use (oxidation) for energy during exercise. In fact, protein supplies very little of the energy to the body (approximately 5 to 15%) during resting conditions and this actually decreases during exercise. This is because during exercise there is an increased need for carbohydrates and fat as fuel. It is typically recommended that endurance athletes increase the intake of protein to 1.2 to 1.6 g/kg/body weight (.6 to 0.7g/lb/body weight). The truth is, as energy expenditure increases (from the increase in training), energy intake (calories in) must increase as well to maintain a normal body weight. Therefore, with this increase in calories, there is a concomitant increase in protein (assuming the increase is not solely from soft drinks, sugar, and other non-nutritive food item).

EXAM ALERT

Which macronutrient is the last choice as an energy source?

Recommended protein intakes

	protein grams	
currently RDA for sed- entary adults	.4g per pound of bodyweight	.8 g per kilogram of bodyweight
recreational athlete	.5 - .7 g per pound of bodyweight	.8 - 1.5 g per kilogram of bodyweight
adult endurance athletes	.6 - .7 g per pound of bodyweight	1.2 - 1.6 g per kilogram of bodyweight
adult strength trained athletes	.7 - .8 g per pound of bodyweight	1.5 - 1.7 g per kilogram of bodyweight

To convert pounds to kilograms, divide the number in pounds by 2.2. Table adapted from Nancy Clark's Sports Nutrition Guidebook, 3rd edition

To identify the protein needs of a particular individual using the table above:

1. Determine the appropriate category based on activity level.

2. Measure their body weight on a scale.

3. Multiply the protein factor by their body weight to determine daily protein needs.

Example: A 200 pound weight lifter would need approximately 0.7-0.8 grams of protein/pound of body weight.

$$200 * 0.7 = 140$$

$$200 * 0.8 = 160$$

Therefore, this athlete should consume between 140 to 160 grams of protein each day to allow his body to continue to recover and grow.

Requirements for Strength Athletes

Unlike endurance athletes, resistance exercise does not increase the rate of protein oxidation. The increase in needs for strength athletes comes with the increase in muscle mass (hypertrophy). Beginning strength trained athletes have the highest needs as their bodies acclimate to the new stressor. This increase seems to subside a bit as individuals become more seasoned in the weight room; however, to allow for optimal recovery and continued hypertrophy, protein needs are increased. Research suggests that strength athletes need approximately 1.5 to 1.7 g/kg/body weight (0.7 to 0.8 g/lb/body weight).

protein choices

Select most often	Select moderately	Select least often
Beans Chicken breast (without skin) Crab Egg whites Flounder Halibut Low-fat/non fat milk Low-fat/non-fat yogurt Low-fat/non-fat cottage cheese Salmon Snapper (red or blue) Soy milk Tilapia Tofu Tuna (steaks or canned, in water) Turkey breast (without skin)	Canadian bacon Mixed nuts Lean cuts of beef/pork Low-fat luncheon meats (e.g., turkey) Peanut butter Reduced fat and part-skim cheese Shrimp Texturized vegetable protein Turkey bacon Whole eggs	Bacon Chicken (with skin) Chicken wings Fatty beef, lamb, pork Fatty luncheon meats (e.g., bologna, pastrami, corned beef) Fried chicken and fish Liver Ribs Sausage Turkey (with skin) Untrimmed beef and pork Whole milk Whole milk cheese

Fat

The Basics

In the early 1990's, dietary fat received the same bad rap that carbohydrates are now receiving. It was thought that fat would be detrimental to performance, health, and cause weight gain when eaten in excess. Contrary to this belief, scientists are now realizing more and more that fats play a crucial role in the body for performance and health. The key is to focus on the quality of the fat, maybe even more so than the quantity. Aside from protein, fat is the only other essential macronutrient; dietary fat provides essential fatty acids (like essential amino acids) that cannot be produced by the body and must be consumed via the diet.

EXAM ALERT

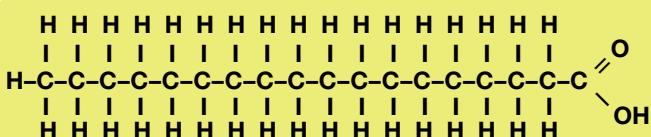
Which fat increases the risk of cardiovascular disease more than any other? Which type of fat is solid at room temperature and typically comes from animal sources?

Types of Fat

All fatty acids have the same basic structure; they are a chain of carbon atoms with varying amounts of hydrogen atoms attached to each carbon. One simple way of describing the various types of fats is to think of the structure of fats as a school bus; the bus itself is the carbon atom chain discussed above and all the seats are the hydrogen atoms.

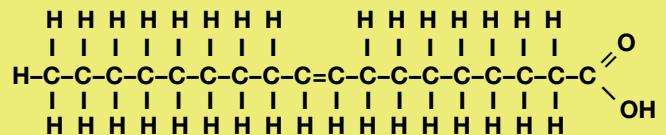
Saturated Fat (SFA)

All the carbon atoms are full of hydrogen atoms making the "seats on the bus" full. No other atoms can fit onto the structure because there are no "empty seats." Saturated fats are easy to identify because they are solid at room temperature (butter, shortening, animal fats, etc).



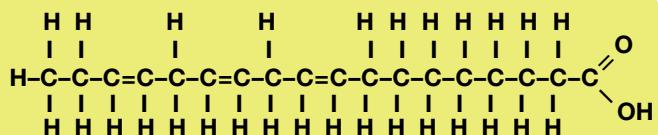
Monounsaturated fat (MUFA) (mono means one)

There is one "empty seat" on the bus and the rest are full. There is room to fit more hydrogen because of the one "empty seat." Monounsaturated fats are liquid at room temperature (vegetable oils, olive oil, canola oil, etc).



Polyunsaturated fat (PUFA) (poly means many)

Several of the "seats" are empty. Polyunsaturated fats are also liquid at room temperature (flax oil, fish oil, etc).



Trans Fats

Trans fats are basically vegetable fats that have been changed chemically by a process known as hydrogenation. Remember the unsaturated fats from above had empty "seats" without a hydrogen atom. The process of hydrogenation or partial hydrogenation is when food manufacturers artificially add hydrogen to liquid unsaturated fats to provide greater stability and, ultimately, longer shelf life; hydrogenation makes liquid fats solid at room temperature. Trans fats should be avoided as much as possible. The FDA has required that saturated fat and dietary cholesterol be listed on food labels since 1993. In 2006, the laws were updated, and consumers now know for the first time how much of all three -- saturated fat, trans fat, and cholesterol -- are in the foods they choose. Identifying saturated fat, trans fat, and cholesterol on the food label gives consumers information in order to make heart-healthy food choices, helping them to reduce their risk of CHD. In general, if the words "hydrogenated" or "partially hydrogenated" are listed on the ingredient list, the food contains some quantity of trans fats. Foods such as hard margarines, shortenings, and most commercially fried foods and bakery items usually contain trans fats. The table that follows lists several common foods and their trans fatty acid content.

Trans fats have been shown through a number of studies to be more harmful than saturated fats; they tend to raise blood cholesterol and increase the risk of cardiovascular disease. Intake should be limited to < 1% of overall fat intake/day.

trans fatty acid content of common foods

food	TFA (grams)
animal crackers	1
beef	.5-1
biscuit	~ 4
breakfast cereal	0-1.5
butter	0
cheese	.5
chocolate chip cookies	1.5-2.5
commercial cinnamon buns	6
doughnut	6
french fries, large	5-7
frozen apple pie	2-4
margarine (1 TBS)	3-4
microwave popcorn	2-3
olive oil	0
onion rings	~ 7-9
shortening	1-5
tortilla chips	1.5
whole milk	.2-5

Note: ranges are given for some foods because many brands differ.

Omega-3 fats are healthier fat options, but remember they still provide the same 9 calories/gram like all other fats. Over eating any type of fat (or other macronutrient) will be stored as body fat.

Essential Fatty Acids

The essential fatty acids are labeled depending on their particular structure. Without delving into advanced biochemistry, the length of the carbon chain (remember from above all fats have a carbon backbone), deciphers the specific types of fat. The primary dietary sources of essential fats are seafood, flax oil/seeds, and mixed nuts.

Omega-3 fats are a family of essential unsaturated fats that have recently received a tremendous amount of press lately; they are touted for their heart health properties, potential aid in recovery, and reducing the risk of several other diseases as well. The three omega-3 acids are alpha-linoleic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). ALA is found in the plant sources of omega-3's, such as flax and mixed nuts, while DHA and EPA are both found in highest concentrations in cold water fish (e.g., salmon, mackerel, lake trout, tuna steaks and canned, anchovies, etc). ALA itself can convert to the more useful EPA and DHA, but the conversion rate is very low (~5-15%).

Omega-6 fats are also essential fats. The major omega-6 fatty acid is known as linoleic acid and is found primarily in vegetable oils, like canola and corn oils. While these are essential fatty acids, the typical American diet is very high in omega-6 fats; it is recommended instead to boost the intake of omega-3's through the food sources listed above.

fat choices

Select most often	Select moderately	Select least often
Avocado Fish oil Flax oil Olives Olive oil Mixed nuts Soybean oil Sunflower-oil Walnut oil	Vegetable oil Margarine (without trans fat) Egg yolks	Animal fat Butter Coconut oil Cream Fried foods Ice cream Lard Shortening Sour cream Whole fat dairy products

Macronutrients and Gastric Emptying Time

Gastric emptying time, (the time it takes for the stomach to empty), is normally 1 to 4 hours, depending on the amount and kinds of food eaten. When eaten alone, carbohydrates leave the stomach most rapidly (within ONE HOUR OR FASTER), followed by protein (which takes about TWO HOURS) and then fat (taking THREE TO FIVE HOURS to leave the stomach). However, in a mixed diet, emptying of the stomach is prolonged. Liquids empty more rapidly than solids, and large particles empty more slowly than small particles. These factors play an important role for the upcoming meal program recommendations and calculations.

EXAM ALERT

Why is it important to eat every few hours?

Because blood glucose control is very important in controlling diabetes, many studies have been conducted to determine how different foods affect blood glucose levels. One study is the “gastric emptying time test,” which measures how long it takes food to leave the stomach. The reason this is a very important study is that the more quickly carbohydrates leave the stomach, the more quickly blood glucose levels rise. Usually, the more quickly blood glucose levels rise, the more effectively glucose gets stored as fat due to larger insulin secretions, and because of these larger insulin secretions, the more quickly blood glucose levels drop (right after the insulin secretion causes blood glucose to be stored), causing us to get hunger pangs and/or cravings. Gastric emptying time studies show that the longest time that CHOs will stay in the stomach is one hour. In contrast, protein will stay in the stomach two hours, and fats will stay in the stomach three to five hours. This is why you find yourself getting hungry 20 to 40 minutes after having a piece of fruit, or some bread, pasta, rice, veggies, or even some cereal. This is also why you feel stuffed for four hours after having a high fat containing meal.

These studies also found that when combining a protein with a carbohydrate, both the protein and the fat contained in the protein (since most proteins have some fat in them) cause the carbohydrate to stay in the stomach longer (approximately three and a half to four hours). This means that the increases gastric emptying time are a good thing, because a longer gastric emptying time also means a slow and controlled increase in blood glucose. This, in turn, lessens the chances of storing a large portion of this meal as fat, due to a quick and high increase in blood glucose followed by a large secretion of insulin. A longer gastric emptying time also means mild successive increases over time, as well as mild or slower successive decreases in blood glucose levels, caused by the extra time that it takes for food to leave your stomach. As a consequence, the onset of hunger is delayed, and cravings are less likely. Cravings are usually caused by the need to raise low blood glucose levels after such a drop as described above occurs.

Fluids

The Basics

Water is the most important nutrient, as it accounts for 50 to 60% of overall body mass. Lean body tissues (e.g. muscle, heart, liver, etc) are about 72 to 75% water by mass, whereas adipose (fat) tissue is about 5% by mass. Therefore, it is crucial to emphasize the importance of regular fluid consumption throughout training and performance.

Hydration Status

Athletes constantly risk dehydration. This is particularly true for those who train in hot and humid environments. The longer and harder the athlete

EXAM ALERT

Which fluid affects athletic performance more than any other nutrient?

works, the greater the risk. Dehydration will hurt performance. In fact, it only takes a 2% loss of body weight (i.e., 3 pounds for a 150 lb person during exercise) for performance to suffer. It is important to emphasize to clients that weight loss in one practice, game, or training session is NOT fat loss; it is therefore crucial to rehydrate. On the contrary, weight gain means you drank too much fluid—cut back the next time. Most importantly, dehydration can be dangerous and large fluid losses can result in death.

water

Water is crucial for life for a variety of reasons:

1. In blood it helps transport glucose (blood sugar), oxygen, and fats to working muscles.
2. It eliminates waste products.
3. It absorbs heat from working muscles.
4. It regulates body temperature.
5. It lubricates joints and cushions organs and tissues.

Measuring Hydration Status

Thirst is NOT an adequate sign of hydration status; by the time a person is thirsty, they are likely already mildly dehydrated. However, follow the cues of thirst; this clearly means it is time to drink.

While more in depth techniques performed in the laboratory are more accurate than making educated guesses, they are often impractical on a regular basis or during training. There are simple ways to measure fluid balance, however.

Assessing Fluid Losses by Weight

1. Have a client weigh themselves naked before and after a workout.
2. The difference in weight will be primarily from fluid losses.
3. Consume 20 to 24 oz. of non-alcoholic fluid for every pound lost.

Assess Fluid Losses by Urine Color and Volume

1. If urine is pale like lemonade and there is plenty of it, this is a good sign of adequate hydration.
2. If urine is dark like apple juice and scanty, it is crucial to consume more fluids.
3. If someone is taking vitamin supplements, urine color may not be a good marker of hydration status; the riboflavin in most multivitamins will give urine a darker color. In these cases, go by volume.

Keep in mind that it is also possible to overhydrate (called, hyponatremia). This is not a common occurrence, but it can be lethal. To prevent hyponatremia, it is important to again monitor urine volume. What is happening is that the body fluids become diluted causing sodium levels to drop dangerously low.

Hyponatremia is seen most commonly in distance athletes (triathletes, ultrarunners, and sometimes unfit individuals who have higher sweat rates than others). While this can be dangerous, it is not common among clients who are training in a fitness facility or a person's home. However, it is important to understand it is possible.

dehydration

Common signs and symptoms of dehydration include, but are not limited to:

1. Muscle cramps
2. Intense thirst
3. Weakness
4. Irrational behavior
5. Reduced performance
6. Headache
7. Nausea
8. Fatigue
9. Dizziness
10. Confusion

Tips for Staying Hydrated

Keep in mind that any non-alcoholic food or beverage counts toward total daily fluid intake. Foods like watermelon and lettuce, for example, have very high water content; therefore, these all count towards the total intake. In fact, foods account for approximately 30% of total fluid intake. Because everyone's sweat rate differs and trainers work with a variety of clients, it is impossible to make a blanket recommendation (e.g., drink 8 cups of fluid every day). Understand that it is important to hydrate regularly throughout the day, because sweat is 99% water.

- 1. Recommend to your clients to carry a water bottle with them during training sessions. Aim for an intake of approximately 16 oz./session; again, this is dependent on overall body weight and sweat volume.**
- 2. Hydrate regularly throughout the day, not only immediately before, during, and after training.**
- 3. Sports drinks (e.g., Gatorade, Powerade, All Sport, etc) are typically unnecessary for activities lasting less than 60 minutes.**
- 4. Suggest squeezing a lemon or lime into water to enhance palatability.**
- 5. Cold water rehydrates the body more effectively than warm water.**
- 6. Drink to replace fluid losses-don't over drink.**
- 7. Drink before, during, and after athletic events or training sessions.**
- 8. Plain water is an adequate way to effectively rehydrate the body.**
- 9. Alcoholic beverages act as diuretics; they are not effective at rehydrating the body.**

Research studies suggest vitamin and mineral intake among athletes in general is sufficient. Athletes tend to ingest above average quantities of micronutrients because of their increased energy intake. Moreover, additional supplementation does not appear to improve performance in any way.

Vitamins, Minerals, and Antioxidants

Vitamins and minerals are necessary for virtually all reactions to occur in the body. While each has its own unique properties, they work synergistically to ensure reactions in the body occur appropriately. Vitamins are essential organic molecules that cannot be synthesized in the body and, like essential amino acids and fatty acids, they must be obtained from food. Vitamins also help to aid in the conversion of fats and carbohydrates into energy for use by the body. Vitamins and minerals do not directly supply energy; however, they are both required in energy metabolism in the body.

There are essentially two categories of vitamins:

fat soluble	water soluble
A D E K	C Pyridoxine Cobalamin Thiamin Pantothenic acid Riboflavin Biotin Niacin Folic acid

Vitamin deficiencies reduce body function and impair health. However, over consuming vitamins and minerals is also not healthy. It's particularly important to note that fat soluble vitamins can all be stored in the body, increasing the likelihood of toxicity if megadoses are consumed. The water soluble vitamins on the other hand can be excreted, but still put undue stress on the body when over consumed. Both extremes can be avoided by eating a wide variety of whole foods and enough total calories. The Institute of Medicine recently released the updated tables and recommendations for all vitamins and minerals. These tables are summarized in the pages that follow.

It is possible to obtain all vitamins and minerals through dietary supplements; however, whole food is the optimal way to obtain all nutrients. Food provides much more than just a single nutrient (such as a vitamin tablet) and no pill, potion, or powder will ever equate to the benefits derived from eating real food, however, The Journal of the American Medical Association recently published a manuscript stating that all adults should take a multivitamin. The key is the multivitamin need not contain 1000's% above the RDA, as many do. It is to act as insurance, not replace or make up for a poor diet.

In the recently released Dietary Reference Intakes, some definitions were established that are important to discuss:

dietary reference intakes	
RDA	Recommended Daily Intake: the average daily nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 or 98 percent) healthy individuals in a particular life stage and gender group.
AI	Adequate Intake: the recommended average daily intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate-used when an RDA cannot be determined.
UL	Tolerable Upper Intake Level: The highest average daily nutrient intake level that is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects may increase.
EAR	Estimated Average Requirement: the average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group.

Antioxidants

The term antioxidant is a classification of several organic substances, including vitamins C and E, vitamin A (which is converted from beta-carotene), alpha-lipoic-acid, grape seed extract, selenium (a mineral), and a group known as the carotenoids, among others. In fact, the list of nutrients that double as antioxidants grows continually. As antioxidants, these substances are thought to be effective in helping to reduce the risk of cancer, heart disease, stroke, aging, side effects associated with uncontrolled diabetes, etc.

Technically speaking, antioxidants serve to “deactivate” certain particles called free radicals, which are created from reactive oxygen species. Although that may sound a bit strange, since oxygen is obviously necessary for life, oxygen also does increase free radical production. In fact, intense resistance and aerobic exercise both increase free radical production (the body requires more oxygen during exercise, thereby increasing the production of free radicals). Fortunately the human body has well-developed defense mechanisms in place to protect against toxic oxygen species.

Here is a very simplified version of how it works: the oxygen molecule wants to be oxidized. The term ‘oxidized’ means that a substance loses one or more electrons. This results in an unstable molecule that can move around the body and cause damage. On the other hand, when a substance is reduced it means that it gains one or more electrons which neutralizes the oxidized molecules such as free radicals. This process of oxidation can sometimes be carcinogenic. Of course this does not mean that exercise is bad, but it is one way that free radical production increases inside the body. Similarly, tobacco smoke (first or second hand smoke), radiation, and exposure to environmental pollutants all increase free radicals. Free radicals are the natural by-products of many processes within and among cells.

minerals daily intake dietary reference

(adapted from www.nap.edu)

mineral	RDA males 19-30	RDA females 19-30	RDA males 31-50	RDA females 31-50	UL	food source	major function
arsenic	ND	ND	ND	ND	ND	Dairy products, meat, poultry, fish, grains, cereal	No biological function in humans
boron	ND	ND	ND	ND	ND	Potatoes, legumes, milk, avocado, peanut butter	Reproductive and developmental effects
calcium (mg)	1000	1000	1000	1000	2500	Dairy products, calcium-set tofu, kale, broccoli, canned salmon with bones	Essential in blood clotting, muscle contraction, bone and tooth formation
chromium (µg)	35	25	35	25	ND	Some cereals, meats, fish, poultry	Helps maintain normal blood glucose levels
copper (µg)	900	900	900	900	10,000	Organ meats, seafood, nuts, seeds whole grain products	Component of enzymes in iron metabolism
fluoride (mg)	4	3	4	3	10	Fluorinated water, teas, fluorinated dental products	Inhibits beginning of dental cavities and stimulates bone formation
iodine (µg)	150	150	150	150	1100	Foods of marine origin, iodized salt	Component of Thyroid function
iron (mg)	8	18	8	18	45	Meat, poultry, fortified bread and grain products	Component of hemoglobin and many enzymes
magnesium (mg)	400	310	420	320	350	Green leafy vegetables, nuts, unpolished grains	Cofactor for enzyme systems
manganese (mg)	2.3	1.8	2.3	1.8	11	Nuts, legumes, tea, and whole grains	Involved in formation of bone, and in enzymes involved in amino acid, cholesterol and carbohydrate metabolism
molybdenum (µg)	45	45	45	45	2000	Legumes, grain products, nuts	Cofactor for enzymes in catabolism of sulfur amino acids, purines and pyridines

minerals daily intake dietary reference (continued)

mineral	RDA males 19-30	RDA females 19-30	RDA males 31-50	RDA females 31-50	UL	food source	major function
nickel (mg)	ND	ND	ND	ND	1.0	Nuts, legumes, cereals, chocolate milk powder	No biological function in humans
phosphorus (mg)	700	700	700	700	4000	Milk, yogurt, ice cream, cheese, peas, meat, eggs, some cereals, and breads	Maintenance of pH, storage and transfer of energy and nucleotide synthesis
selenium (mg)	55	55	55	55	400	Organ meats, seafood, plants (dependent on soil selenium)	Defense against oxidative stress and regulation of thyroid hormone action
silicon	ND	ND	ND	ND	ND	Plant-based foods	No biological function in humans has been identified
vanadium (mg)	ND	ND	ND	ND	1.8	Mushrooms, shellfish, black pepper, parsley, and sill seed	No biological function in humans has been identified
zinc (mg)	11	8	11	8	49	Red meat, oysters and some other seafood and fortified cereals	Component of multiple enzymes and proteins; involved in the regulation of gene expression

vitamins daily intake dietary reference

(adapted from www.nap.edu)

vitamin	RDA males 19-30	RDA females 19-30	RDA males 31-50	RDA females 31-50	UL	food source	major function
biotin	30	30	30	30	ND	Liver, meats, and fruits	Coenzyme in synthesis of fat, glycogen, and amino acids
choline (mg)	550	425	550	425	3500	Milk, liver, eggs, peanut butter	Precursor for acetylcholine, phospholipids, and betaine
folate (µg)	16	14	16	14	35	Meat, fish, poultry, enriched and whole grain breads, bread products, fortified ready to eat cereals	Coenzyme in the metabolism of nucleic and amino acids
niacin (mg)	16	14	16	14	35	Meat, fish, poultry, enriched and whole grains	Involved with many biological actions
pantothenic acid (mg)	5	5	5	5	ND	Chicken, beef, potatoes, oats, cereals, liver, yolk	Coenzyme in fatty acid metabolism
B₂ (mg) (riboflavin)	1.3	1.1	1.3	1.1	ND	Organ meats, milk, bread, and fortified cereals	Coenzyme in reactions
B₁ (mg) (thiamin)	1.2	1.1	1.2	1.1	ND	Enriched, fortified, or whole-grain products, bread, and bread products	Coenzyme in the metabolism of carbohydrates and BCAA
A (µg)	900	700	900	700	3000	Liver, dairy products, fish	Required for normal vision, development, and immune function
B₆ (mg)	1.3	1.3	1.3	1.3	100	Fortified cereals and organ meats	Coenzyme in the metabolism of glycogen and amino acids
B₁₂ (mg)	2.4	2.4	2.4	2.4	ND	Fortified cereals, meat, fish, poultry	Coenzyme in nucleic acid metabolism, prevents megaloblastic anemia
C (mg)	90	75	90	75	ND	Citrus fruits and many vegetables	Cofactor in many reactions and an antioxidant
D (µg)	5	5	5	5	50	Fish liver oils, liver, fortified milk	Maintain serum calcium and phosphate
E (mg)	15	15	15	15	1000	Vegetable oils, nuts, unprocessed grains	Powerful antioxidant
K (µg)	120	90	120	90	ND	Green vegetables, plant oils, margarine	Involved in blood clotting

If free radicals are left “untouched,” they can cause damage to cell walls, certain cell structures, and genetic material within the cells. Think of free radicals as the pinball in an arcade pinball machine; when in motion, it can hit everything and anything in its path, but unlike the pinball, free radicals can cause irreversible damage over time. This can lead to disease, such as heart disease or cancer. Free radicals are not the only cause of such diseases; there are genetic factors and other lifestyle habits that have a negative effect on the development of disease, but just one more piece to the puzzle.

This is where antioxidants come into play. Think about the term antioxidant-oxidized molecules become free radicals, so something that works against the oxidation process (anti, means against) would be beneficial. Antioxidants are sold as pills, drinks, and even topical creams; the fact of the matter is that the absolute best way to consume all antioxidants is through eating a variety of whole foods. A diet abundant in fruits, vegetables, and whole grains, provides nutrients that cannot otherwise be obtained from any dietary supplement. Give the list of colorful fruits and vegetables to clients and recommend they eat produce from every color and category in that chart, regularly.

Much of the research measuring the effects of antioxidant supplementation on exercise has been conducted in animals, where the doses of antioxidants used are too high to replicate in humans. Research in humans is growing, however, but is truly in its infancy; the best known source of antioxidants are fruits and vegetables since they offer much more than just a few vitamins and minerals.

Food Guide Pyramid (www.mypyramid.gov)

The United States Department of Agriculture developed major updates to the Food Guide Pyramid (FGP) in 2005. The FGP was designed as a guide to educate the general public about what constitutes a healthful nutrition plan. The recently released FGP differs from the original one in its design. The new pyramid has six cate-

gories of food groups in vertical lines throughout the pyramid. Food groups are wider at the bottom of the pyramid and should correlate to the level of physical activity performed. If a person is regularly active, they should eat more towards the base of the pyramid meaning more of each food group. Similarly, if a person is less physically active their caloric needs would be lower, so they would eat more towards the top of the pyramid.

The FGP design was changed from the previous pyramid to be more applicable to the general population, meet the needs of most individuals, and get away from a “one size fits all” approach. Moreover, this newly release pyramid includes specific physical activity recommendations that were void from the previous version of the pyramid. There are different ways to consume a balanced diet; the benefit to this updated FGP is that individuals can log onto the website and enter their age, gender, and activity level, and the find recommendations specific to them. It is an important tool to understand and can be useful to introduce to clients. As a qualified personal trainer, it is wise to use tools such as the FGP to help clients improve their dietary habits.

Eating a balanced diet requires variety. All too often, individuals fall into the same dietary pattern, eating the same foods repeatedly. For example, although apples are a great source of nutrients, they should not be the only fruit consumed. Each food offers many unique vitamins, minerals, antioxidants, and phytochemicals, which are all beneficial to the body.

When working with different individuals from various backgrounds, cultures, and ethnicities, many different eating styles can meet the requirements of an adequate diet. The FGP is an excellent starting point to assess a client’s dietary intake. As a general rule of thumb, if an individual is eating a variety of foods from each food group, they will obtain the necessary variety of vitamins and minerals. However, with the popularity of low carbohydrate diets, as one example, many individuals are reducing and in some cases eliminating an entire food group. In these cases, it is impossible to consume a diet

that provides adequate levels of vitamins, minerals and, in this case, fiber.

Similarly, it is also important to note that for certain individuals, the FGP may not provide sufficient total energy; high level athletes are a great example, since their needs may exceed the highest level of calories recommended with the maximum number of servings in the pyramid. As a trainer, you will be working with a wide variety of clients, so it is important to assess the needs of each unique individual and work in conjunction with a registered dietitian to assist the client the best you can.

The FGP is a good starting point for basic recommendations, but each individual is unique. Nutritionally speaking, overall success, whether it's weight loss, weight gain, or even performance changes, comes down to energy balance and meeting the needs of clients to help them reach their goals. Success with dietary changes can be a key factor in helping you to get a client to stay on track, by monitoring food intake on an individual basis, when it is convenient for the client.

Special Populations

What Makes a Special Population?

There is a good chance that some of your clients will not be in a state of optimal health when you assess them. The fact that a client is working with you may, in fact, be an indicator of a special need and this could include preventing or managing certain conditions. Individuals with a chronic condition (i.e. asthma, AIDS) or specific situation (i.e. pregnancy, obesity) that either never goes away or one that lasts for months (or years) are in need of special consideration or accommodations in their workout programs and are therefore considered to be a special populations member. This client profile will typically vary from other members of the general population when we consider their responses to physical activity. These factors or responses involved can be complex and include experiencing greater fatigue versus normal recovery-based fatigued. It may also be difficult to differentiate normal pain from physical exertion versus acute pain or pain from their disease or disorder. CV responses for those in special populations also can be significant, seen when comparing normal elevations in breathing versus labored breathing or overexertion due to their disease or disorder. At the heart specifically, you may observe maladaptive elevations in heart rate from exercise or heart arrhythmias. Thus, the trainer must follow a few simple guidelines once a client is identified as one who falls into a category of special populations.

1. The trainer must determine whether or not they are qualified to help the client in their present condition, and whether the benefits outweigh the risks
2. The trainer must gather information and research pertaining to the condition of the client
3. Complete a comprehensive medical and health history and be aware of specific medications and their effects and side effects
4. Obtain medical clearance where necessary and communicate with the client's doctor/physician
5. Discuss objectives (results may be limited compared to the norm) with a new client and help them establish faith in the trainer's abilities to trust the trainer's judgment
6. Empower the client to be as independent of additional professional help as possible and keep the condition from worsening

The best way to prevent future problems or aid in the recovery from a chronic condition or disease is through a carefully designed exercise program. There will be situations where a condition has progressed to the point that exercise may not be possible. The goal of the trainer or fitness professional is to prevent this from happening. Although trainers are part of the extremely few health and fitness professionals who exist to help PREVENT disease or abnormal functioning, there will also be situations when a trainer will also be required to design programs for clients who have gone beyond a point of prevention.

EXAM ALERT

What is a special population? What would be the personal trainer's next step if a potential client was found to have a cardiovascular/pulmonary condition?

EXAM ALERT

Be able to give examples of proper progressions for an aging client.

Aging and the Elderly

Everyone gets older as time goes by. As we age, our bodies adapt and change. How fast we lose our capabilities of our earlier years is greatly affected by how much we move (frequency) and how effectively we exercise. Some of the changes, listed below, are characteristic of the general population - however, there are exceptions, depending on activity level and other health factors.

functions or characteristics that DECREASE as we age

- Hormone production (including testosterone, estrogen and growth hormone)
- Maximum oxygen uptake
- Bone rigidity and porosity
- Neurological capabilities (malfunctioning of the nervous system/coordination)
- Muscle mass and strength (due to inactivity and hormonal decline)
- Balance (loss of coordination and strength with a resultant fear of falling)

functions or characteristics that INCREASE as we age

- Fat mass (due to inactivity and hormonal decline)
- Resting and training heart rate (due to inactivity and requiring a lower exercise intensity compared to earlier years)
- Dependence upon others for activities of daily living

Know that fat body mass increases as we age due to lack of activity and hormonal decline.

How should an aging client progress?

Now that we know about clients who may be part of a special population, it's time to explore one of the most common groups that you will encounter - those who are aged, or elderly. In general, begin with a program design that fea-

tures light resistance exercises, utilizing machines that load across the joints used. This is done in order to help increase both basic strength capabilities and bone density. A good program design for a mature client should also include light balance activities, such as standing on one leg for 30 seconds and once mastered, attempting to do the same with the clients eyes closed. The most efficient form of resistance training for an elderly or beginning participant in this population is the use of bodyweighted exercises (BW) as a starting point, before external loading is incorporated. Progressions should include more difficult exercises, such as learning to move forward, backward, laterally and stepping up and down with external loading, or some time spent holding their position in space. If the individual cannot stabilize properly, then they are most likely not ready to add more complex movements.

Each aging client must be taken as an individual and the utmost consideration for their safety and well-being is a primary responsibility for any trainer. Adequate rest and recovery are crucial, just as they are for the average client, and slight modifications must be made depending on their goals. As with all clients, assess performance while encouraging the client to provide feedback related to how they are feeling while under your watch.

The greatest challenge to the trainer is the need to be constantly aware of the various movements the client must perform both correctly and consistently. This is most effectively done by using observation and assessments of the client from every angle, with the integrity of the kinetic chain always in mind.

EXAM ALERT

What is the most efficient form of resistance for an elderly, beginning participant and/or a child?

program modifications to slow the effects of aging

1. Exercise on a consistent daily basis to stimulate hormone production
2. Use of resistance exercise to slow the loss of bone, muscle strength and mass (loading across the joint like a bicep curl or knee extension instead of loading through the joint like a shoulder press or leg press may be advisable in some situations due to a weakened bodily structure)
3. Include balance activities such as movements forward, laterally and backward to help maintain coordination and stabilization capabilities
4. Use the Rate of Perceived Exertion scales to assess training effects.
0 – Nothing
1 – Very Light
2 – Light
3 – Moderate
4 – 5 Somewhat difficult
6 – 7 Heavy
8 – 9 Very Heavy
10 – Single Maximal effort

Children and Teens

Most people have heard the statistics. Obesity in our society is quickly becoming the number one health concern of our nation. According to the Centers for Disease Control and Prevention, a poor diet and physical inactivity caused 400,000 deaths in 2000, representing a 33% jump over 1990. Children are now at the greatest risk. The Associated Press reported that about 15.6% of American children between twelve and nineteen were obese in 2002. This was an increase from 6.1% reported in 1974. The combination of our society's sedentary lifestyle as well as an abundance of poor quality and high quantity food has created a "modern day epidemic."

EXAM ALERT

What is the most significant reason for the obesity of young children? When is resistance training not recommended for children?

With the advances in modern technology, children do not play like they did in the past. It would be a normal occurrence to see children spending a majority of their free time playing outside and being physically active. Now more often than not, they are inside - watching TV or passing time on a computer or gaming console. Sedentary children are no longer the exception; they have become the norm.

To design and instruct a proper program for kids, we must first look at what proper strength training can and cannot do for children. One of the primary benefits of strength training for children is increased muscular strength. Many parents might be concerned that this type of training will cause seemingly unnatural muscular growth in their child or excessive muscular hypertrophy. Parents might fear that their children will become "miniature body builders." This fear, while largely unfounded, means that the dynamics involved in training children must be understood. From a program design perspective, it is recommended that PFT's working with children should focus more on concentric muscle actions instead of eccentric loading to avoid hypertrophic effects. An appropriate program design will both aid muscular strength and neuromuscular control (coordination), independent of muscular hypertrophy.



think about it

While hypertrophy may be a fear when training children, almost all strength gains produced in children come from neuromuscular coordination. Heavy resistance exercises are potentially harmful for children, but using bodyweight and functional balance exercises will produce very similar positive results as resistance training.

Another common concern is that resistance training will put undue stress on a child's bones and joints. In fact, due to their developing skeletal and muscular systems, children are more prone to certain types of injury. This is mainly true of growth cartilage, a type of connective tissue that is located at three major sites: the growth plate or epiphyseal plate of long bones, the site of tendon insertion onto bone (apophyseal insertion), and cartilage on the joint surfaces (articular cartilage). However, these injuries occur primarily in sports-related circumstances or when lifting maximal or near maximal weight (especially if unsupervised). Furthermore, scientific studies continue to indicate that resistance training can actually increase bone density. At one time there was a fear that this type of training might be detrimental to bone growth but we now know that the opposite is true. Emerging research continues to support the belief that resistance training seems to be the most potent stimulus for bone growth and development for all ages.

There are still many more myths out there. These include that children should not start this type of exercise until they are at least fifteen (or insert any age here). Once again, this is simply not true. Not only can children achieve the results noted above, but there will also be improvement in body composition (body fat to lean mass ratio), improvement in strength, balance around joints, and an improvement in performance.

As part of a special population group, the nutritional concerns for children or young adults *may* require a PFT to refer these clients to a qualified profession. Proper nutrition is not only vital for a successful program, but will also establish a foundation for healthy eating behaviors for a lifetime. In order to give appropriate advice, it is important that a fitness professional be well versed in the fundamentals of nutrition. The same basic guidelines we apply to adults are no different for children. These guidelines are simply more important for children, as this is a significant time of growth and development and may influence nutritional habits going forward.

One of the best methods for training children and teens is to include whole body exercises, using the child's own bodyweight, or to use circuit training, to achieve optimal results. The main emphasis is

to influence cardiovascular function, bone growth, coordination, and muscular growth. This might include program variables that allow minimal breaks (30-60 seconds) and high repetitions (15-25), with an appropriate amount of resistance for the child/teen, while still maintaining proper technique. Special consideration must also be made for individual goals.

The fitness professional must remember that when training a child or young adult (teen), there is often a higher risk with minimal benefit. The bottom line is that we do not train a child or young athlete like an adult or accomplished athlete. As more of a social issue or concern, there is an increasing desire emerging to start training kids at a very young age, in order to gain a competitive lead over other athletes or to attain a college scholarship at a later date. This debate is fueled by multiple external dynamics and is not very relevant to the application of science when training members of this special population. The best advice is to remember one of the basic NESTA golden rules of personal training,

"Do no further harm to the client"

Cardiovascular Disease

Cardiovascular disease is a disease or malfunctioning of the heart or blood vessels.

A heart attack or a myocardial infarction is the death of part of the heart muscle due to the sudden loss of blood supply. Typically, the loss of blood supply is caused by a complete blockage of a coronary artery from a blood clot. The coronary arteries supply blood (along with essential nutrients) to the heart muscle. Death

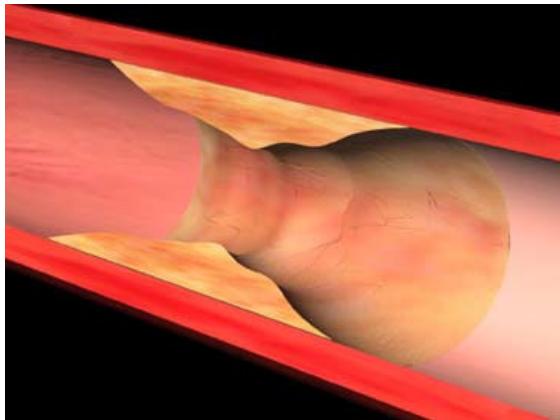
EXAM ALERT

What is the physiological cause of heart attacks?

of the heart muscle (necrosis) can result in chest pain and electrical instability of the heart muscle tissue. The resulting electrical instability of the heart causes ventricular fibrillation if a normal heart rhythm is not quickly restored. Systematic transmission of electrical signals in the heart is

important for the regular pumping actions of the heart. When the heart undergoes ventricular fibrillation, it simply shudders, and cannot pump or deliver oxygenated blood to the brain. Permanent brain damage and death may occur unless oxygenated blood flow is restored within five minutes.

Longitudinal section of an artery seen in a 3/4 view. Lumen is narrowed due to atherosclerotic plaque.



Cardiac Risk Factors

Statistics reveal and extensive clinical studies have recognized numerous factors that increase one's risk for coronary heart disease. Some of them can be changed or treated (controllable), and some cannot (uncontrollable). The more risk factors one has, the greater their risk of heart attack or stroke. Controlling as many of these risk factors as possible is the optimum way to keep a heart healthy. Major risk factors have been shown by medical research to considerably increase the risk of heart and blood vessel (cardiovascular) disease. If a client has one or more cardiac risk factors, the personal trainer needs to get a doctor's release form before the client can begin an exercise program.

Major Risk Factors of Coronary Heart Disease That Can Be Modified or Treated

1. Sedentary Lifestyle

Lack of physical activity is a risk factor for coronary heart disease and regular exercise plays an important role in preventing heart and cardiovascular disease. Exercise, even at a moderate intensity level, is beneficial if done regularly and over a long period of time. There is a dose-response effect to regular PA, indicating that more intense activities are associated with more benefits. Using sound exercise programming techniques, we can help to control blood cholesterol, diabetes and obesity as well as help to lower blood pressure in some people.

2. Obesity and Being Overweight

People who have excess body fat (men greater than 25% and women greater than 32% of total body weight) are more likely to develop heart disease and stroke, even if they have no other risk factors. Obesity is unhealthy because excess weight increases the strain on the heart and is directly linked with coronary heart disease. If left unchanged or unresolved, obesity is seen to have negative effects on health. Obesity influences blood cholesterol and triglyceride levels, and makes diabetes more likely to develop.

3. Non Insulin Dependent Diabetes Mellitus (Type II)

Diabetes seriously increases the risk of developing cardiovascular disease. Even when diabetics maintain control of glucose levels, the disease

EXAM ALERT

Be able to list all nine risk factors for coronary heart disease. Which risk factors for coronary heart disease can be modified or changed? Which cannot?

can still increase the risk of heart disease and stroke. Two-thirds of people with diabetes die of some form of heart or blood vessel disease. It is critical for those with diabetes to monitor and control any other risk factors as much as possible.

4. High blood pressure

High blood pressure (BP) increases the heart's workload, causing the heart to become enlarged and to weaken over time. Elevated BP also increases the risk of stroke, heart attack, kidney failure and congestive heart failure. Blood pressure at or above 140/90 mm/Hg is considered too high and 120/80 or less is an ideal range to maintain.

5. High blood cholesterol levels

Research has shown that the risk of coronary heart disease and stroke rises as blood cholesterol levels increase. When other risk factors (such as high blood pressure and smoking) are present, this risk increases even more. A persons' cholesterol level is also affected by age, gender, heredity and diet. Total cholesterol should remain below 200 mg/dl with HDL levels at or above 35 mg/dl. A total cholesterol ratio (HDL + LDL / HDL) should be less than 3.5. A simple blood test done will quickly determine total cholesterol as well as HDL and LDL levels.

EXAM ALERT

What are HDLs? What are LDLs? What are the physiological effects of common antihypertensive medications?

6 .Cigarette Smoking

The risk of heart attack among tobacco smokers' risk is more than twice that of non-smokers. Cigarette smoking is the biggest risk factor for sudden cardiac death and smokers have two to four times the risk of nonsmokers. Smokers

who do suffer a heart attack are more likely to die as a result of smoking or die suddenly (within an hour) than are nonsmokers. More recent evidence continues to indicate that chronic exposure to environmental tobacco smoke (secondhand smoke, passive smoking) may also increase the risk of heart disease.

7. Stress

The health and medical communities continue to learn more about the effects of stress on heart health. According to the results of a study reported in the American Medical Association's Archives of Internal Medicine, heart patients can significantly lower their chance of having more cardiac problems by making use of stress reduction techniques.

Major Risk Factors of Coronary

High-Density Lipoprotein: (HDLs) "Good cholesterol" that removes cholesterol from the walls of arteries in the extremities and returns it to the liver, helping the liver excrete it as bile, a liquid acid essential to fat digestion. Low-Density Lipoprotein: (LDLs) "Bad cholesterol" that transports cholesterol from the liver to the cells of the extremities. As they work, LDLs leave plaque-forming cholesterol in the walls of the arteries, clogging the artery walls and setting the stage for heart disease.

Heart Disease That Can NOT Be Modified or Treated

8. Heredity (including race)

Genetics or heredity are major factors of heart disease development prior to the age of 55 for men and 65 for women, are more likely to develop heart disease themselves. African Americans have more severe high blood pressure than Caucasians, resulting in a higher risk of heart disease.

EXAM ALERT

What is hypertension? What consistent blood pressures readings are indicative of a risk factor for coronary heart disease?

9. Increasing age

About 85 percent of people who die of coronary heart disease are age 65 or older. At older ages, women who have heart attacks are twice as likely to die from a CV event in comparison to men in the same age range or group.

10. Gender

As a result of the changes in both our society and lifestyle, heart disease is no longer predominately a man's disease. In the United States, cardiovascular diseases claim the lives of nearly 503,000 females annually. One out of every five women has some form of cardiovascular disease. About 18,900 females under age 65 die of coronary heart disease each year; about 35 percent of them are under age 55, whereas men primarily have heart attacks earlier in life.

Use the rate of perceived exertion scales to both determine effort levels and to maintain a consistent CV and strength training program. In theory, this will lower the risk of heart attack or heart failure by training the cardiovascular and musculoskeletal systems to work more efficiently. This means that you may be required to follow recommendations and/or limits of exertion (safety concerns) for the individual as agreed upon by their doctor or physician. There are otherwise no specific considerations for individuals with a heart condition other than keeping effort level to what is indicated.

For anyone with a known cardiovascular disease (may include myocardial infarction, arteriosclerosis or ailment such as congestive heart failure, bypass surgery or transplantation), the fitness professional must remain in close contact with the client's doctor or physician in addition to getting a medical clearance before programming acute exercise variable such as intensity, frequency or duration.

Hypertension

Hypertension is the medical term for high blood pressure and is a primary risk factor for cardiovascular disease. Any individual with a consistently high reading of greater than 140 systolic over greater than 90 diastolic is either hypertensive or at risk.

The fitness professional should refer a client with these values to a physician immediately following the health assessment or medical history interview. This is a mandatory process and needs to be completed before administering any exercise programming to ensure the safety of the client.



think about it

Hypertension is the gradual clogging of coronary arteries due to high cholesterol, lack of exercise, poor diet, etc. This clogging of arteries causes the heart to work harder to keep the body alive by providing oxygen to the tissues. A myocardial infarction, or heart attack, is the eventual death of tissues from this lack of oxygen to the heart and body, which can lead to death.

Again, genetics can play a major factor in ones' health history, and the trainer should note if there is any incidence of hypertension in the client's family. Individuals who are hypertensive may appear to be normal, healthy adults, but in reality, they assume greater risk with heavy exertion or heightened times of stress.

Regular cardiovascular exercise can lower blood pressure significantly and reduce stress levels. Stress from every day life cannot and must not be overlooked as a significant contributor to elevated blood pressure or heart rates. Adequate sleep, exercise and nutritional habits are also influencing factors in the management of BP and must be monitored. When appropriate levels of rest and PA are not met, risks increase for CHD. Put simply, PA helps to prevent or offset the effects of stress but also can also be a source of acute stress on both muscles and the nervous system.

anti-hypertensive agents	
diuretics	Diuretics cause the kidneys to remove more sodium and water from the body (short term effect); the long-term results from diuretics is seen to be an unknown vasodilator effect that decreases blood pressure by decreasing resistance, which helps to relax the blood vessel walls, thereby lowering blood pressure. Possible side effects include increased urination, dehydration, increased thirst, weakness, and impotence.
beta-blockers	Beta-blockers decrease heart rate and the amount of blood the heart pumps out with each beat, while relaxing the blood vessels, which reduces blood pressure. Possible side effects include increase of asthmatic condition, decreased heart rate, decreased HDL, increased blood sugar levels, and erectile dysfunction.
ACE inhibitors	Angiotensin-converting enzyme (ACE) inhibitors block an enzyme needed to form a substance that narrows blood vessels (vasoconstrictor). As a result, blood vessels relax and widen, making it easier for blood to flow through the vessels, which reduces blood pressure. These medications also increase the release of water and sodium through the urinary system, which lowers blood pressure as well. Possible side effects include allergic reactions, rash or a dry cough, and should not be taken by pregnant women or individuals at risk for kidney failure.
calcium channel blockers	These medications work by reducing the amount of narrowing (constriction) of the blood vessels caused by high blood pressure. This makes it easier for blood to flow through the vessels and lowers blood pressure. Possible side effects include decreased heart rate (or rapid heart rate with some medications), dizziness, headaches, and constipation.

The fitness professional may need to do their own additional research to determine which medications fall into the above or other categories before continuing or beginning an exercise program.

Obesity

Over the past 20 years in the United States, the prevalence of obese individuals has risen dramatically. As the rest of the world becomes more sedentary and mechanized (use of machines instead of moving one's body at work or for transportation) the trend is believed to lead to an increase in obesity figures globally. An individual is considered obese when their body fat exceeds 25% for a male and 32% for a female. These numbers are significant because research has shown that individuals who present within these parameters had the least number of health issues and the lowest risk for additional deficiencies or abnormalities. Conversely, athletes or individuals with extremely low body fat, although necessary for performance, have a higher risk for a myriad of health problems and may be part of another concurrent situation (body image disorders, etc.).

Body mass index, or BMI, is used in most standardized research for measurement of healthy bodyweight. This number is important because of the correlated risks and resulting stress on the musculoskeletal, nervous and endocrine (hormonal) systems, independent of fat or muscle. While increased muscle is certainly desired more than increased fat in most cases, this presents a higher risk as well. Body mass index is determined based on an individual's height in inches by their total bodyweight in pounds. Both an individual's BMI and body fat percentage must be taken into account to determine overall stress on the functioning of the body.

Individuals we present with obesity have taken many months or years to be in their present condition. The fitness professional must make it clear that it will take at least as much time to return to a normal, healthy state and perhaps longer. Shortcuts to quick weight loss may remove weight quickly but come with many new and dangerous risks. It is important to discuss these risks with the individual prior to recom-

mending advice on caloric intake. A physician or doctor clearance should be required by the trainer, as this is another example of a person within a special population.

increased risks for obese individuals

- Hormonal deficiency or altered production
- Excessive strain on joints and skeletal muscle
- Increased risk for diabetes, arthritis or coronary problems
- Decreased desire to exercise given their current extreme state and a feeling of a lack of control over one's own body
- Increased muscular imbalances due to a sedentary lifestyle

exercise solutions for obese individuals

- Above all else find an activity they enjoy or they will not adhere to it
- Consistent exercise to burn calories more efficiently
- Decrease total caloric intake or increase caloric expenditure through exercise or a combination of both. It takes 3500 calories to yield a pound of weight loss.
- Choose exercises which are appropriate for the individual's size and abilities
- Discuss their goals as well as concerns and frustrations over past exercise failures very thoroughly and stress the need to follow a consistent program

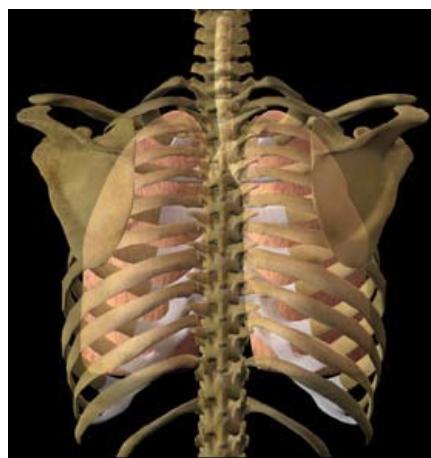
EXAM ALERT

When is a male considered obese? A female? Identify the increased health risks due to obesity.

Application: One pound of body weight equals approximately 3500 calories. In order to lose weight safely, 1-2 lbs should be lost every week. For example, if one wanted to lose 1 lb in a week, they should have a caloric deficit of -500 a day. To ensure not too much lean mass is lost, the person should consume 250 less calories each day, and burn 250 calories with exercise.

Asthma

Asthma is a disease of the airways and can either be due to airflow obstruction or an involuntary constriction of the smooth muscles of the bronchial passage, due to a muscular spasm, which limits air flow both to and from the lungs. Asthma attacks can be caused by air pollution, allergens such as pollen,



dust or medications, or it can be exercise induced.

Exercise induced asthma can occur within a few minutes or a few hours following exercise. Symptoms usually include wheezing, shortness of breath, chest tightness, and sore throat or headaches. While simply breathing through the nasal cavity may aid in decreasing an attack, the use of a bronchodilator or inhaler may also be needed. The fitness professional must be certain that the individual's necessary medication or inhaler is present at all times. Attempt to work out in warm, moist air conditions rather than cool and dry environments to decrease the probability of bronchial irritation or constriction of breathing.

Chronic asthmatic conditions can be exacerbated at any time and care must be taken to remove the

individual from a situation where pollution or other allergens may create difficulty. When considering proper breathing during exercise, progression of a strength training program should increase cardio-pulmonary efficiency and generally poses no risk to the individual provided their heart rate stays under the anaerobic threshold of the individual (use the Karvonen Equation). Aerobic training must be monitored closely and the individual should stay within the proper recovery zone of cardiovascular training (40-65% of MHR) until advisable by the individual's physician, to enable progression into more intense levels of programming.

Diabetes Mellitus

Diabetes is any of several metabolic disorders marked by excessive discharge of urine and persistent thirst, especially one of the two types of diabetes mellitus. This usually occurs as a result of problems with the production, supply, and use of insulin in the body.

Insulin is the body's key blood sugar-regulating hormone. Without insulin, our bodies cannot obtain the necessary energy from our food. Insulin is made in the pancreas and is released by cells known as *beta* cells. When a person has diabetes, either their pancreas does not produce the insulin they need (Type I), or their body cannot use its own insulin effectively (Type II). As a result, people with diabetes cannot effectively utilize glucose from food. This leads to a rise in blood glucose levels called hyperglycemia. If a person secretes too much insulin, this leads to lower blood sugar levels, also known as hypoglycemia or low blood sugar.

Insulin Dependent Diabetes Mellitus (IDDM - formerly Type I):

People with IDDM are unable to produce insulin. This disease can affect people of any age, but usually occurs in children or young adults. People with IDDM require daily injections of insulin as a means of controlling their blood glucose levels. Their doctor will usually prescribe a combination of "fast acting" and "slow acting" insulin. The slow acting insulin is usually injected once per 24 hour period, and the fast acting is usually used just before a meal.

The dosages of the fast acting are calculated based on the carbohydrate load or amounts of the meal to be had. Lack of insulin, as well as an incorrect insulin dosage to a person with IDDM can be deadly. The symptoms of IDDM are often subtle, but can become severe if not addressed. They include:

- Increased thirst
- Increased hunger (especially after eating)
- Dry mouth
- Frequent urination
- Unexplained weight loss (even though they are eating and feel hungry)
- Fatigue (weak, tired feeling)
- Blurred vision
- Numbness or tingling of the hands or feet
- Slow-healing sores or cuts
- Loss of consciousness

Non Insulin Dependent Diabetes Mellitus (NIDDM - formerly Type II): People with NIDDM do not usually require injections of insulin. NIDDM used to be called adult-onset diabetes or Type II. However, as a consequence of increased obesity among children, NIDDM is becoming more common in children and young adults.

Usually, blood glucose levels can be controlled by diet, exercising regularly, and by taking oral medication. Those with NIDDM often rely on a class of drugs known as thiazolidinediones (TZDs) to make their cells more sensitive to insulin. NIDDM is most common in people older than 45 who are overweight; however, as noted earlier, more and more cases of children of all ages are being diagnosed with NIDDM, caused by childhood onset obesity. NIDDM is the most common type of diabetes and accounts for 90 - 95% of all people with diabetes.

Data from a long-term study suggests that postmenopausal women who are physically active have less risk of developing diabetes mellitus over women who are sedentary. According to a study published in a recent American Journal of Public Health, approximately 8% of NIDDM cases in older women could be prevented with regular physical activity. If people with NIDDM are not diagnosed and treated, they can develop serious complications, which could result in death. Worldwide, millions of

people have NIDDM without being aware of it, and without access to adequate medical care.

NIDDM may show some of the same symptoms as those of IDDM. Most often, there is a very gradual development of symptoms, or there are no noticeable symptoms at all. In fact, half of all people with NIDDM don't know they have it.

Additional symptoms include:

- Slow-healing sores or cuts
- Itching of the skin (usually in the vaginal or groin area)
- Yeast infections
- Recent weight gain
- Velvety dark skin changes of the neck, under arm, and groin called acanthosis nigricans

risk factors for NIDDM

-Age: Up until recently, the vast majority of people with NIDDM have been those over 40 years of age.

-Obesity: Over 80 percent of people with NIDDM are overweight.

-Heredity: Research has shown that people are more at risk if there is a history of NIDDM in their family. However, it is also known that more than a propensity to have NIDDM, what is inherited are the same eating and inactivity habits their parents had that led them to become NIDDM patients.

-Sedentary Lifestyle

Regular exercise has been proven effective in preventing the development of NIDDM. Research has shown that exercise promotes cardiovascular fitness and increased insulin sensitivity which may lower the dosage of oral hypoglycemic drugs required. A healthy person's blood sugar is usually between 70 and 110 mg/dl (milligrams of glucose per deciliter of blood). It can also be expressed in millimoles; where between 3.9 and 6.0 mmol/L is considered normal. Impaired glucose tolerance (IGT) is a level of blood glucose which is higher than normal, but not high enough to be in the range where doctors classify this as diabetes. A fasting blood glucose level of 126mg/dl

dl is usually the determining number for a diabetes diagnosis (NIDDM).

Other types of diabetes:

Gestational diabetes is another type of diabetes that occurs in pregnant women. This may be a temporary form of diabetes that usually disappears when the pregnancy is over. Women who have this type of diabetes are at higher risk of developing NIDDM later in life. Because of the high amounts of insulin secreted by women with Gestational Diabetes, the fetus' organs are overdeveloped and the child may be born with internal organs that are too large for the body's systems to support. Within this group, there is a higher risk of being born with or becoming IDDM patients, or to end up developing NIDDM at a very young age. When this happens, the fetus is so overly developed that most gestational diabetes babies have to be delivered via Caesarean.

Exercise is an effective treatment for clients of all ages who have IDDM and NIDDM. Clients in this group should be instructed on how to integrate diet and hydration management with workouts and glucose monitoring. The personal trainer must refer diabetic clients to a Registered Dietitian, familiar with sports nutrition, so he or she can create an individualized custom nutrition program. Clients should also be encouraged to consult a podiatrist for proper footwear, as well as regular follow ups with an endocrinologist specializing in diabetes. It is also important to design adequate warm-up and cool-down routines within the program designs for these individuals. Timing of high-energy snacks, workouts and fluids is crucial. Usually, no specific exercise modifications are required for diabetes patients unless they have complications, but a best practice includes recommending that diabetics stay hydrated while exercising, as exercise causes fluid loss via perspiration. In diabetic patients, perspiration can lead to increased blood glucose levels due to a decrease in serum/blood volume, secondary to fluid loss. It is recommended to not exercise if blood glucose levels are under 150-200mg/dl before exercising.

Conclusion

Regardless of a particular individual's special needs relating to their disease or disability, members within special populations are like all other clients in that they require the utmost attention to detail from the fitness professional. If a fitness professional wants to be worthy of the profession, a PFT must establish the best possible exercise foundation in order to create a healthy future for the client.

Pregnancy
Menopause
Arthritis
Cancer
HIV/AIDS
Chronic Fatigue and Fibromyalgia
Reflex Sympathetic Dystrophy Syndrome

chapter 8

Assessments

What is an Assessment?

An assessment is a tool used for either measuring an individual skill or mastery, or to evaluate a client's biometrics (BP, BW, BF). It is the responsibility of the professional who administers an assessment to use reliable testing methods that provide meaningful information to both client and trainer. The trainer uses client assessments to find a starting point for a new client, identify their abilities, and to re-assess their abilities as an exercise program progresses. The client is able to learn information that they would not otherwise know or understand, without the guidance of the trainer. A trainer or other fitness professional must continually assess and re-assess their clients to determine their strengths and weaknesses and to determine the effectiveness of their current program design. Effective assessments and an experienced assessor (trainer) not only give significant information to the trainer, but provide a strong selling point for the trainer to help a client recognize that fitness is not as simple as throwing weight around or stepping on a treadmill to raise their heart rate (HR). Personal training is a science. It is exercise science. Pursuing a training program without basing its design upon solid scientific research is an inferior program that will produce lesser results and greater risks. A doctor would not prescribe medication or operate without a thorough assessment; neither should a fitness professional design an exercise program without a thorough assessment. We have

EXAM ALERT

What is the main purpose of an assessment? What form(s) should be filled out prior to any exercise performed under the supervision of a client by a personal trainer?

administering formal assessments

health history

Take 20-60 minutes to inquire about the past and current health and medical background of the client before beginning an exercise program. Additional information, important to gather, includes exercise history, equipment availability, long term goals and client preferences.

PAR-Q

This is a standard Physical Activity Readiness Questionnaire and its use is described later in this Chapter.

assessing six components of fitness

1. Body Composition assessments
Assess muscle to body fat ratio through varying methods: hydrostatic, infrared, calipers, BIA or girth measurements.
2. Cardiovascular assessments
Determine resting blood pressure, resting heart rate, and VO₂ max or sub-maximal tests (aerobic capacity).
3. Balance assessment
Determine client's ability to maintain body position in space.
4. Flexibility assessment
Determine joint ROM for the client through static and dynamic postural assessments in search of muscular imbalances.
5. Muscular Strength assessments
Determine current strength capabilities or force production of the major muscles of the body.
6. Muscular Endurance assessments
Determine ability for muscles to exert significant force over a period of time.

You can't know where you are going if you don't where you've been. It's been said many times before. How does it apply in training? Programs must be altered based upon age, size, weight, current exercise program, fitness levels, movement skill, injuries, diseases, and current goals. That's a lot of information. It's also a lot of information to assume if it is not uncovered. It's impossible to design a safe, efficient, and effective program without understanding these variables for each individual. Many coaches and trainers have simply based a program on "now" (trial-and-error), and the end goal(s), rather than exploring the past. Failing to uncover a past injury, illness, disease, or physiological limitation could be disastrous. Assessments must be performed to gain a greater understanding of individual capabilities and limitations, among many other reasons to be explained shortly.

Assessments defined by type

Assessments consist of biometric screens or performance checks tied to fitness or skill development. Assessments are performed as either formal or informal evaluations. Informal assessments of skills should occur with every step, every movement, and every repetition of every exercise. These informal assessments are microassessments. Formal assessments are known as macroassessments. These macroassessments occur at pre-designated periods for more formalized performance checks. Examples of formalized assessments include checking biometrics for change after a 12 week program design. Timing is important, as it is often best to have a complete rest day or series of lighter days prior to holding a formal assessment, to ensure that the fatigue of training does not affect assessment results. The formal, scheduled assessments must be as objective as possible while ensuring that the client is motivated (by knowing the assessment date and understanding what is to be assessed ahead of time) and in their peak condition. The results of the assessments will reflect the areas emphasized in training. All clients must receive feedback from the trainer regarding their assessments .

Why assess?

The reasons for performing both micro and macroassessments include:

- Determining capabilities before designing the program
- Determining limitations before designing the program
- Serving as a baseline of comparison for future assessments
- Setting realistic performance standards to personalize the training program and set appropriate performance goals
- Assisting in prediction of future performance
- Showing whether the client is improving or regressing in specific components of fitness and performance
- Providing an indication of a client's readiness following an injury or illness
- Creating or increasing motivation for the client (to improve upon results)
-

Factors that may affect results in formalized assessments include:

- Room or air temperature and humidity
- Sleep over the previous 2-3 days
- Current emotional state of the client
- Medication taken by the client
- Time of day
- Caffeine intake
- Food and fluid ingested and timing over the past 24-48 hours
- Knowledge of and experience with performance tests
- Appropriate warm-up period and choice of warm-up activity(ies)
- Rapport between client and coach
- By-standers or audience presence
- Knowledge and skill level of the coach

When and how often should assessments be performed?

Microassessments are performed by the coach at all times. The PFT must continually be modifying and adapting predetermined workouts (workouts should always be written down with on-the-fly adaptations made from the written plan), based on actual performance and client feedback before, during, and after workouts. This requires the coach to take a few minutes before each session to review the plan and progress, to take a few minutes following the workout to write down notes and observations, and perhaps 15-30 minutes to prepare the plan for the next workout based on all this information and feedback.

Macroassessments should be performed every 4-8 weeks or based on some other predetermined period. Why 4-8 weeks? Significant training adaptations are expected after a few weeks following a change in the training program (assuming the client or client sticks with the program as designed). The macroassessment will serve as either positive or negative feedback regarding the results of the current training program.

Coaches should keep a detailed training log that not only keeps track of the workout itself, but the client's specific performance, feedback, and anything the coach may notice that might be useful to know at a later date.

What should be assessed?

While the client is almost certainly focused on outcome goals, it is the job of the PFT to ensure that the client meets basic standards of health and fitness before focusing on such goals. Each assessment is listed next, in order of suggested implementation, along with an estimated time for performing each assessment.

Areas to be Assessed	
Health	Current state of physical well-being
Fitness	Current basic physical capabilities
Skill	Sport-specific technique and performance capabilities

Summary of suggested health, fitness and skill assessments:

Health Assessments (about 30-60 minutes)

- Health/Fitness History (15-45 minutes)
- RHR (2-3 minutes)
- BP (2-3 minutes)
- Weight (1-2 minutes)
- Girth (2-3 minutes)
- Body Composition (2-3 minutes)

Fitness Assessments (about 30-75 minutes)

- Balance (2-3 minutes)
- Static Posture (1-2 minutes)
- Overhead Squat (2-3 minutes)
- Push-up (1-3 minutes)
- Pull-up/body row (2-3 minutes)
- Plank (1-5 minutes)
- Leg Press (2-3 minutes)
- Aerobic Capacity (3-20 minutes)
- Anaerobic Threshold/Maximum Heart Rate in (15-30 minutes)

Skill Assessments (about 30-90 minutes)

- Sports Specific Assessments (if necessary)

Taking a health history is like putting together a puzzle. The personal trainer is putting together clues to a healthy client that is ready to participate in physical activity. The personal trainer is not expected to solve the puzzle (physicians do this with a diagnosis), but to put enough of it together to see if there is a potential problem. The point is... if you see a pattern or a possible risk, refer the client to a physician as soon as possible to ensure their safety, and yours.

How to perform the assessments

Health assessments are performed first, as these assessments are the least invasive and easiest to implement, following the completion of the health/fitness history questionnaire. The health assessments should take as little as half-an-hour and perhaps as much as an hour to perform. The order of the assessments that follows is based on increasing physical requirements of the client over the course of the assessment procedure. Efforts should be made to ensure that assessments which can be hindered by other activities are performed first (i.e. resting heart rate and body composition measurements are first as the results will be very different following exertion of any kind).

Call the previous day (24-48 hours in advance) to remind the client of the scheduled assessment date and time (not calling is a surefire way to ensure the client will forget about the appointment).

Remind the client client of the following prior to the first assessment/first time meeting and for any ongoing, formalized macroassessments:

- Wear comfortable, athletic clothing
- Eat a healthy meal 2-3 hours prior to the assessment
- Do not drink any caffeine within several hours of the assessment
- Call if there are any concerns or rescheduling is necessary

On assessment day, the coach must:

- Have all necessary equipment ready and available
- Clipboard
- Pen
- Health/fitness history questionnaire
- Heart rate monitor
- Heart rate transmitter
- Sphygmomanometer (blood pressure monitor)

- Calipers or body composition measurement tool
- Tape measure
- Scale
- Be ready and waiting for the client at the described meeting location, at least 5-10 minutes early
- If necessary, wait until at least 15 minutes following the specific meeting time before declaring the client a no-show
- Smile, offer a firm (not bone crushing) handshake, and maintain eye contact, until both coach and client are seated
- Sit close enough to the client to be able to reach out and make physical contact but not so close that contact is unavoidable (there should not be a table, desk, or any objects between coach and client)
- Remember that the trainer is interviewing the client for the opportunity to work with the trainer, not the other way around (to help the trainer focus on obtaining information and to get to know the client as one of the foremost goals of the first assessment session)

Health Assessments

Health Assessment #1: Health/Fitness History Questionnaire (15-45 minutes)

Before any work is performed, the trainer must perform a thorough health/exercise history with the client. There are a number of questions that could or should be asked (a sample health/exercise history questionnaire is provided at the end of this chapter for use). The coach must ask the questions and fill out the form for the client. Many trainers are inclined to have the client fill out the form and then look over the client's responses. Most people will answer questions on a form as quickly as possible in order to get through the form and move on to the workout or training that will follow. This is simply human nature to get past the small details and move on to what the person feels is most important. For this reason, and to ensure that the most accurate information is discovered through an ensuing dialogue, the trainer must ask the questions and fill out the form.

The time taken to ask questions and complete the form could be as little as 10-15 minutes (assuming perfect health and little history to speak of) or as much as 30-45 minutes (if the athlete has numerous concerns and/or an extensive exercise/training history). Before asking any questions related to the health/exercise history questionnaire, the trainer must set the stage for what will follow. The trainer must explain that there will be a series of questions asked that must be answered as completely and accurately as possible in order to ensure information that will lead to the best results, as quickly as possible. The program will only be safe, efficient and effective if the assessments are complete and accurate. If all information is not known, the program cannot be fully safe in avoiding potential injury or in avoiding harm to the client. If all information is not fully known, the program will not be efficient as there will be a great deal of wasted effort in guess-work with programming and the implementation of the program. Finally, not having all pertinent information will hinder an effective program. It is difficult to be effective when all facets of the client are not known.

Asking questions is an art and a skill. It takes time to become skilled at the art. The only way to get better at asking questions is to ask more questions. The more questions the trainer asks (to obtain clarification), the more precise the questions will become. With practice, more information will eventually be obtained in less time. This will take time to "perfect". What is a "bad question"? The question that is not asked. The trainer should ask questions until the answers are sufficient to meet the needs of the trainer in designing a (surprise, surprise) safe, efficient, and effective program. The more adept the trainer becomes at asking questions, the faster the questionnaire can be completed. For the first few times in performing a first assessment with a new client, be sure to allow 75-90 minutes for completion of the assessment rather than the expected 60 minutes or less. It will be a challenge to implement the assessment in a short period of time. The ability to do so will add to the professionalism of the PFT.

PAR-Q

A Physical Activity Readiness Questionnaire is a short, specific health history form. It is designed to discover the small number of adults for whom physical activity is of medical concern or who may require medical consent by a doctor before beginning a program.

Risk Factors	
Low Risk	Individual males below the age of 45 and females below 55 who meet no more than one of the coronary artery disease risk factors from the list below.
Moderate Risk	Males 45 or older and females 55 or older who meet two or more risk factors from the list below.
High Risk	Individuals with known cardiovascular, pulmonary or metabolic disease.

If a client is either moderate or high risk, a medical consent form must be signed by a doctor or physician and returned to the fitness professional before exercise programming may begin. If an individual has a disease or ailment which is not known or understood by the trainer or fitness professional, then medical consent is also required. Not obtaining medical consent when significant risk is present is unprofessional and puts the client at considerable health risk with considerable financial liability for the trainer. It would always be in the best interest of the trainer to request a medical consent under any questionable circumstances.

How often should an individual get a full physical examination?

Screenings for adults are generally determined by gender or age. In some cases, ethnicity, family history, and lifestyle factors also influence the need for a full physical evaluation. Each person's combination of factors requires a slightly different health maintenance plan. It's important for clients to choose a primary care physician to monitor and determine the best time for each in-

dividual to get a physical, and to help implement a customized health maintenance plan. For adults 19-39 years of age, the exam should be scheduled every 5 years; for 40-49 years of age, the exam is recommended every 3 years. Those 50 years and older should receive an exam every 1 to 2 years.

What should an individual expect with a full physical examination from a physician/Doctor?

The most important part of the physical might be the discussions between physician and client. This may include information on family and personal health history; lifestyle behaviors; ethnic origin; occupation; financial background; sexual activity; signs of depression; use of medications; childbearing, menstrual or menopausal issues; current problems or symptoms or even concerns related to the elderly. This interaction helps physicians connect with their patients and helps to reassure them that their overall health is being monitored. Usually if the exam is not directed by symptoms, it is rare to find anything wrong.

The exam itself usually entails measuring weight, height, blood pressure and resting pulse. A full examination might also include testing vision and hearing, examining skin, heart, lungs, abdomen, prostate, rectum, pelvis, breast and lungs. Exams give patients a chance to discuss family histories and any risk factors. They may also turn up areas to modify certain behaviors and make "lifestyle changes," says Douglas Souvignier, M.D., chairman of the Internal Medicine Department at CMG. Adult health maintenance guidelines offer a good roadmap, but one size does not fit all.

Coronary Artery Disease Risk Factors defined by the ACSM

A family history of myocardial infarction, coronary revascularization, or sudden death before 55 years of age for a male relative (father, brother, or son) or female relative before 65 for a female (mother, sister, or daughter).

A current cigarette smoker or who has quit in the past six months.

Current hypertension or systolic blood pressure above 140 mm/hg or diastolic blood pressure above 90 mm/hg. This must be confirmed by a health professional using measurements from two separate occasions or diagnosis by a doctor.

Current hypercholesterolemia or total serum cholesterol of greater than 200 mg/dl or HDL of less than 35 mg/dl or on current cholesterol medication.

Impaired fasting glucose of greater than 110 mg/dl (diabetic concerns).

Obesity or body composition of greater than 32% for a female and greater than 25% for a male (waist girth of greater than 100cm or 40 inches).

Sedentary lifestyle or a person not participating in a regular exercise program.

If an individual is either moderate or high risk for coronary artery disease, a moderate to vigorous exercise test regimen and sub-maximal and maximal aerobic capacity tests are recommended to be performed by a doctor or medical professional.

Health Assessment #2 – Resting Heart Rate (3 minutes or less)

Resting heart rate can be obtained during the blood pressure assessment with many automatic blood pressure machines/sphygmomanometers. If the sphygmomanometer does not have this option, use of a heart rate monitor is recommended. It is best if the trainer uses a heart rate monitor and multiple transmitters, so that one or two can be drying (after being washed following a previous client's use) and one is ready for use. If a transmitter (placed just under the chest directly on the skin) is used, allow a minute or two

for the client to go place the transmitter privately and return. This placement is ideally performed prior to completing the health/fitness history questionnaire to avoid a rise in heart rate before assessing resting heart rate.

The client must be sitting at rest for at least 5 or more minutes to ensure accuracy in the test. The client never has to see the readout on the watch. The trainer can observe the measurement and record the lowest number observed during completion of the health/fitness history questionnaire (since the watch is on the trainer's wrist). While resting heart rate is best taken upon waking, this measurement will serve as an appropriate gauge for heart rate at the beginning of each workout and to be assessed at the same time of day at a later date. Make sure the client has not had any caffeine within the last several hours and has not already trained on the day of assessment (the trainer should remind the client of this need 24 hours prior to the assessment, as part of the reminder call for the appointment).

EXAM ALERT

What are the Coronary Artery Disease Risk Factors defined by ACSM? Be able to identify when a medical release is needed before an exercise program may begin.

If no heart rate monitor is available, have the client measure the heart rate at the radial artery (or, if the trainer is comfortable, the trainer should place a hand on the radial artery and perform the measurement for greater accuracy). The measurement should be taken for one full minute and recorded.

As in all assessments, if the client asks questions, unless the question can be answered in 10 seconds or less, simply say (while making eye contact), "That's a great question. Remember it so that we can take a moment to go over it at the end of the assessment. Okay? Okay, onto the next assessment..." Waste no time in each assessment or when moving from assess-

ment to assessment. Be professional, be enthusiastic, and smile, but waste no time. Have the client keep the heart rate transmitter on for use later in the cardiovascular fitness assessments if such assessments will be used in the session (these assessments will be explained later in the chapter).

Assessment #3 – Blood Pressure (2 minutes or less)

Blood pressure is a measurement of the pressure on the ventricles of the heart with each heartbeat as blood fills (diastolic) and is then pushed away (systolic) from the heart. Blood pressure should ideally be 120/80 (systolic over diastolic) mm/Hg or less at rest. Blood pressure that is 140/90 mm/Hg or higher is indicative of hypertension (high blood pressure) with as little as 130/80 mm/Hg being hypertensive for a diabetic or individual with kidney disease (ACSM resource manual, 2006; medlineplus <http://www.nlm.nih.gov/medlineplus/lbwloodpressure.html>). Pressure that is 90/60 mm/Hg or lower is considered low blood pressure (hypotension). Low blood pressure or hypotension is only dangerous if it is coupled with frequent lightheadnesses, dizziness, and fainting episodes.

Either high or low blood pressure must be confirmed with at least 2 measurements, several minutes apart, before recommending a medical clearance be obtained. Medical clearance MUST be obtained if the trainer confirms a high or low blood pressure reading. Even if the reading is incorrect, it is better for the client to be safe and be wrong than to take any chances (although it is generally unusual for individuals with higher aerobic capacities to have high or low blood pressure, due to increased efficiency of the heart and circulatory system).

- Immediately following the resting heart rate assessment, while the client is still seated, follow this protocol for the blood pressure assessment:
- Determine cuff size and adjust if needed (it should encompass the arm just above the elbow) (too small a cuff will give an overly high reading and too large a cuff

may give an abnormally low reading)

- Place cuff on left arm of client (preferably on skin, but reading should work if clothing is thin)
- Place the stethoscope sensor (or machine sensor) on the brachial artery (thumb-side) of the arm at the inside of the elbow
- Make sure the client's arm is relaxed in a slightly flexed shoulder and elbow position at heart level by supporting the elbow/forearm with your arm (the client's muscles must be relaxed) (if the arm is allowed to be parallel to the torso the reading may be abnormally high)
- Ensure that the client breathes normally, does not move, and does not talk during the test
- Press the start button on an automatic machine or pump up the pressure manually to about 170 mm/hg
- If performing the measurement manually, hearing the first clear heartbeat through the stethoscope is the measurement of systolic blood pressure
- The point when the heartbeat becomes muffled or can no longer be heard is the measuring point of diastolic blood pressure
- Remove cuff from arm and place equipment back in place

(Missouri.edu blood pressure protocol website)

This test should take no more than 2-3 minutes to administer from beginning to end if equipment is kept close by and neither client or trainer do not have to move following RHR or Health/Fitness History Questionnaire Assessment.

Health Assessment #4 – Weight (1-2 minutes)

Measuring body mass (or weight) is valuable for monitoring changes over time (in muscle or fat). Weight changes in muscle or fat should be assessed weekly or monthly. It simply isn't possible to lose or gain muscle or fat by more than a pound or two per week. Any other weight changes are due to water shifts in the body. To lose or gain a pound or two of muscle or fat per

week is incredibly difficult. If it were easy, then 50-100 pound changes each year would be very common. Most weight loss or gain is from water changes (the body can lose or gain as much as 3-6 pounds of water in a single day). It is also common for first-time exercisers who have not been training for several months to actually gain 1-2 pounds per week for the first few weeks or so in training, as the body adjusts to a new level of exertion (as it will store more water to assist the increased muscular involvement).

Weight measurements are particularly helpful for usage before and after a workout for athletes. This can be a very valuable way to measure fluid loss from sweating during the workout (which will vary based upon intensity and duration of effort as well as the individual's propensity for sweating!). For every pound of water lost from training fluid should be replaced by 1½-2 times the amount (24-32oz of water needed to replace just one pound of water loss). Maintaining the proper fluid balance is crucial for performance.

Weight should never be judged on the number alone. It is a point of comparison and it does not necessarily equate with fitness or performance levels. A client will become lean with the increasingly intense process of eating better, paired with the right training. The trainer must be very careful with training programs that solely target changes in weight.

For weighing purposes follow this protocol:

- Use the same scale with each measurement
- Ensure the scale is zeroed out or balanced
- Wear the same clothing with each measurement
- Be as still as possible
- Measure weight at the same time of day as previous measurements
- Talk with client briefly about the meaning and usefulness of weight measurement (as well as the concerns with weighing too often or putting too much emphasis on the number itself)

Health Assessment #5 – Girth Measurements (2-3 minutes)

Girth measurements are useful as anthropomorphic changes will often be noticeable before significant changes in weight are seen. Girth measurements should be taken to help the client understand and observe the changes that occur from training. A flexible measuring tape should



be used (with a spring-loaded mechanism being ideal so that the tape remains taut during measurement). Care should be taken to ensure that the tape is taut without changing the size (by pressing too hard on the skin) of the area being measured (the measuring must be consistent and precise between measurements).

Have the client stand in anatomical neutral while performing the measurements and tell the individual to be as relaxed as possible. Stand to the side of the client and have the client turn as necessary (rather than reaching around the client when possible) to assist in placing the tape.

Use the following measurement tape placement when performing girth measurements:

- Shoulders: Around the center (socket) of each shoulder
- Chest: At nipple level and under the arms
- Arm: At point of maximal circumference between elbow and shoulder
- Waist: Around midsection over the umbilicus (belly button)
- Hips: One hand-width below the belly button (close-fingered)
- Thigh: Just below buttocks
- Calf: Around largest point between knee and ankle

Note: If exact location is difficult to pinpoint, always default to the point of the greatest circumference or greatest size of a particular area for measurement

It is reasonable to expect that moderate to

considerable anthropomorphic changes will occur every 4-8 weeks. Due to fluid changes, size may change daily to some extent, but the point must be stressed to the athlete that these daily changes are temporary.

Health Assessment #6 -Body Composition

Body Type - ACSM	Female	Male
Athlete	<17%	<10%
Lean	17-22%	10-15%
Normal	22-25%	15-18%
Above Average	25-29%	18-20%
Over-fat	29-35%	20-25%
Obese	35+%	25+%

Numbers may differ slightly between studies and varying sources. For those individuals whose body composition lies outside of the ideal range, it has been found that these individuals have more health risks tied to obesity. Being above the ideal category shows that when compared to the ideal standard, an overweight individual has a greater risk of coronary artery disease, specifically. We know that athletic performance dictates that body composition be as lean as possible. But with your client's needs in mind, the fitness professional must recognize that athletic performance and general health do not always go hand in hand.

When considering the method to determining body composition, cost, accuracy and convenience of the testing procedure are all very important factors. When choosing a method, make sure you find a balance between all of these factors that works well for both your business and your clients.



Methods of determining body composition

Hydrostatic Weighing

This method uses the Archimedes principle, which states that when a body is submerged in water, there is a buoyant counter force equal to the weight of the water which is displaced. Because bone and muscle are denser than water, a person with a larger percentage of fat free mass will weigh more in water and have a lower per-cent body fat. Conversely, fat floats. Therefore, a large amount of fat mass will make the body lighter in water and have a higher percent body fat. If each test is performed correctly according to the recommended guidelines, there is a +/- 1.5% error. Test accuracy depends on the client's ability to blow all the air out of their lungs both during a pre-test screening with a spirometer (to measure vital lung capacity), and during the test itself. Since air makes the body float, inability to perform either of these maneuvers will result in overestimation of the subjects' percent body fat.

hydrostatic weighing

advan-tages	<ol style="list-style-type: none">1. This method is currently considered the "gold standard" in percent body fat measurement2. Repeat measures usually prove consistent, and can be used to chart progress
disad-vantages	<ol style="list-style-type: none">1. This method usually requires a lot of equipment and space2. Testing is time consuming and involved3. Requires in-depth knowledge to administer the tests and compute the calculations4. Being submerged under water may be difficult and produce anxiety4. Results can be altered by hydration status or bone density5. Cost: Usually hydrostatic weighing will cost anywhere from \$10-\$75 due to the involved nature of the test.

Near-Infrared Reflectance (NIR)

This method of assessing body fat is based on the principles of light absorption, reflectance, and near infrared spectroscopy. To estimate body composition, a computerized spectrophotometer with a scan and probe are used. The probe is placed onto a selected body site such as the biceps and emits an infrared light which passes through both fat and muscle and is reflected back to the probe. Subject data such as height, weight, sex, age, frame size and activity level are taken into consideration. Density measurements are obtained and incorporated into the prediction equations. A digital read out, including percentage body fat and lean tissue, are displayed. Futrex 5500 is an example of NIR. This method of determining body composition is quick, convenient and non-invasive.



Advantages of NIR

- Non-invasive
- Within 2% of hydrostatic testing
- Fast
- Reproducible and precise results

Calipers

This method is the most widely used body composition testing method for assessing percent body fat (BF). Equipment used for this assessment includes skinfold (SF) calipers designed specifically for the simple and accurate measurement of sub-cutaneous tissue. In the personal training operating environment, either a 3 or 7 skinfold site method is typically used, although it is important to note that other skinfold tests protocols exist.

How accurate is it?

If SF tests are performed correctly, according to the recommended guidelines, there is a +/- 3% error. Validity (compared to underwater weighing): 7 site skinfold ($r = .90$), 3 site skinfold ($r = .89$).*

Commonly used calipers:

Lange Skinfold Calipers: This device is widely used in schools, colleges, and fitness centers. It is very

\$179.00 – \$220.00. The Harpenden Skinfold Caliper is the standard caliper used in research. The majority of data involving body composition assessments in use today are based on studies using these calipers. Its accuracy is within \approx 0.2 mm and can be read to the nearest 0.1 mm. Harpenden Skinfold Calipers are popular among Exercise Scientists and or Health Science Researchers. The price range is \$275.00 – \$400.00.

calipers

advan-tages

1. Easy to use once skill has been mastered
2. Inexpensive way of estimating percent body fat

disad-vantages

1. Technical sources of error due to inexperience of fitness professional and inconsistency in precise site locations between measurements
2. Mostly concerned with subcutaneous fat (under the skin)
3. May not be an ideal measurement for those who are obese and very lean due to theory of caliper testing that states body fat is 50% subcutaneous and 50% can be measured at the skin layer (accurate theory for 18-22 year old males)
4. Potentially invasive for many individuals



Bioelectrical Impedance (BIA)

BIA is a quick, easy and convenient method to assess BF. Using a calibrated device, the subject either grips the handles (when using a handheld model) or stands barefoot on metal foot plates, where a low voltage electric current is sent from one hand through the body to the other hand (up one leg and down the other). Since fat is a very poor conductor of electricity, it will impede (slow its progress) the electric current more than lean tissue does. By measuring the resistance to the current, the machine estimates the percent body fat. In clinical research environments for body composition testing, using this form of assessment requires that the individual lie down, with electrodes attached to the both hands and both feet. Most commercial testing equipment does not follow this protocol, which may create drastic variance in measurement accuracy and reliability. Protocol of original research must be followed in order to ensure high accuracy.

How accurate is BIA? When done correctly on properly maintained equipment, it is approximately $+/-$ 3%. However, accuracy is dependent upon several client-based variables. It is recommended the following guidelines be followed:

- Abstain from eating and drinking within 4 hours of the test
- Avoid exercising within 12 hours of the test
- Void (urinate) completely prior to testing
- Do not drink alcohol within 48 hours of the test
- Avoid taking diuretics prior to testing unless instructed by your physician
- Caffeine intake - due to its diuretic effects, should be avoided in the hours before the test.

bioelectrical impedance

advan- tages

1. Requires little or no technical knowledge of the operator or client
2. Testing itself takes under 1 minute
3. The unit can be easily transported from place to place
4. Requires only an electrical outlet

bioelectrical impedance

disad- vantages

1. This method has a higher standard error range if protocol not specifically followed
2. Tends to consistently overestimate lean people and underestimate obese people
3. The accuracy BIA does have is very dependant on multiple variables which may be hard to control for some people

cost

1. To be measured on a machine at a school or club, prices range from free to \$30 per use
2. BIA machines can be purchased for home use for \$100 to \$400.

EXAM ALERT

What is considered ideal body composition for men and women? What is obese? What are the various methods of body composition testing? How are they administered? Be able to name some advantages and disadvantages of each.

Health Assessment #7 - Metabolic Testing (when appropriate)

Basal metabolic rate (BMR or RMR), or metabolism, is the rate at which the body expends energy. This is also referred to as the "caloric burn rate". Knowing metabolic rate is vital for weight loss, as results help to determine proper food intake guidelines to either manage various disease states or for optimum performance.



The MetaCheck device from KORR Medical Technologies measures a person's resting metabolic rate with a simple 10 minute breath test. During the test, expelled air values are measured to determine how much oxygen the body has consumed and used. These values are then used by the MetaCheck unit to determine the amount of calories burned at rest or resting/basal metabolic rate (RMR/BMR). The MetaCheck device also provides basic nutritional plans, based on individual RMR, and is safe and easy to use.

Health Assessment #8 - Cardiovascular Testing

Resting blood pressure



Blood pressure can be assessed manually or automatically (electric-powered), with a sphygmomanometer. A desirable reading is 120/80 mm/hg (Systolic/Diastolic) A reading over 140(for systolic BP)/90 (for diastolic BP), on two or more separate occasions requires a medical consent or release prior to exercise programming starting.

Administering the blood pressure assessment:

1. Place the cuff firmly around the upper arm with the lower edge one inch above the elbow. The middle of bladder should be over the brachial artery.
2. Place the bell of the stethoscope one inch below the cuff, directly over the brachial artery.
3. Inflate the blood pressure cuff to 170 mm/hg while listening through the stethoscope.
4. Slowly release the pressure 2-3 mm/hg. The first beat heard is the systolic pressure.
5. Steadily decrease pressure at the same rate until the pitch either changes or a beat is no longer heard. This is the diastolic pressure.
6. Wait 1-2 minutes or more before repeating if necessary to allow circulation to return to normal.

Make sure to measure blood pressure after the individual has been seated and relaxed for several minutes for a more accurate reading. Readings done while activity is occurring can be difficult. But what would these responses be? When performing aerobic exercise, systolic BP will rise, with diastolic pressure dropping or staying roughly the same. Ideally, the arm should always remain relaxed during a BP assessment.

Resting Heart Rate (RHR)

An accurate resting heart rate reading is acquired first thing in the morning after waking. Waking by an alarm clock or music may temporarily cause a rise in HR, so a few moments may be necessary to allow the body to relax. The average of three morning RHRs is taken to provide an accurate RHR. The second best method is to sit quietly for a five or 10 minutes during the day and take the heart rate for a full 60 seconds to get an accurate measurement. If RHR varies by 10-15% (higher than average) on any given morning, that is a day for a very light workout or none at all. For whatever reason, due to fatigue, stress or illness, the heart is working harder than

normal at rest and it would be better to let the body rest or to recover until RHR returns to normal. It is expected to see heart rate rise with physical exertion, and quite another to see it rising without any physical effort.

As described in Chapter 2, the most accurate technique for acquiring heart rate is to wear a heart rate monitor. The Polar F-T80 directly records the electrical stimulation of the heart, much like an electrocardiogram (ECG) which is an invaluable medical diagnostic tool. In fact, the difference between the ECG and a heart rate monitor is that the ECG give a picture of the complete heart rhythm while the heart rate monitor measures the duration and number of heartbeats.



If a heart rate monitor is not available, RHR is best taken on the radial artery at the wrist rather than the carotid artery on the neck - but excessive pressure on either artery can cause HR to slow in an unwanted manner. Due to the proximity of the carotid artery in the neck and relating to blood flow to the head and brain, it is safer to take the heart rate at the radial artery.

Resting heart rate can be affected by many factors. The more aerobically trained a person is, the lower their resting heart rate will be. High blood pressure causes higher RHR. Alcohol consumption decreases RHR, while medications such as pseudoephedrine increase RHR. Keep these factors in mind when measuring someone's RHR, and remember to take a health history before assessing heart rate.

EXAM ALERT

What are the various methods of cardiovascular testing? Be able to describe the purpose of each, how they are administered and when they are appropriate.

VO₂ Max and Sub-max Testing (when appropriate)

As mentioned in Chapter 2, VO₂MAX is maximal oxygen uptake or the highest volume of oxygen an individual can use during exercise. It is both a predictor of endurance sports performance and a healthy cardiopulmonary system. There are several ways to measure VO₂MAX and cardiovascular fitness and each method has their advantages and disadvantages.

Medically Supervised VO₂MAX

From a medical standpoint, a treadmill stress test is performed because symptoms and signs of heart disease can be unmasked by exposing the heart to the stress of exercise. Individuals with coronary artery blockages may have minimal symptoms or an unremarkable EKG (electrocardiogram which records electrical signals from the heart to detect heart arrhythmia or heart muscle damage) reading while at rest. During exercise, healthy coronary arteries dilate or open more than would an artery with a blockage. A narrowed artery due to a blockage "starves" the organ receiving blood flow and may produce chest pain or abnormal breathing during a stress test if a blocked coronary artery exists. Such testing is performed under close medical supervision.



SubMax VO₂ Test

The fitness professional has several methods available for determining VO₂MAX with submaximal tests. The first of these is use of The CardioCoach Fitness Assessment Instrument

from Korr Medical Technologies. The individual wears a heart rate transmitter (strap) while breathing into a tube connected to The CardioCoach, much like in a clinical or medical setting. Intensity is gradually increased over 6-20 minutes after the proper individual information is input into The CardioCoach, which notifies the fitness professional when the test is finished. This is not the same as when maximal testing is done under medical supervision. The Car-

dioCoach utilizes sub-max testing to accurately estimate VO₂MAX and to design the proper individual heart rate training zones (as defined in Chapter 2). It is self-calibrating, compact, and easy to use.

The Polar Fitness Test for More Effective Cardiovascular Exercise Programming

The purpose of the Polar Fitness Test is the same as all fitness tests: to monitor progress. The exact OwnIndex® values are not what is most important but the resulting HR trendline is, instead, the most important variable to follow. Are improvements seen as expected? Has performance increased with a lowering or maintenance of THR?

As described in Chapter 2, a complex mathematical model is used when calculating results from a VO₂MAX test, but without the need to maximally load the heart. The FT80 calculates this VO₂MAX estimate (i.e. OwnIndex®) by taking a resting measurement, lasting about 3-5 minutes.

All of the user's information must be entered into the watch prior to the test. For the test to be valid, certain protocols must be adhered to:

- The client must be calm and relaxed.
- The test environment should be calm. No talking is allowed during the test.
- The client should not eat a main meal, smoke or drink coffee 2-3 hours prior to the test.
- Remember: Intensive exercise/training the previous day, alcohol and pharmacological stimulants affect the results.
- When the test is repeated, it should be done so under the same conditions.

255 heart beats are measured over a 3-5 minute period to determine an individual's aerobic fitness. Physical activity is self-assessed as low, middle, high or top on most Polar HRMs. (See NASA/JSC physical activity scale used by Ross et al. 1990 for another non-exercise test to determine aerobic power prediction by Jackson et al. 1990).





think about it

The beauty of the Own-Index® Test is that it is so practical. It is low in cost, easy to do, and is great for sedentary or symptomatic individuals who normally could not do a maximum or submaximum test.

It is expected that a healthy adult can achieve a 10-15% increase in aerobic fitness over a 3 month period when exercising 3-4 sessions/week for 30-40 minutes/session at a moderate intensity.

The variables of the Polar Fitness Test cannot be totally separated from each other, as the variables always act synergistically. In truth, the activity self-assessment combined with the RHR provide about 50% of the OwnIndex® determination, with gender, age, height and body weight referenced for the remaining half. The more each of these factors changes, the greater the change in OwnIndex® measurement of VO₂MAX.

The greater the long term activity, the better an individual's CV fitness will improve. It is expected that at least 6 weeks of regular activity is needed to achieve long term changes in resting heart rate and to reduce heart rate variability. Resting heart rate and heart rate variability are sensitive measures and reflect the status of the body. There is normal variability in the RHR heart rate overall, and daily heart rate fluctuations. Variations in breathing or blood pressure can cause momentary variations in this measurement. For this reason it is important to not speak, cough or move during the test to avoid fluctuations in OwnIndex® accuracy.

3-Minute Step Test

A simple test, although not as informative and reliable, for the trainer and fitness professional, is the 3-minute step test. There is no warm-up prior to testing. A metronome is set at 96 bpm, with the client taking a step in rhythm with each

beat on a bench or step 12 inches high. The pulse is taken for one full minute at the radial artery prior to testing and for one full minute after sitting immediately (allow a few seconds to get into seated position – DON'T RUSH!) following the test for another full minute. The heart rates are then compared; the closer they are to one another the higher the individual VO₂MAX. If the individual has a LOWER recovery heart rate than at the beginning of the test, they are considered to have a high VO₂MAX.

The Cooper Test

The Cooper Test involves seeing how far an client can run/walk in 12 minutes with the result rounded to the nearest 100 meters. This test is suitable for endurance clients and players of endurance sports but not for individuals where the test would be contraindicated. Reliability would depend upon how strict the test is conducted and the individual's level of motivation to perform the test.

The difficulty with performing The Cooper Test or a cycle test for determining VO₂MAX is that they are more applicable to either running or biking and may not be indicative of a true VO₂MAX. For this reason, and due to lifestyle factors of stress, sleep habits, nutritional and exercise habits, any VO₂MAX test is theoretical and dependent also upon the motivation or mindset of the individual at the time of testing. This is not to discourage the usage of such tests, they are extremely valuable. The fitness professional must understand that it is more useful as information to consider when designing an appropriate exercise program and to be able to assess progress and development, regardless of whether the individual is an client or simply seeking to improve their level of health and fitness.

Fitness and Skill Assessments

Fitness and skill assessments are used to determine basic movement and strength capabilities (fitness assessments) and sport-specific skill capabilities (skill assessments). The fitness and skill assessments should never be performed unless a thorough health assessment has already been performed and the triathlete is determined to be healthy, or free from major injuries or ailments that would be affected by more intense training (health assessments explained in detail in the previous chapter). As the health assessment may take 30-60 minutes to complete, it may be necessary to hold a longer session to incorporate the fitness and skill assessments (health, fitness, and skill assessments may take 90-120 minutes to complete in entirety).

The skill assessments require that the triathlete be fresh so it may be necessary to perform the fitness and skill assessments on separate days. It will be up to the professional determination of the trainer as to which assessments are more significant to complete first. It is the contention of this program that fitness assessments be performed first (following the health assessments) to determine baseline movement efficiency and strength levels before determining sport-specific skill level.

Following the first health, fitness, and skill assessment, each successive assessment should be set 4-8 weeks following the previous assessment. This will vary with each athlete and the needs and wants of each athlete. But the assessments must be consistently revisited in order to objectively measure and evaluate progress. The results won't always be desirable, but the results will be vital feedback for both coach and athlete.

Please review the previous assessment chapter (if not already read) before continuing on with the fitness and skills assessment information.

Fitness Assessments

The fitness assessments are suggested to be completed in the order that creates the best possible results by not causing undue fatigue that may overly affect the results of any one assessment. Remember that the greatest priorities are to see where capabilities currently stand and to be able to use the information as a gauge or a baseline for performance comparison and evaluation.

It is imperative that the athlete know the date of assessment in advance (as far ahead of time as possible) to ensure the highest motivation and meaningfulness of the process. Set a firm date for the next assessment at the end of each assessment session.

The fitness assessments are suggested to be completed in the following order:

Single Leg-Balance
Static Posture
Overhead Squat
Push-Up
Pull-Up/Body Row
Plank
Leg Press
Aerobic Capacity
Anaerobic Threshold/Maximum Heart Rate

If the fitness assessments are to be implemented in the same session with the health assessments (which is advisable, if possible), there should be minimal transition time from the health assessments directly into the fitness assessments.

Remember, if any question asked by the client during the assessment or training session will take longer than a few seconds to answer, in order to avoid taking up valuable assessment/training time say, "That's a great question. Remember to bring that up again at the end of the session once we have finished the assessments. Okay? Now, on to the (blank) assessment..."

Balance Assessment

EXAM ALERT

What variables will affect balance?

The ability to balance and stabilize in space is crucial for individual progress and development. Name one prominent client who does not have good balance. Can you? There are very few. It does not matter whether your clients are clients; it is simply a vital part of human movement. Without balance, coordinated movements will be lacking in results and increased risk of injury. Balance equals control and a lack of ability to control leads to muscular imbalances and increased muscle weakness and tightness. Balance is vital.

A simple balance test is to have the client stand on one foot and attempt to do so for as long as 30 seconds, then repeat on the other foot. If they can perform this exercise adequately have them attempt the same with their eyes closed. The third stage is to have them stand on one leg and reach with their opposite hand to the ground and return to an upright, neutral position (keeping their foot off the ground), and repeat.

This is information for the trainer and the client and their current abilities. Once most individuals see how poor their balance may or may not be, it makes the concept of programming more clear and the need for a qualified fitness professional quite obvious.

Fun Fact: This balance test is also known as a "Romberg's Test," and is also done for suspected concussion patients. Just because someone can't balance on one foot doesn't mean they have a concussion, however, so don't be too worried. This test is actually quite challenging... try it yourself!

Fitness Assessment #1 - Single-Leg Balance

Balance is the ability to maintain position in space. Balance can also refer to body symmetry from side-to-side and from top-to-bottom. Body symmetry is part of the static posture assessment. The single-leg balance assessment is de-

signed to assess the ability to maintain position in space.

The coach should preface this assessment by saying:

"We're going to do a simple balance test. This will take only about 2 minutes." This is all the coach needs to say as the less that is said, while still being professional and polite, the better.

To implement the single-leg balance assessment, make sure to:

- Utilize an open area to avoid injury
- Start with upright, standing, anatomical neutral posture
- Bring the knee of one leg up until the hip is flexed approximately 45 degrees
- Seek to hold the position for 30 seconds
- Repeat with the other leg
- Repeat with eyes closed

This is really a rather simple assessment. However, the amount of information that can be derived from it, and the impact it can have on the client are immense. The assessment is strictly pass-fail. The client either had good balance or does not have good balance. An athlete with good balance will show very little balance challenge and the assessment will be completed quite easily. Surprisingly, most athletes will have a difficult time with this basic test.

Clients may be significantly challenged in this test due to one or more of the three following reasons:

- Focus
- Fatigue
- Muscular imbalance(s)

If the client is unable to focus on the task at hand, balance will be challenged. If the client is tired or worn down for any reason, balance will be challenged. Finally, if any considerable areas of muscular tightness or weakness exist, balance will be challenged. Following the 2-minute test (30 seconds each leg with eyes open and with eyes closed), simply ask the client which area he or she feels is most significant in creating a balance challenge. Then state the following (depending on the client's actual response):

"If you come to the training session without being focused on training, you will not achieve optimal results. Just look at how focus affected this little balance test! Imagine how lacking the right focus will affect the entire workout! You must put your day and your duties behind you if you want to get the most out of your training sessions. If you do not get the proper rest or recovery, you can see what it did to you here! It doesn't take much to realize how much that fatigue will affect your workout results either. Finally, if you have any particular areas of weakness or tightness, we will need to address those areas in order for you to be able to move properly and efficiently."

In addition, the trainer should be watching the facial expressions and mannerisms of clients. A client who laughs a lot during the test and at him or herself is likely to be pretty easy going and open to the opinions and suggestions of the coach. A client who shows no expression at all but seems determined to fight very hard to maintain balance is likely to work very hard at whatever tasks he or she is given to perform and the tasks will be performed well. Lastly, if the client makes faces as if this were the dumbest thing the person has ever had to do, the coach should be prepared for dealing with a client who may ask a lot of questions and question the decisions and suggestions of the coach.

That's a lot of information that can be obtained from just one simple balance assessment. If performed in the way described here, the client will be amazed at the information derived from the assessment, and will be very aware of basic balance. Amazing the client and making the client aware of body control (or lack of it) cannot be overemphasized.

EXAM ALERT

What are some potential negative variables to the sit-and-reach test?

Static and Dynamic Postural Assessments

Postural assessments serve as flexibility assessments while also defining or pinpointing muscular weak points. By posture, we are referring to the position of one's body in space. How the individual positions their body at any one moment in time is their posture at that moment. When they have found an alignment which they revert to while standing, this is their current static posture. How they position themselves as they move is referred to as dynamic posture.

Instead of referring to posture as either good or bad, it is better to think of it as ideal or not ideal. Different situations will call upon different expectations for movement and bodily positions. Ideal posture is the position of the body at any moment in time with the least risk for injury or joint dysfunction. Ideal posture is a state of musculoskeletal body balance or bodily musculoskeletal equilibrium. An individual's ability to maintain control over their posture and maintain this equilibrium is their level of postural control. An individual may slouch or sit unevenly for a period of time, but may be able to attain ideal posture at a moment's notice. It is important for the fitness professional to recognize that all postural positions from one individual to the next are just that – individual. There are certain guides or norms for ideal posture but they will vary depending upon the joint lengths and bone configurations of the individual.

For our purposes here, we will refer to neutral alignment as the ideal posture. Neutral alignment is a position directly between extremes of motion at a joint. While standing, anatomical neutral is a position with hands at the sides and palms facing the body. This differs from anatomical position with palms facing forward (external rotation at wrist or supination).

Fitness Assessment #2 - Static

Posture

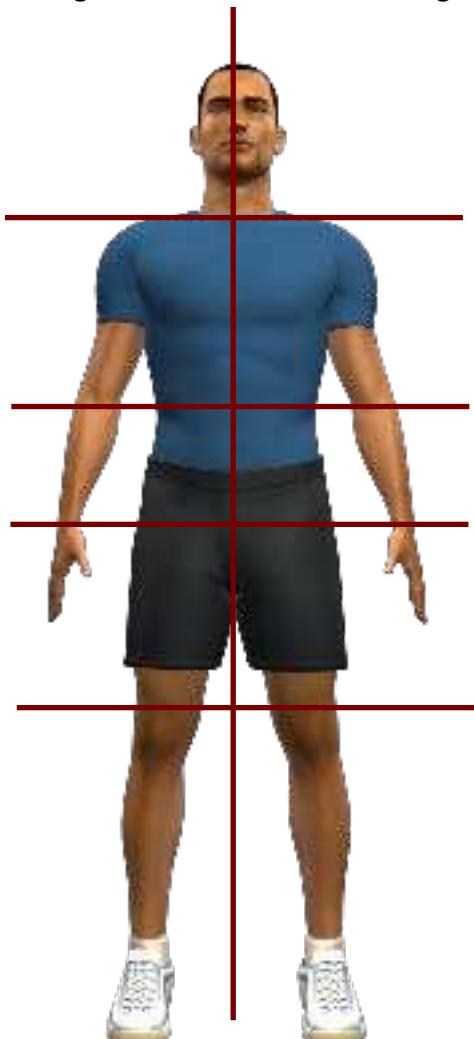
The static posture assessment is a simple way of quickly assessing the client's recognition of body position in space. Not being aware of or not being able to control body position can be severely detrimental to performance. The coach is not looking for perfect posture (no such posture exists). The coach should be looking for gross abnormalities from an anatomical neutral position that could cause future injury (or worsening current injury) or affect performance (through a waste of energy innervating muscles at the wrong time or that should not be active at a particular moment).

The job of the coach is not to nit-pick the smallest of details. The job of the trainer in the static posture test is to take note of perceived gross abnormalities in posture. These abnormalities should be written down, not discussed with the client during the assessment. The single-leg bal-

ance assessment is suggested to be performed first as the brief dialogue that accompanies the assessment will set the tone for the remainder of the fitness and skill assessments to follow. If the client inquires what the coach sees, the coach should simply state, "Well, there are a couple things that may or may not be significant in our training. I'd like to do a few more assessments to see if we can confirm or deny my perceived observations". If the client still insists on knowing what is being written down then, once again, the trainer should say, "Great question, remind me to come back to that

Ideal posture

A plumb line should be able to be drawn through the ear, shoulder, hip knee and ankle (malleolus) from the side, and directly down the middle of the body from the front or back with equal weight and body proportions to each side. If neutral is not able to be accomplished without queuing or external recognition from an outside viewpoint,



a muscular imbalance is likely present. Here is the desired result for ideal posture from each major body part:

In performing the static posture assessment:

- Have the client stand relaxed
- If the client appears to be standing in a position that shows awareness of being assessed rather than a natural posture, have the client march in place for 10-20 seconds and then relax to find a more natural rather than practiced posture
- Observe the client for 20-30 seconds maximum from each of four viewpoints (anterior, lateral left, lateral right, and posterior)
- Take no longer than 1-2 minutes for the entire posture assessment
- Make note of gross abnormalities from anatomical neutral for the:
 - Head/Neck (Cervical Spine)
 - Shoulders (Glenohumeral Joints)
 - Shoulder Blades (Scapulae)
 - Middle and Lower Spine (Thoracic and Lumbar Vertebrae)
 - Hips (Acetabulofemoral Joints)
 - Knees (Patellofemoral/Tibiofemoral Joints)
 - Ankles (Talocrural Joints)
 - Note deviations with brief descriptions (such as “slight cervical lateral flexion left” or “slight head/neck lean left”)

EXAM ALERT

What is Posture? What is “Ideal Posture”? What is a dynamic postural assessment? A static postural assessment? Be able to give examples of each.

Flexibility Assessments

The ability to train through a full ROM is crucial for optimal development and decreased risk of injury by avoiding muscular imbalances. A tight muscle is preceded by the weak opposing muscle (i.e. weak gluteals often precede tight hip flexors) and it is important for the fitness professional to be able to identify muscular imbalances due to muscle tightness or weakness before they become problematic. If the muscular imbalance at a joint continues for a significant length of time or is forced to withstand high levels of exertion it may lead to injury and a greater difficulty reversing or healing the problem.

To avoid such situations, there are flexibility assessments which can be used to identify such imbalances. The first of these is the sit-and-reach test.

Sit-and-reach test: This test aims to measure the flexibility of the erector spinae, hamstrings, upper back musculature and muscles of the calf and lower leg. Very little equipment is needed. Results can vary greatly due to the length of varying body segments. If the individual has long arms or a longer torso than lower body, the individual will appear to have greater flexibility than one who does not have such a limb/body length discrepancy. This situation causes the norms for measurement to vary widely. As well, a seated, fully flexed position creates maximal compressive forces on the disks of the vertebrae. These are considerations the fitness professional must take into account before administering this assessment and determine its effectiveness for each situation.

sit-and-reach testing procedure

1. Have the client perform a general warm-up for a few minutes to increase circulation, body temperature and muscular elasticity.
2. Client removes shoes and sits with knees extended and feet 12 inches apart. Use a box, yard stick or tape measure for results.
3. Place the measuring device so that the feet are at the 15" marker. For example the yard stick would lie on the floor between the legs with the feet in line with the 15" marker. Those who cannot touch their toes will have a reading under 15 and those who can reach beyond their toes will have a score above 15.
4. Instruct client to place hands on top of each other with fingers straight. The client should exhale slowly and reach out as far as possible on the box or tape measure.
5. Repeat test two more times with client holding position for at least 2-3 seconds.
6. Take the best score of three attempts (normal sacral range is 80-90 degrees)

To perform the overhead squat assessment, make sure to:

- Hold a dowel or foam roller above the head with arms straight
- Stand with feet hip-width apart with toes pointing straight forward
- Squat as low as possible in a 2-0-2 tempo (2 seconds down, no pause at either end range, and 2 seconds up)
- Keep both feet completely on ground throughout the squat movement
- Observe the squat from the anterior, both lateral angles, and the posterior
- Perform at least 3-5 squats or more for each observation angle
- Make note of gross abnormalities from anatomical neutral for the:
 - Head/Neck (Cervical Spine)
 - Shoulders (Glenohumeral Joints)
 - Shoulder Blades (Scapulae)
 - Middle and Lower Spine (Thoracic and Lumbar Vertebrae)
 - Hips (Acetabulofemoral Joints)
 - Knees (Patellofemoral/Tibiofemoral Joints)
 - Ankles (Talocrural Joints)

Note deviations with brief descriptions (such as "slight cervical lateral flexion left" or "slight head/neck lean left")

Fitness Assessment #3 - Overhead Squat

The overhead squat assessment is utilized to observe basic movement control and mobility (and therefore flexibility and stability). In order to squat properly (basically sitting and standing without external support) there must be a sufficient level of balance, flexibility, stability, and mobility. It is crucial for any athlete to at least have the ability to squat well. Although the sport of triathlon does not require full-depth squatting during a triathlon, the ability to achieve the proper levels of balance, flexibility, stability, and mobility in the shoulders, scapulae, spine, hips, knees, and ankles is crucial for any athlete in order to avoid injury and detriment to performance.

Postural deviations noted will be used for future reference in designing the program with exercises to reinforce efficient movement. It is not the intention of the overhead squat to determine every tiny dysfunction or postural deviation. The primary intent of the overhead squat test is to observe overall range of motion, balance, and movement/postural control (mobility/stability).

If the client is able to bring the hips to the heels or nearly to the heels while maintaining balance from a standing position to the bottom of the squat, the client will be given a score of 3 (perfect score). It is perfectly normal to perform a body weight squat bringing the hips to the heels. A score of 3 indicates that the client has good basic movement capabilities. If the client is barely able to sit to the point of the thighs becoming parallel to the ground, or any other

joints deviate somewhat significantly to the anterior, laterally, or the posterior, the client should be given a score of 2. A score of 1 would be indicated by an inability to even come close to bringing the thighs parallel with the ground or if significant balance or movement limitations exist in performing the squat.

A score of 3 should be given if:

- No pain or perceived tightness exists during the squat
- Feet remain parallel to each other, pointing straight forward
- Heels and feet remain flat on ground without significant ankle pronation or supination
- Tibias (lower leg) are parallel to the spine at the bottom of the squat
- Hips are able to descend to or almost to the heels
- No significant deviations are observed by the coach (professional judgment call)
- Hips, knees, and feet remain in alignment
- Spine (lumbar, thoracic, and cervical) remains in neutral
- Arms remain straight, in alignment with spine
- All of the above are consistent upon completion of several squats (never observe just one)

A score of 3 indicates:

- Good basic mobility and stability
- Readiness to consider more complex structural exercises in programming
- Decreased chance of injury during training

A score of 2 should be given if any of the following are observed:

- Some discomfort or tightness exists during the squat
- Feet deviate slightly from parallel and no longer point straight forward during the squat
- Heels lift slightly from ground or slight pronation or supination is shown
- Hips are not able to descend past parallel (thus the tibias will not be parallel to the spine)

- Hips, knees, and feet are not able to maintain alignment with each other
- Pelvis shifts anteriorly or posteriorly (can only be accurately determined by observing ASIS and PSIS positioning)
- A weight shift or rotation is observed moving toward the right or left during the descent and ascent phases
- Torso leans far forward
- Spine (lumbar, thoracic, or cervical) deviates from neutral position
- Arms migrate to the anterior or laterally, or position differs significantly from one arm to the other
- Elbows bend

A score of 2 indicates:

- Average mobility or stability
- Need to pursue one or more of the following secondary tests to determine where the greatest mobility or stability problem lies
 - Board under heels
 - Thomas Test
 - Hamstring Length Test
 - Latissimus Dorsi/Teres Major Length Test
- Increased chance of injury if specific mobility or stability deficits are not met with appropriate exercises

A score of 1 should be given if any one or more of the following are observed:

- Significant pain or tightness exists at any time during the squat
- Feet exhibit significant deviation from straight forward (considerable external or internal rotation)
- Heels come far off ground and/or considerable ankle pronation or supination is shown
- Poor depth is observed with thighs unable to come near parallel to the ground
- Hips, knees, and feet deviate considerably from alignment
- Dramatic weight shift or rotation is observed during the descent and ascent phases
- Spine becomes considerably kyphotic (rounded at thoracic region) or lordotic (extended at lumbar region)

A score of 1 indicates:

- Poor mobility or stability
- Need to pursue one or more of the following secondary tests to determine where the greatest mobility or stability problem lies
 - Board under heels
 - Thomas Test
 - Hamstring Length Test
 - Latissimus Dorsi/Teres Major Length Test
- Increased chance of injury if specific mobility or stability deficit are not met with appropriate exercises (will require more time and effort than with client who scores a 2)

It must be understood that it will take observation of hundreds of individuals before the coach can become adept at making judgments on scoring and determinations from the overhead squat assessment. In the early stages of usage, the coach must simply rely on professional judgment, knowing that the score may change following further assessment or with experience. Many individuals who score a 1 or 2 may simply not understand the motion that is being observed and may be able to achieve a score of 3 after only a few days or weeks of basic training in squatting (some individuals can go from a 1 or 2 to a 3 upon some basic instruction from the coach, but this is not typical and should not be expected).

The entire overhead squat assessment should be completed in no more than 5 minutes and perhaps closer to 2-3 minutes, if the client has good mobility and/or stability.

EXAM ALERT

What is the proper order for performing physical assessments?

Fitness Assessment #4 - Push-Up Assessment

The push-up assessment is to be utilized to determine basic upper body push strength and control/stability. Unless the client has a pre-existing injury or dysfunction, it is expected that

the assessment will be utilized. Whether the client can complete 30 push-ups or not even one complete push-up, it is the basis from which to start.

Performing the push-up assessment:

- Have the client perform the push-up movement (horizontal adduction with elbow extension) while standing to ensure the proper movement pattern can be followed (active range of motion)
- Lie prone
- Position hands so that both wrists are out from and level with the chest (not shoulders) and so that both hands point forward in the same direction with elbows directly above wrists
- Keep finger spread wide apart (for greater stability) with just enough space under palms for a pencil to fit or slide under the hands (as if trying to screw the hands into position into the ground)
- Start with chest off ground and shoulders just below level of elbows then push-up until the elbows are not quite fully extended (consistent with the active range of motion performed while unloaded, but expecting that the range of motion will decrease due to the added external load of body weight)
- Maintain neutral spine (cervical, thoracic, lumbar) throughout entire movement
- Maintain 2-0-2 tempo with each push-up in order to be counted (2 second ascent, no pause at either end range, 2 second descent)
- End the test if there is any pause, shifting from the above described positioning, or client is unable to continue (either the coach or the client can stop the test)
- Count each rep completed as the elbows extend at the top of the push-up
- Observe the client from variable positions throughout the assessment (anterior, lateral, and posterior views)
- Do not count push-ups that do not meet all of the above criteria (unless the coach chooses to utilize testing on the knees while performing push-ups)
- Do not use additional external loading

Note the number of push-ups completed. Clients who are unable to perform even one push-up should be reminded that this is merely a beginning, and that this result will likely change after a few weeks of well-designed, well-followed, and carefully implemented training. This assessment should take no more than 2-3 minutes (as it is unlikely most clients will be able to perform 2-0-2 tempo push-ups for more than or as much as a minute).

Fitness Assessment #5 - Pull-Up/Body Row Assessment

The pull-up/body row assessment is designed to determine basic upper body pulling strength. Whether the coach utilizes a body weight pull-up, an assisted pull-up, or a body weight row depend on coaching preference and the current ability of the triathlete. All of these upper body pulling strength assessments are valid. The coach should recognize that the pull-up is inherently more challenging than the push-up due to a greater overall range of motion (distance traveled) and greater load (full body weight in vertical position versus partial body weight in prone position).

Regarding selection of upper body pulling strength choose the:

- Pull-up assessment if the client regularly performs pull-ups and/or is in very good to excellent condition
- Assisted pull-up assessment if the client is in average to below average condition or is of a larger size
- Body weight row assessment in place of the pull-up assessment if a pull-up bar is not available or as a matter of choice

Performing the body weight pull-up assessment:

- Have client perform the pull-up movement (shoulder adduction with elbow flexion while standing to ensure the proper movement pattern can be followed (active range of motion)
- If the distance to the overhead bar is more than a easy jump or long reach, have the client utilize a step to get up to the bar (for

safety and to avoid any fatigue from the jump and grab)

- Grab the bar in natural position at the top of the active range of motion for the triathlete
- Keep neutral spine (cervical, thoracic, lumbar) throughout movement
- Start with elbows extended and shoulders in abducted position and pull-up until maximal shoulder adduction is reached (consistent with the active range of motion performed while unloaded, but expecting that the range of motion will decrease due to the added external load of full body weight)
- Pull in front of the face or head, never behind (slight internal rotation of shoulders, may require slight hip extension or slight lean back)
- Maintain 2-0-2 tempo with each pull-up in order to be counted (2 second ascent, no pause at either end range, 2 second descent)
- End the test if there is any pause, shifting from the above described positioning, or client is unable to continue (either the coach or the client can stop the test)
- Observe the client from variable positions throughout the assessment (anterior, lateral, and posterior views)
- Do not count pull-ups that do not meet all of the above criteria
- Do not use additional external loading

Performing the assisted pull-up assessment:

- Have client perform the pull-up movement (shoulder adduction with elbow flexion while standing to ensure the proper movement pattern can be followed (active range of motion)
- Choose a weight (as counterbalance on an assisted pull-up machine) that is equal to the client's body weight (this weight may be altered upon professional judgment of the coach)
- Grab the bar in natural position at the top of the active range of motion (whether kneeling or standing, depending on the equipment utilized)
- Maintain neutral wrist position throughout movement with strong grip of bar in closed-

grip position

- Keep neutral spine (cervical, thoracic, lumbar) throughout movement
- Start with elbows extended and shoulders in abducted position and pull-up until maximal shoulder adduction is reached (consistent with the active range of motion performed while unloaded, but expecting that the range of motion will decrease due to the added external load of partial body weight)
- Pull in front of the face or head, never behind (slight internal rotation of shoulders)
- Movement has nothing to do with getting the chin above the bar
- Maintain 2-0-2 tempo with each pull-up in order to be counted (2 second ascent, no pause at either end range, 2 second descent)
- End the test if there is any pause, shifting from the above described positioning, or client is unable to continue (either the coach or the client can stop the test)
- Observe the client from variable positions throughout the assessment (anterior, lateral, and posterior views)
- Do not count assisted pull-ups that do not meet all of the above criteria

Performing the pull-down assessment:

- Have client perform the pull-up movement (shoulder adduction with elbow flexion while standing to ensure the proper movement pattern can be followed (active range of motion))
- Utilize resistance as much as equal to the client's body weight or as little as 1/4 of the client's body weight (based on professional judgment of the coach)
- Sit so that the path of the bar comes just in front of the face of the client during the descent (may need slight hip extension or slight lean back)
- Grab the bar in natural position at the top of the active range of motion
- Keep neutral spine (cervical, thoracic, lumbar) throughout movement
- Start with elbows extended and shoulders in abducted position and pull-up until

maximal shoulder adduction is reached (consistent with the active range of motion performed while unloaded, but expecting that the range of motion will decrease due to the added external load of full body weight)

- Maintain 2-0-2 tempo with each pull-up in order to be counted (2 second ascent, no pause at either end range, 2 second descent)
- End the test if there is any pause, shifting from the above described positioning, or client is unable to continue (either the coach or the client can stop the test)
- Observe the client from variable positions throughout the assessment (anterior, lateral, and posterior views)
- Do not count pull-ups that do not meet all of the above criteria

Performing the body weight row assessment:

- Have client perform the low row movement (shoulder extension with elbow flexion and wrist supination) while standing to ensure the proper movement pattern can be followed (active range of motion)
- Grab the bar in natural position (based on carrying angle) at the top of the active range of motion
- Keep neutral spine (cervical, thoracic, lumbar) throughout movement
- Start with elbows extended and shoulders in abducted position and pull-up until maximal shoulder adduction is reached (consistent with the active range of motion performed while unloaded, but expecting that the range of motion will decrease due to the added external load of full body weight)
- Maintain 2-0-2 tempo with each pull-up in order to be counted (2 second ascent, no pause at either end range, 2 second descent)
- End the test if there is any pause, shifting from the above described positioning, or client is unable to continue (either the coach or the client can stop the test)
- Observe the client from variable positions throughout the assessment (anterior, lateral, and posterior views)
- Do not count rows that do not meet all of

- the above criteria
- Do not use additional external loading

The trainer will need to determine which assessment is the best upper body pull strength assessment based on the individual triathlete's current goals and capabilities. The upper body pull assessment should take no more than 2-3 minutes total time to teach, implement, and record.

Fitness Assessment #6 - Plank Assessment

The plank assessment is designed as a core strength assessment to determine basic core stability strength and muscular control. Typically, only the crunch or sit-up test is used for core assessments, based on the number of crunches or sit-ups performed. But the plank assessment is chosen here as stability *and* strength must be present before more advanced exercises should be either programmed or implemented. Lacking the ability to perform the plank is indicative of significant strength or muscular control deficits that must be remedied before moving to more dynamic core strengthening exercises (in order to avoid injury AND increase performance capabilities). These limitations may also include muscular endurance observations, as the plank assessment will also reveal how long the core can be stabilized by the exerciser.

Performing the plank assessment:

- Lie prone
- Place elbows directly below shoulders
- Maintain parallel arms with two fist and thumb side up
- Keep hips level with shoulders
- Maintain neutral spine (cervical, thoracic, lumbar) throughout movement
- Feet should be hip-width apart (quite close, but not touching)
- Only forearms and toes/balls of feet remain in contact with the ground
- There should be no joint movement at any time during the assessment (includes shifting of position)
- End the test if there is any shifting from the above described position or client is unable

- to continue (either the coach or the client can stop the test)
- Observe the client from variable positions throughout the assessment (anterior, lateral, and posterior views)
- Log the total time the position is maintained with all the above criteria being met
- Do not use additional external loading

The trainer should remind the client that this assessment is merely a starting point (as many clients will become frustrated at not performing well in a fairly simplistic assessment). The plank assessment should take no more than 3-5 minutes to perform (very few clients will be able to plank for more than 1-2 minutes without sufficient training and it is unlikely a client will be able to perform the plank while following all the predetermined criteria for more than 4-5 minutes).

Fitness Assessment #7 - Leg Press Assessment

The leg press assessment is designed to determine basic lower body strength. The leg press is utilized in place of the squat as it requires less stability control for the average triathlete client (but if the coach feels the client can perform an adequate squat with external load, this is always an option).

In performing the leg press assessment:

- Have the client perform the leg press movement (squat) while standing to ensure the proper movement pattern can be followed (this active range of motion will require much less hip extension than an actual squat due to the positioning in most leg pressing machines)
- Utilize an external load equivalent to the weight of the triathlete (180lbs for an 180lb person) or a other reasonable load based on the coach's professional judgment
- Maintain neutral spine (cervical, thoracic, lumbar) throughout movement (avoid leg press machines that prop up the neck)
- Keep whole foot in contact with platform at all times
- Ensure hips, knees, and toes (1st and

2nd toes) are in alignment at the bottom position of the pressing motion

- Assume width and placement of feet that allows greatest mobility and control in a body weight squat, not to exceed 45 degrees of external rotation (recognizing that width and external hip rotation will vary with load, joint structure of triathlete, and current joint mobility)
- Make sure tailbone maintains contact with the pad at all times
- Avoid locking out the knees in extension
- Allow as much depth as can be attained without losing alignment and while maintaining tailbone on pad
- Maintain 2-0-2 tempo with each press in order to be counted (2 second ascent, no pause at either end range, 2 second descent)
- End the test if there is any shifting from the above described position or client is unable to continue (either the coach or the client can stop the test)
- Observe the client from variable positions throughout the assessment (anterior, lateral, and posterior views)
- Do not count rows that do not meet all of the above criteria
- Do not use additional external load

Muscular Strength and Muscular Endurance Assessments

The traditional form for testing muscular strength has always been the 1 rep max (1RM) test. This is used to determine how much an individual can lift with one maximal effort. A table is then used to determine how many reps should be performed at varying intensities (40-100% of max) for varying goals (fat loss, coordination, strength, etc.) based on the 1 repetition maximum test result. The question is whether the test is an accurate reflection of true strength or more a question of motivation or energy. Further questions exist as to whether the 1 rep max test is reliable in determining the effectiveness of most fitness programs or if it is accurate to compare results between individuals. The

results from a 1 rep max test are questionable as to how much benefit they provide the individual in determining future programming and current conditioning levels. In addition, there is much risk in having an individual perform a maximum lift with little benefit in most cases.

For the reasons above, we do not endorse a 1 repetition max testing protocol as a standard for assessment of muscular strength outside of a controlled professional setting with qualified spotters and observers for an advanced client. Instead, it is recommended to utilize a 10 repetition maximum assessment. This assessment can be used to estimate 1 rep max and provides a better evaluation of muscular strength endurance capabilities.

Use the weight training video/DVD descriptions for proper form and technique and the table below for estimating intensity levels based upon 1-15 repetition maximum lifts.

max reps	% 1 RM
1	100
2	95
3	93
4	90
5	87
6	85
7	83
8	80
9	77
10	75
12	67
15	65

Note: In using the table above, if an individual lifts 65 lbs/kg for 15 repetitions they would have a 1 rep max of 100 lbs/kg

The trainer can inquire about the goals of the client either at the beginning, middle, or end of the health history questioning. It is important to

have a logical progression toward asking open-ended questions that are relevant, meaningful and accurate. For this reason, it may be advisable to ask the client about their goals following the physical assessments, since their goals may change once they have received new information, revealed through assessments, related to their overall health or physical capability status. This will also be an indicator as to how well you have listened to your client.

Goal Setting

Assessing clients also has an applied art, in that you will help the client assess and define goals. One of the most often overlooked yet crucial components of the first meeting with a new client is their individual goals or desired results from an exercise program. While an experienced and knowledgeable fitness professional may know what is best for the client, the client's wants must be made in conjunction with or before their needs. To what extent *needs* may ex-



think about it

Remember that you and your client should work together to create their goals. While you should accommodate to your client as much as possible, never jeopardize their safety or go past your breadth of knowledge.

ceed *wants* is situational, dependent and at the discretion of the trainer and/or the client's physician.

SMART Goals

Specific

Simply stating that one wants to lose weight or "get big" is too vague and needs clarification. How much do they want to lose? Do they want to "get huge" everywhere or just certain locations? For what reason do they want this goal? When you can get the client to not only say that they want to lose weight but want to lose weight

to look good in a bathing suit so that their husband or wife thinks they look "sexy" you will help them buy into achieving their goal and link their success to your involvement because you care enough to ask specific questions with their best interests in mind and you will learn more about the person sitting in front of you.

Measurable

It is of vital importance that their goals can be measured in a way that they are able to observe their progress. The scale is not a good form of measurement. Girth measurements, body composition or various strength tests can be returned to again and again dependent upon client goals to receive immediate, reliable (use the same testing methods) results toward progress.

Action plan organized

Goals must be clearly described with dates for landmarks or certain levels of achievement to keep the client motivated, the trainer conscientious to their needs, and provide both with the necessary information of the effectiveness of the program to meet client goals.

Realistic

The client should not be reinforced in their goals of looking like the local champion bodybuilder when they have always been sedentary and are obese. This is very situational dependent and the client must be helped to understand the importance of genetics in certain situations. Encourage the client to make realistic goals by asking, "Do you think you can achieve this?" "Are you prepared to do what is necessary to meet that goal?" Clarify their ability to be reasonable by asking, "How long do you feel it will take to achieve this?" Or, "When would you like to have achieved this goal?" Remind them in a kind manner that you cannot reverse years of bodily abuse with a few weeks or months of training. Short term results for a long term problem will bring long term risks.

Timed

Set goals at monthly intervals. It takes at least a few weeks to adapt to a new stimulus and observe its benefits and it is the job of the trainer to help their client recognize this concept. The trainer must also help the client realize that a week is 168 hours long and it will take more than 1-4+ hours a week with a trainer to make a significant change. To make a major change requires many smaller changes in one's lifestyle and exercise habits. For example, to lose weight a client should not expect that 2-3 hours of training with a trainer will result in 2 pounds of fat loss per week without also looking at changes in their diet, sleeping habits, and lifestyle that cause them to hamper their body's own immune system functions and limit hormonal growth factors. They must change beyond the walls of the gym.

Conclusion

In fundamental terms, it is important to know why assessments are done. An experienced PFT both sees and uses the connection between assessments and client goals. In each case, *health, fitness or skill* assessments can provide motivation and incentive for clients. Since we start all potential clients with an assessment, it is important to know how to read assessment information, and to interpret elements for the proper program design.

In performing each of the assessments described in this chapter, the personal trainer should follow in order of greatest energy exertion or intensity first. The body composition and girth measurements are recommended first to avoid any changes in water storage or depletion from exercise and skew results. Agility or balance exercises would then follow, with flexibility exercises or assessments next and strength exercises or assessments preceding aerobic capacity testing.

The numbers obtained from assessments are to be used as a foundation for the trainer and client to begin. While these numbers can be compared to the results of others, it is primarily the performance of the individual being assessed and their performance to come that is the greatest importance. These numbers should be used for determining current capabilities and measuring progress every 4 - 8 weeks (may vary depending upon programming and exercise and program adherence) to assess the efficacy (desired outcome) of the exercise program. Measurement under 3-4 weeks is unlikely to show significant change in skill or ability with the exception of a beginner (who may display dramatic initial results) in the first few weeks of training.

Modified Physical Activity Readiness Questionnaire (PAR-Q)

Name		Date	
DOB	Age	Home Phone	Work Phone

Regular exercise is associated with many health benefits, yet any change in activity may increase the risk of injury. Completion of this questionnaire is the first step when planning to increase the amount of physical activity in your life. Please read each question carefully and answer every question honestly:

Yes	No	1) Has a physician ever said you have a heart condition and you should only engage in physical activity recommended by a physician?
Yes	No	2) When you engage in physical activity, do you feel pain in your chest?
Yes	No	3) When you were not engaging in physical activity, have you had chest pain in the past month?
Yes	No	4) Do you ever lose consciousness or lose your balance due to dizziness?
Yes	No	5) Do you have a joint or bone problem that may be made worse by a change in your physical activity?
Yes	No	6) Is a physician currently prescribing medications to lower your blood pressure or for a heart condition?
Yes	No	7) Are you pregnant?
Yes	No	8) Do you have insulin dependent diabetes?
Yes	No	9) Are you 69 years of age or older?
Yes	No	10) Do you know of any other reason you should not exercise or increase your physical activity?

If you answered yes to any of the above questions, talk with your doctor BEFORE you engage in physical activity. Tell your doctor your intent to exercise and to which questions you answered yes.

If you honestly answered no to all questions you can be reasonably certain that you can safely increase your level of physical activity gradually.

If your health changes so that you answer yes to any of the above questions, seek guidance from a physician.

Participant signature	Date
-----------------------	------

Medical Clearance and Physician's Consent Form

To: (Your name, address, city, state and zip code)

Dear Personal Trainer:

My patient, _____, has advised me that he or she intends to participate in a fitness assessment. This assessment will include muscular endurance and flexibility tests, body composition assessment, a blood pressure reading, and a cardiovascular fitness assessment. An exercise program will be designed based on this assessment which will include, but not be limited to, resistance training and cardiovascular training. The sessions will last approximately one hour, and will begin at a very moderate, sub-maximal level.

Please be advised that my patient, _____, should be subject to the following restrictions in the fitness assessment and/or in his or her exercise program:

In addition, under no circumstances should he or she do the following:

I have discussed these restrictions and limitations with my patient and, with these specific restrictions, he or she has my permission to participate in a fitness assessment and pursue an exercise program under your guidance.

Truly yours,

(Sign name here)

Date: _____

(Print name here)

Phone number: _____

Health History Questionnaire

1. What is your birth date?	
2. Has a doctor diagnosed you with any heart conditions? Examples include: mitral valve prolapse, myocardial infarction, angina, dysrhythmia, atherosclerosis of the coronary artery.	Y N
3. Has a doctor diagnosed you with any obstructive pulmonary disease? Examples include: asthma, interstitial lung disease, emphysema, bronchitis, cystic fibrosis.	Y N
4. Has a doctor diagnosed you with any form of metabolic disease? Examples include: diabetes mellitus (type 1 or type 2), thyroid disorder, renal or liver disease.	Y N
5. Has anyone in your immediate family had any heart problems prior to age 55?	Y N
6. Have you been diagnosed by a doctor as hypertensive (high blood pressure)?	Y N
7. Have you been diagnosed by a doctor as having high cholesterol?	Y N
8. Have you been diagnosed by a doctor as having hypoglycemia?	Y N
9. Have you been diagnosed by a doctor as having high triglycerides?	Y N
10. Are you epileptic?	Y N
11. Have you ever suffered a concussion or been knocked unconscious?	Y N
12. Do you smoke (or have you quit within the last 6 months)?	Y N
13. Are you pregnant?	Y N
14. Are you pre or postnatal?	Y N
15. Do you consider yourself to have a sedentary lifestyle (i.e. do you sit a large part of your day)?	Y N
16. Have you ever experienced chest pain?	Y N
17. Have you ever experienced abnormal dizziness?	Y N
18. Have you ever experienced shortness of breath (with mild exertion)?	Y N
19. Are you on any medications right now?	Y N
20. Have you been diagnosed by a doctor as having osteoporosis?	Y N

continued next page...

21. Do you have arthritis or joint pain?	Y N
22. Do you have any back pain or a spine disorder?	Y N
23. Have you ever had any broken bones?	Y N
24. Do you have any musculoskeletal pains/injuries?	Y N
25. Are you sensitive to touch or pressure in any area?	Y N
26. Have you ever had a hernia?	Y N
27. Have you ever had surgery?	Y N
28. Do you have difficulty sleeping?	Y N
29. Do you experience poor circulation in your extremities (cold hands and feet)?	Y N
30. Do you have any gastrointestinal disorders?	Y N
32. When was your last complete physical?	
Name of your Emergency Contact (Name and daytime and evening phone numbers)?	
NOTES:	

Program Design

Introduction to Program Design

Up to this point, we've examined anatomy and physiology (structure and function), adaptation due to physical training (exercise physiology), biomechanics (the laws of physics/mechanics (forces) and their effects on human motion, as well as how nutrition affects our metabolic capacity to produce energy. You have also reviewed basic assessments to evaluate both the clients' biometrics and movement efficiency, as well as their current levels of fitness, to determine a safe starting point for training. Making use of all of this science can be quite overwhelming and confusing to say the least. From an anecdotal perspective, choosing which piece of science is most practical and useful for any client, at any point, can be intimidating as well as confusing. Learning proper program design strategies, particularly for novice trainees, is paramount for success.

A vital key to client progress and the reputation of the personal trainer (not to mention business success) relates to how effectively the personal trainer designs client programs and ensures consistent progress. Every individual must properly train their body utilizing the science of fitness training. The key words here are science and individual. There is an overabundance of information regarding fitness training with each system guaranteeing success if you just follow a particular and all encompassing program. Trade

EXAM ALERT

What are the Components of Fitness? Why are they important? What is periodization?

publications (i.e. magazines, books) offer more anecdotal information which, in some cases, can be utilized successfully IF one is familiar with the science of training. Anyone can copy a program from a magazine or book. While this may be beneficial, it does not ensure success for any client unless the program is specifically designed for achieving *their* individual goals. Success can only truly be attained if the trainer can skillfully plan a program that, once again, is designed specifically for the individual being trained. This requires adhering to basic scientific principles as well understanding how the body adapts to stress (yes – exercise is considered stress). This data then directs the personal trainer to truly develop a scientifically based program based on objective data. Again, using this data, along with the scientific rationale behind program design, can be tricky; nevertheless, an awareness of the concept "*the art of scientific program design*" will guide the trainer and client to achieving success.

“ ...There is no one program that works for any one person at all times or for all conditions. ”

- *Science and Practice of Strength Training*
(Zatsiorsky and Kraemer, 2006, 2nd edition)

Basic Definitions

Take a closer look at the definition of fitness (below.) Please note a key word imbedded in the definition of fitness – performance. This word may indicate sports performance. Numerous training programs exist, specific to sports-specific enhancements. Nevertheless every human being must physically perform every day. This performance is what the health and fitness industry call Activities of Daily Living (ADL). Real

life IS one big performance! Everyone needs to be physically prepared to handle the rigors of everyday life. Every day we lift, push, pull, bend, twist, squat up and down, step, lunge, and carry. These movements are fundamental human movements that everyone performs on a daily basis – this includes athletes, fitness enthusiasts, and the average, everyday person. Increasing our physical abilities comes from physically challenging our bodies to adapt to physical stress, encountered daily.

components of fitness

physical activity (PA)

This is any movement of the body produced by muscle resulting in energy expenditure. This refers to numerous activities such as walking, yard work, housework, manual labor of any variety, etc. Health organizations state we should be physically active at least 30 minutes per day performing some kind of PA.

exercise

In its most basic form, exercise is nothing more than planned, structured, and repetitive physical activity performed to improve or maintain one or more components of physical fitness (ACSM, 2006; Nieman, 2003). Exercise could be numerous activities: aerobic classes, weight training, walking/running, yoga, etc. but this can be ambiguous to say the least. True planning requires knowledge of what each form of exercise influences and structuring a training schedule/plan to achieve some type of result. The ACSM (2006) states a minimum of 60 minutes per day is required to substantially decrease health risks.

fitness (often referred to as physical fitness)

Fitness, in the simplest of definitions, is a multi-dimensional concept which means performing activities with adequate vigor and energy. This term may conjure up various visions of lean, muscular bodies doing exercise classes, biking, running, lifting, etc. This type of visual interpretation may have deleterious consequences on the general public's idea that being thin and beautiful is the only way to be fit and healthy.



The ACSM (2006) has divided physical fitness into various categories:

Health-Related Fitness (HRF)

Skill-Related Fitness (SRF)

Physiological Fitness (PF)

Health-Related Fitness (HRF)

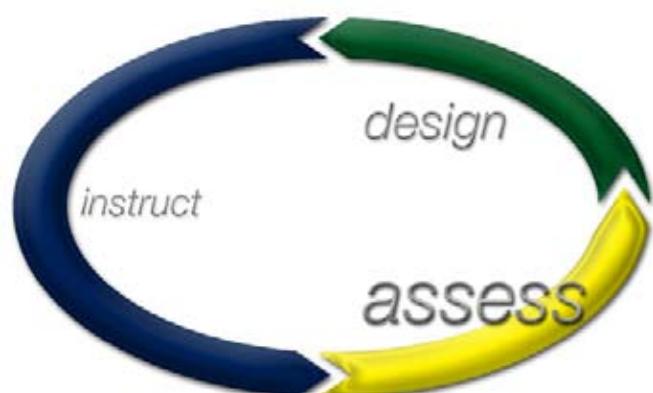
HRF is related to performing ADL with vigor and associated with a low risk of premature development of hypokinetic disease (disease from physical inactivity).

flexibility	Interestingly this aspect of musculoskeletal fitness is seldom thought of a category of strength. Nevertheless, this type of strength is paramount for efficient and effective quality movement. Refers to range of motion about a joint.
muscular strength (MS)	MS is normally associated with the maximum amount of weight one can move in a specific resistance training exercise as well as producing maximum force. This definition is very vague, since most novice/beginning trainees do not benefit from initial maximum testing to determine strength levels. Maximum strength testing is only beneficial after a substantial period of training to develop a base level of conditioning. This base level of conditioning is termed foundational strength and helps to decrease training injuries associated with untrained individuals.
muscular endurance	Refers to the ability of muscle to sustain a sub-max force output for a period of time. The majority of fitness strength programs focus on this type of strength and seldom reaches recruitment of the high-threshold motor units required to produce high-force outputs (Kraemer, 2007)
cardio-vascular fitness	Refers to the capacity of our cardio-respiratory/cardiovascular system (VO ₂ MAX). This component has long been considered the highest priority in a fitness program. Strength of our CV system to deliver oxygen and nutrients to every cell is vital for survival.
body composition (BC)	Ratio of fat-free mass to fat-mass. Research clearly indicates higher levels of fat-mass increase our risk of numerous metabolic diseases and decreased life span. BC is fundamental to good health and is one benefit of a properly designed training program.



think about it

These 5 Health Related Components of Fitness are the same 5 that we assessed in Chapter 8 (along with Balance which is a Skill-Related Component). When we assess and design programs for our clients, we are focusing on Health FIRST! If our clients are athletes, then Skill-Related assessments may be necessary. For that, please see the NESTA Speed, Agility and Quickness program or the NESTA Master Personal Fitness Trainer program.



Skill-Related Fitness (SRF)

Related to Sport Performance

agility	The ability to change direction under control. Everyone utilizes a degree of agility in ADL. Possessing the ability to momentarily accelerate/decelerate in any direction requires cognitive as well as physical ability. This type of specialized training can be utilized accordingly after foundational training.
balance	Balance training (training movement patterns on unstable surfaces) has been utilized to train the core musculature as well as the smaller stabilizer muscles surrounding each joint throughout the kinetic chain. Recent research indicates that this type of training does not transfer well to real-life movement due to light loads, long tension times, and low velocities. Force production is severely decreased with motor patterns altered, due to the slow movement velocities with unstable training protocols (Willardson, 2007).
coordination	Most individuals have unilateral or bilateral deficit (one side stronger than the other). Decreasing this deficit can be part of the overall program design if the deficits are not too severe. This can also be assessed during the initial stages of training when the trainer is teaching clients the basic movement patterns of exercises. Identifying faulty movement patterns may indicate previous injuries sustained in the past or identifying motor learning/motor control/motor ability difficulties (some clients have problems learning new movements and require alternative methods for learning movements). If any client has substantial deficit or motor ability problems, a trainer must refer this client to a trained specialist for further review.
speed	Refers to performing all movement in a biomechanically efficient manner that relies on coordination of the neuromuscular system. Efficient and effective movement require proper sequencing of segments and must be coordinated in the correct sequence (intra and intermuscular coordination) i.e. proper motor learning efficiency.
power	Related to actual speed work (sprinting exercises as part of a well-designed cardiovascular program) or speed-strength training. Life does not always move at a slow pace therefore strength training(depending on the type of strength one is training) should be specific not only to actual movement patterns but to the speed of movement as well. This is considered a more advanced training method and is a valuable variable to a trainee, after building a foundation of absolute strength to enhance movement efficiency (NMF), as well as adding variety to training.
reaction time (reactive abilities)	The ability to improve ones' reaction time, especially when involved in performing activity. Learning a particular movement initially involves slow, controlled movement to facilitate neuromuscular efficiency. Once the technique is learned and control is established (proper motor patterning), increasing the speed of movement increases RFD (rate of force development). This is the amount of force required to overcome any external resistance, be it weight training, plyometrics, or agility training (change of direction), etc. This can also be related to improved conduction rates of related motor units as well (intramuscular coordination), which increase intermuscular coordination.

Physiological Fitness (PF)

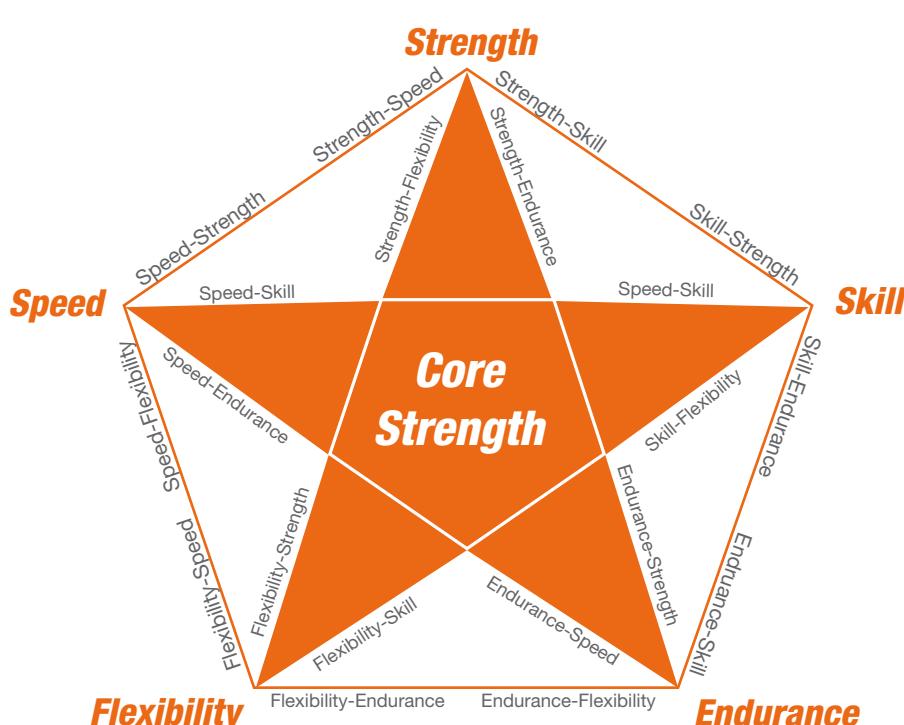
Includes non-performance components relating to biological systems influenced by habitual activity

metabolic fitness	Status of all metabolic systems and variables that may predict risk for diabetes and cardiovascular disease.
morphologic fitness	Status of body composition factors (body circumference, body fat content, regional fat distribution).
bone integrity	Status of bone mineral density

Strength and Strength Training

The concept of strength is very misunderstood. Considerable research reveals that strength is not a single fundamental fitness factor, like cardiovascular endurance (Siff, 2003). Most associate the term strength (in the training community) with one's ability to lift a maximum amount of weight. This is only one category of strength and it involves an exquisite complexity via an understanding of biomechanics, functional anatomy and physiology of the human movement system (Siff, 2003).

The original definition of strength is the ability to exert force; however, this is too simplistic. A more complete definition is “the maximum amount of force a muscle or group of muscle can generate in a specified movement pattern (any direction) and at a specified velocity during any movement (Knuttgen and Kraemer, 1987).



*Adapted from the Inter-relationship of Fitness Characteristics (Stone, Stone, & Sands, 2006)

The task of strength training is to develop the multiple categories of strength in a more or less multifaceted fashion (Stone, Stone, and Sands, 2006). Developing general fitness strength forms the foundation of fitness for the general public as well as athletes. A trainer must be knowledgeable enough to recognize the various categories of strength to develop an individual working model for every client. The type of training program designed should develop training effects which bring about specific adaptations to the client's

body. The interconnection in the various types of strength is shown in the following model, originally developed by Siff and Verkhoshansky (1993) and redesigned by Stone, et al, 2006. DeLong (unpublished data, 2004) developed a model for personal trainers which coincides with the current model.

The SAID Principle

Performing various forms of resistance training augments the criteria for improving general and specific forms of strength. A well known criteria and principle for strength training is the SAID principle (Specific Adaptations to the Imposed Demands). This principle is well documented and states if one wants a specific change/adaptation to occur a training regimen must stress a muscle/group of muscle utilizing a specific energy system. Examples of this are:

- Strength – designing a program to target a specific type of strength (absolute/maximum strength, speed-strength, starting-strength, endurance-strength, strength-endurance, skill-strength, core-strength, flexibility-strength, etc)
- Endurance – what type of endurance? Aerobic? Strength? Speed? Skill?
- Hypertrophy (muscle growth) – must tax the muscle with a certain level of stress (number of sets/repetitions/exercises per muscle groups - this is referred as Volume of training), length of rest periods between sets and exercises, and number of workouts per week/exercise/muscle groups. Research indicates that moderate intensity is standard for muscle growth, but it is the VOLUME of training that elicits that optimal overload for muscle growth, especially in intermediate/advanced trainees. Genetics also plays a substantial role in one's ability to maximize muscle growth.

Bottom line – if you want a specific adaptation you must physically train a specific way to achieve a specific outcome.



think about it

In the most simplistic sense, all we're doing when we exercise is attempting to adapt our bodies to a stimulus. It goes through similar physiological adaptations when learning any new physical activity (a new dance, sport, martial art, etc.). It is very important that we not forget this.

Have you ever noticed those people who work-out regularly (the "gym rats") but never seem to have any changes in their body? It is often because they've been doing the same basic workout for years. Their bodies have already adapted to the stimulus (exercise) they've been doing. This concept must be made clear to our clients. Not only is there no one perfect exercise routine for everyone, there is no perfect exercise routine for anyone (i.e. the workout always needs to be updated and changing to match the adaptations within the individual). This is why the concepts of Progression and Periodization are so important.

EXAM ALERT

**What is the principle of Overload?
What is the SAID principle?**

Why do we care?

Keep in mind that in order to be specific to a certain muscle, you must know which exercises work each muscle. In addition, it is important to know the muscular anatomy so an exercise can be adjusted to meet goals more effectively. Keep both the *SAID* and *specificity* principles in mind as you continue to study anatomy, program design, and exercise applications.

the basics of program selection

analyze

One must gather data for client: initial interview, HHQ, Par-Q, posture, basic strength levels (NOTE: this is not maximum strength. This is specific strength referring to flexibility/muscle strength imbalances at all joints that may impede/prevent quality and/or efficiency of movement), basic real life functional movement patterns, selected balance tests (Note: this is only used to determine if a strength deficit exists unilaterally and/or bilaterally. This is not a determination of balance deficiency in the inner ear - this determination is for a medical professional only).

optimize

This term is often misused in the fitness industry. According to Webster's optimize simple means "to make the most effective use of." Therefore, NESTA uses this term for:

- Use all test data in the most useful and efficient manner possible to optimize all individual training programs.
- Reference and utilize all scientific data/applications for addressing the multiple categories of strength used in developing a training program.
- Proper selection of exercise to increase efficiency and effectiveness of movement (what is the optimal type of exercise at any time during the program?).
- Proper/optimal sequencing of every exercise in a training session, optimal selection for every phase/cycle of training and optimal selection of volume (sets, reps, # of exercises, rest periods, etc) within a session as well over the course of each cycle of the training plan.
- Optimizing transference of effect from exercises to real life (NOTE: this may include using machines first in order to teach basic movement patterns, since some clients experience motor-potential difficulties. The trainer should first attempt to evaluate basic, goal-oriented human movements using bodyweight, then add external load. If a client has difficulty learning these basic motions, work backwards (i.e. ground-based movements on stable surfaces then work backwards to machines).
- Optimize style of technique for EVERY exercise!! This seeks to resolve the myth that there may be one standard technique for each exercise; in reality, every person is proportioned differently. Limb segments (arms and legs) are in different proportions or ratios, relative to trunk length or overall size. These ratios are different for every person.

maximize

Refers to the use of time within the training session (optimal use of the simple and complete concept of program design: simple – few exercises as possible; complete – utilize ground-based, multi-joint, multi-planer, large muscle group movement that relate to normal human movements (when applicable). NOTE: optimization of exercise mechanics, sequencing, etc. can maximize efficiency and effectiveness of transference/adaptation capabilities of all exercises and programs as a whole, to reach said goal(s).

minimize

Addressing optimization of technique, program design, proper selection and sequencing of all exercises minimizes the risk of injury, not reaching goals (non-productive time usage) and maladaptation.

Periodization

Remember the “job of a trainer”? To Bridge the Gap between the client’s current physical condition and their wants (goals) and needs. The trainer must create a long-term plan based on solid exercise science to achieve these goals. Long-term Planning (Chronic Program Manipulations), better known as Periodization is the varying/cycling of the frequency, intensity and volume of the acute program variables over time. This is the *central concept of program design* – varying the stress and allowing adequate rest/recovery for obtaining the correct adaptations to achieving the client’s goals.

EXAM ALERT

**What is Periodization? Microcycle?
Mesocycle? Macrocycle?**

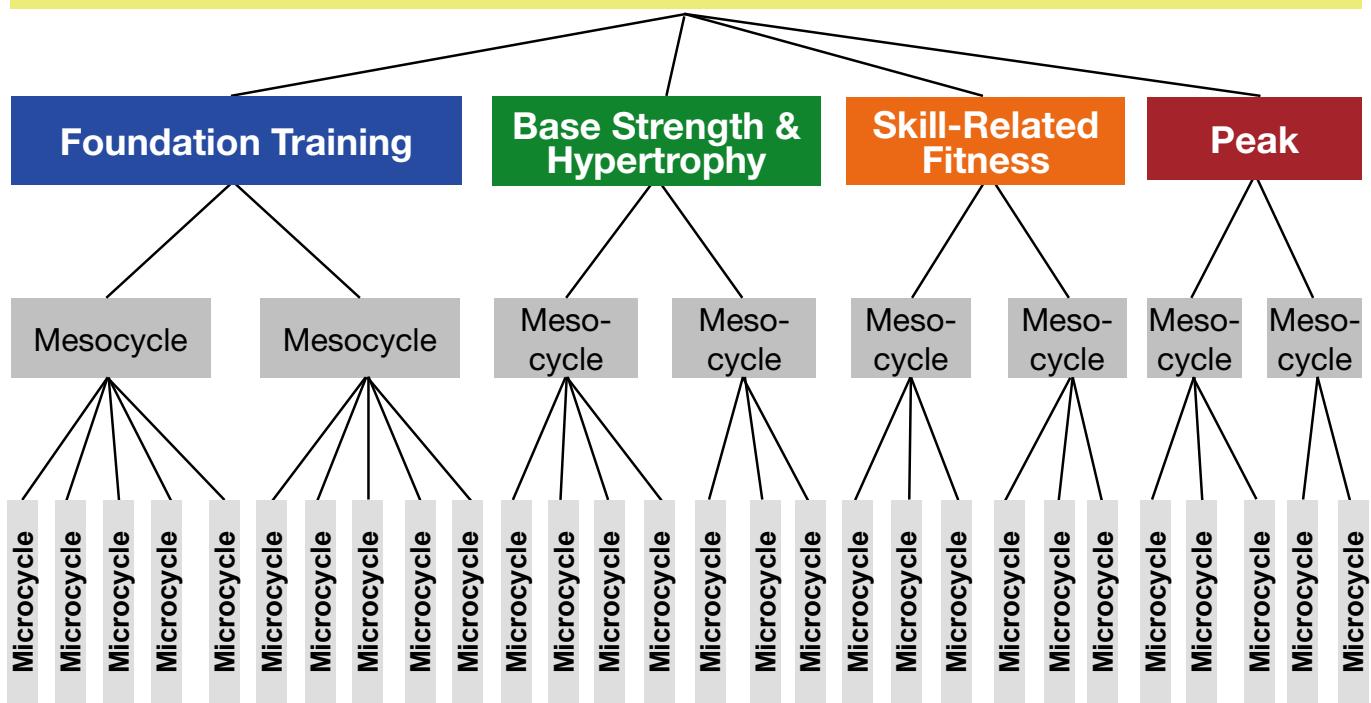
macrocycle	Entire Training Period (often 1 year)
phases of training	Proper progression through each of these phases ensures both safety and efficiency of program
mesocycle	Smaller periods, often months
microcycle	Smaller still, often weeks

Bridging the Gap

B GOALS
Fitness Wants
and Needs

A Current Health & Fitness Level

Macrocycle

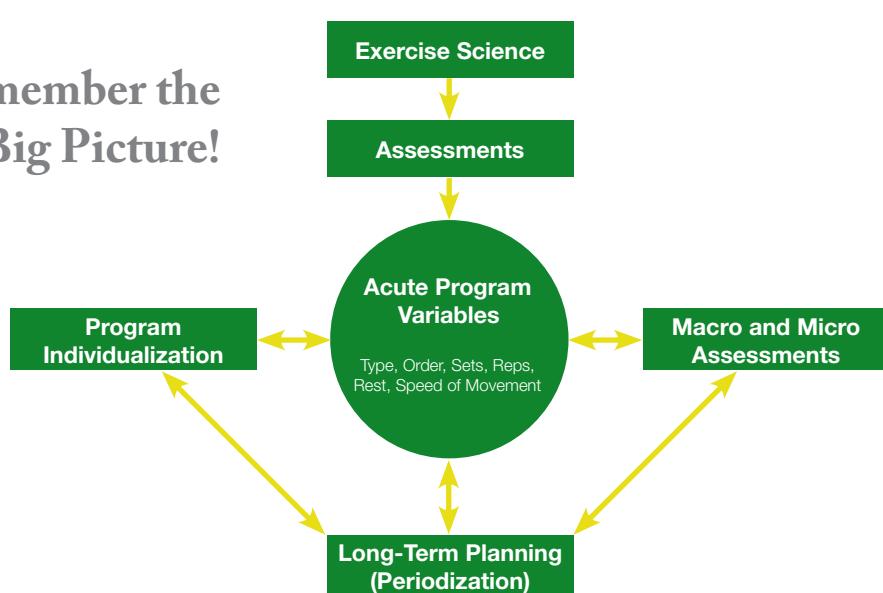


Acute Program Variables

In Chapter 2 - Exercise Physiology, the basic adaptation process (GAS) was discussed. The need to overload the body was mentioned as the well as need for exercise program progression. This begs the question, "What are the variables that a personal fitness trainer can manipulate in order to design an optimal exercise program for their client's goals? The following approach was developed by Kraemer (1983) for determining a specific set of variables for each workout. These variables provide a guideline for any single workout. These variables are:

type of exercise	These include structural (loading the spine - considered ground-based, multi-joint, multi-planer movements which are similar to basic/goal-oriented human movements), single-joint, power (jumping, weightlifting or Olympic lifting), muscle action (concentric/eccentric/static action only) free-weight, cable-type machines (now considered more "functional" due to their similarity to basic human movements) or standard selectorized machines.
order of exercise	Refers to the order of the choice of exercises, e.g. multi-joint verses single-joint, power verses strength, fast verses slow, complex verses simple, high-skill verses low-skill.
volume	Number of sets and repetition for each exercise as well as the number of exercises in each session
load	The amount of resistance used for a specific exercise, all the while focusing on optimization of technique.
speed of movement	This is dependant on training level and the type of strength being trained.
intensity	This has many definitions and refers to how much work performed, how much load (resistance) used, length of rest period, number of exercises, total volume.
rest periods	Between sets and sessions. The length of rest periods between sets is dependant on the type of strength being trained (type of adaptation), the load being used and the strength levels of each client. Numerous training manuals/philosophies state various rest periods of obtaining specific adaptations. These are good guidelines; however, caution should be taken here. Novice trainees may have little tolerance to exercise and may require longer rest periods to recover from certain exercises. This is a normal response in the initial stages of training (Foundational stage) but each client's work capacity will increase if the program is individualized accordingly.

Remember the
Big Picture!



Two key points for designing a successful resistance training program are:

- Microassessments: (a.k.a. Progress Monitoring). This includes keeping meticulous records
- Macroassessments: Periodic Testing (measuring work capacity to include number of reps performed, heart rate responses, (i.e. does the heart rate return to an acceptable level to resume training), or the rating of perceived exertion (RPE)). These methods can be coupled with HR response using a Polar Heart Rate Monitor for even more objective evaluations).

These components must be strictly adhered to in order for the optimal individualization of each client's program design. Trainers can use the basic model, but must be adjusted accordingly to elicit optimal training responses.

NESTA's Strength Training Pyramid

Our new pyramid is a visual representation for developing a logically designed strength training program. Any training program must have a solid foundation of strength to progress to the next level. This pyramid was developed from an extensive review of strength training literature (both empirical and anecdotal) and observations of trainers in various training centers across the country. This model represents levels of physical preparedness, imperative for any level and any type of performance (think back to the statement "life is one big performance").

EXAM ALERT

Be able to properly implement each stage of resistance and cardiovascular training with proper progression.





What Does It All Mean?

It is the job of the Personal Fitness Trainer to design a systematic workout plan that allows the body to adapt in a progressive fashion. In other words, one just can't take their clients and start training them as if they are a professional athlete. This may seem obvious, but it begs the question, "How do we get to these higher performance levels?" The body must physiologically and structurally adapt to be brought to these levels of performance.

This is why the bottom level of the NESTA Pyramid (the first phase of the Macrocycle) is Foundation Fitness. It is at this level where motor learning (learning proper technique) is vital to ensure proper adaptations later in the Macrocycle. Once technique is acquired, intensity can be increased to allow for structural adaptations (i.e. increased structural integrity of the connective tissue, so that it can handle increased loads and speeds of loads). Then the acute training variables can be modified again for increasing strength endurance (i.e. work capacity).

Level One – Foundation Training

It is during this stage that the trainer addresses the basic fundamentals of human movement, with any client, at any level. Learning proper technique for all resistance training exercises is a vital step in motor learning. The trainer should attempt to teach each client elementary human movements (those movements we perform most often in every day life). These simple movements are the backbone of activities of daily living (ADL). On the contrary, these movements may be rudimentary meaning underdeveloped.

Application:

Now, very few clients are going to want to be professional athletes (unless you choose them for your target demographic). The majority of people want to "be healthier", lose weight, gain muscle, feel better, or perform better in some sport that isn't going to get them on ESPN. These are admirable and important goals (remember: they are very IMPORTANT because these goals are the reason they are paying you!). Most of these goals are towards the top of the pyramid. The reason many people do not achieve their long-term goals is because they want to jump to these "higher levels" right away. While they may meet some goals, they will never reach their full potential, because they haven't built a good structural and physiological foundation. Furthermore, for this same reason they will be more prone to injury and hence become discouraged and quit. It is YOUR job as a trainer to explain and "Paint a Picture" of the whole process. In this way, the client understands what they can expect to go through and you will then be able to establish yourself as the Fitness Professional with a Plan!

Teaching proper movement techniques is not to be taken lightly. Faulty movement patterns performed over many years can lead to compensations and eventually overuse injuries. Learning to sequence any movement properly enhances our neurological capacity in many ways (motor learning patterns or engrams, intra/intermuscular coordination, spatial awareness/proprioception, etc.).



Level 1, Stage 1 - Motor Learning

- First 4 – 6 weeks
- Develop technique/motor skill/motor potential using a select group of exercises

you wish to teach (start with basic human movements). Start with teaching one or two exercises per session and add one or two each session or after client can perform an exercise with efficient technique. The number of exercise chosen will vary depending on their motor learning capabilities. It is advisable to attempt whole body, structural type of exercises that use many muscle groups. Selection of exercises will also depend on the environment the client is training in (home, commercial gym, outdoors, etc.).

- Develop a client's strength-endurance (also called work capacity). Over the course of the month the trainer will add in additional exercises, which will challenge the client's ability to perform a certain amount of work. This will increase their work capacity (physiological adaptation for higher volumes of stress from higher volumes of imposed work) and increase their caloric output.
- Begin with 1-2 sets of a few repetitions to as many as 15-20 reps and 3 sets (this is very dependant on a client's motor ability, initial work capacity levels, tolerance to exercise, RPE, adherence , as well as their commitment to the program
- Constantly analyze each client's movement quality in each movement. You must optimize each client's style of technique in every movement to ensure the stress is going where it is supposed to (refer back to your biomechanics chapter on lines of force/vectors). This will also enhance movement quality (optimal technique to maximize efficiency and effectiveness of the movement), maximize rate of neurological adaptations (motor learning) and most importantly minimize the risk of injury
- Assess client's strength-endurance capabilities to determine where they initially started and estimate what the maximum load is based on the number of repetitions performed at the end of the first month. (NOTE: Use caution here. Use this guideline for large muscle group movements.

Any small muscle (auxiliary) movements used need not be tested.

- Rest period lengths will vary considerably. Do NOT go too fast during this stage of training. The client will adapt according to the above stated guidelines for sets/reps. As each client increases the number of exercises and volume (sets x reps), their ability to tolerate exercise will increase. Once again, tolerance to exercise in very individual!!

Acute Program Variables for Level 1, Stage 1 Motor Learning

Application:

A trainer must not only monitor technique efficiency but the client's ability to recover from each set of every exercise. An excellent way to monitor recovery is heart rate. Use of the heart rate max chart is a useful guide here. Calculate a training zone which corresponds to anaerobic training (above 65% of max). Use this as a guideline when performing resistance training exercises particularly if the movement is a ground-based movement (e.g. squats, push press, any type of lifting movement from the floor, etc). Monitor their max heart rate on every exercise for every set performed. Pay particular attention to how fast HR drops (this is very subjective) HR should decrease to a number within the 40-60% max range. Couple this objective number with an RPE as well – this will take some work on the trainer's part but will be most beneficial at the end of this particular phase of training).

A trainer can palpate the wrist (radial artery) or neck (carotid artery) to monitor max and recovery HR. A more efficient way to monitor recovery and training zones is with a POLAR Heart Rate Monitor. In the past, these tools have been used exclusively for aerobic/cardiovascular training regimens; however, the ability to monitor increases in adaptations (work capacity and tolerance to exercise), specific to resistance training, is paramount to overall changes for all the components of fitness. Use of the POLAR monitor is essential for tracking one's fitness changes in multiple categories of strength, including strength endurance. Monitoring increases in strength training is also essential for tracking total caloric expenditure in resistance training, independent of a CV training session. Changes in work capacity are also essential for changing/augmenting programs to enhance one's ability for reaching fitness goals.



Acute Program Variables Level 1, Stage 1 Motor Learning

type of exercise	Basic movements that are ground-based, 3-D, multi-joint as well as a few single-joint exercises. Refer to exercise selection chapter.
order of exercise	Structural type (those that load the spine) that require skill, balance and stability first. These require the most attention during the formative stages of training. Machines, single-joint and static types of exercises should be used after these types.
volume	This is your total amount of work (sets and reps). Begin with learning movements using a few repetitions and move toward 15 -20 reps. Number of sets should be 1 – 2 to start (depending on client) and working up to 3 sets.
load	Light weight (resistance) should always be used first. Use body weight for structural types of exercise then slowly add resistance. If a machine is being used, align the client first then teach the proper mechanics with a load the trainee can easily handle. Follow the protocol of: 1. Learn the Movement 2. Control the Movement 3. Challenge or Load the Movement
speed of movement	This is sometimes referred to as Time under Tension (TUT) or Tempo. For Foundation Stage 1, always use the slow and controlled method, i.e., slow eccentric action (3-4 seconds) with a slow concentric action (3-4 seconds). A Tempo example would be 4-0-4. This the motor learning/motor ability stage to learn the correct movement pattern for exercise.
intensity	This has many meanings: this initial stage is considered low intensity (low volume, low load, slow tempo). As client increases motor ability and work capacity, intensity can be increased.
rest periods	Most novice trainees have a low tolerance for exercise, therefore longer rest periods are initially required to decrease the risk of undue fatigue. Length of rest periods normally vary between 1 – 3 minutes or longer, depending on recoverability rates of the client. Use of the Polar monitor and RPE is extremely useful at this stage. The talk test is another tool for determining when to begin the next set.

NOTE: At the end of this stage, subjectively determine the amount of load utilized for each exercise. Have the client perform a high number of repetitions (> 15) with their highest load during this stage. These data dictate/determine the load used during building phase.

Level 1, Stage 2 Structural Integrity & Strength Endurance



Application: All exercises, especially during the foundational stages of training, should follow the Complete and Simple protocol developed by Garhammer (1987) which states:

- Complete – balanced training (all sides of the joints) with all major muscles groups, stabilizers, synergists, etc trained (whole body)
- Simple – use as few exercises as possible. This follows NESTA's philosophy of using basic whole body movements whenever possible.

After developing correct motor patterns with a select cache of exercises, the next step in building a solid foundation is strengthening the connective tissue network (structural integrity) and building more strength endurance.

- Next 4 – 6 weeks

Acute Program Variables for Level 1, Stage 2

Structural Integrity & Strength Endurance

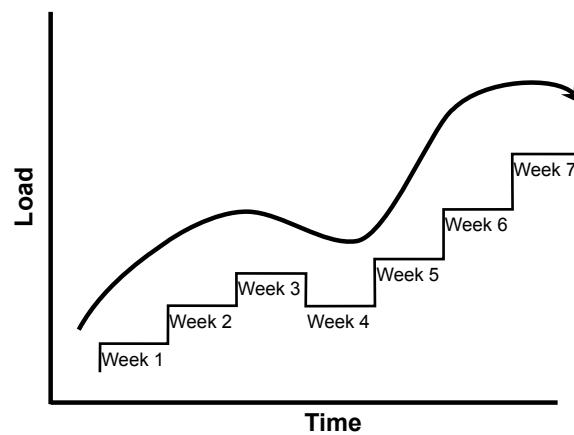
type of exercise	Structural exercises with machines, single-joint movement and core strengthening exercises
order of exercise	Same as in initial stage
volume	Increase volume to 15 – 25 repetitions and 3 -4 sets per exercise
load	Increase load, which enables client to be significantly challenged for the rep range chosen and for all sets
speed of movement	use 4-0-3 tempo
intensity	This has increased due to increased volume, as well as decreasing rest period times
rest periods	This varies somewhat with each client. Using your Polar monitor and RPE, program rest periods (30 – 90 seconds) between sets.

Level 2, Stage 1 Strength Endurance and Hypertrophy



In this stage, the client has established a foundation of strength in their movement pattern efficiency, a stronger connective tissue network as well as increased work capacity (strength endurance) during the past several months (approximately 3 months total). Therefore, the next step is to increase lean tissue (muscle hypertrophy) and further augment strength endurance. These cycles will alternate hypertrophy training (3 weeks) with strength endurance (1 week). This pattern of training normally follows increases in repetitions, sets or overall load for each week of hypertrophy training (3 weeks); this is followed by 1 week of "downloading" (strength endurance – decreased intensity in both load and volume) for recovery. Care must be taken

here to ensure adaptation (changes) by using the concept of "stress recovery/adaptation." A visual representation of "step loading and recovery" (this is the GAS, previously discussed) is as follows:



Each phase within this mesocycle for hypertrophy/strength-endurance is approximately 4 weeks long, with 3 weeks of increasing intensity, followed by one week of recovery. Two full phases are completed during this section of Level 2 (approximately 2 months).

Acute Program Variables for Level 2, Stage 1 Strength Endurance and Hypertrophy

type of exercise	Add additional structural exercises using free weights/ machines, single-joint movement and other core strengthening exercises (static and dynamic)
order of exercise	Same as in initial stages
volume	Hypertrophy phase is 3-5 sets of 8-12 repetitions; Strength-Endurance during the recovery week will entail 1-2 sets of 15-20 repetitions.
load	Increase load each week in hypertrophy phase. Use the “2 x 2” rule – if a client can perform 2 additional repetitions on the last 2 sets at the end of each week, increase weight accordingly. Load for strength-endurance is approximately 40-60% of highest load used.
speed of movement	Use 4-0-2 tempo for hypertrophy; 4-0-3 for SE
intensity	Load, volume, rest periods and tempo have all changed, therefore intensity has increased as well.
rest periods	One minute between sets for hypertrophy; 30 – 45 seconds between sets for SE. Allow at least two minutes for between exercises

Level 2, Stage 2 Hypertrophy and Basic Strength



This level will focus on basic strength levels, i.e. heavy lifting. Anecdotal and empirical evidence exists stating a majority of fitness trainees (particularly females) seldom go less than 8-10 repetitions or heavier than 80% of their predicted 1-RM. Kraemer (2007) noted that repetitions over 12 do not elicit fast-twitch (type II fibers) thereby decreasing one's ability to increase absolute/maximum strength and hypertrophy. One does

not have to train like a competitive lifter, but, overall structural training for developing the multiple categories of strength is necessary for complete development of the musculoskeletal system.

This stage follows the undulating (alternating) or step loading process as the last stage; however, the initial 3 weeks in each phase will entail substantial load increases for specific exercises and long rest periods. The download week will have increased volume but not near the type used in the hypertrophy stages. Two full cycles are used here as well (3 weeks heavy, 1 week light), for approximately two months.

Acute Program Variables for Level 2, Stage 2 Hypertrophy and Basic Strength

type of exercise	Heavy lifting will use standard/basic ground-based movements [squats, deadlifts, stiff-leg deadlifts, overhead press, all standard chest exercise (bench, incline). ONLY USE ONE OR TWO EXERCISES PER WORKOUT IN EACH SESSION – THESE ARE VERY TAXING TO THE SYSTEM!! Any supplemental movements can use multi-joint and/or single joint types
order of exercise	Same as in initial stages
volume	Absolute/max strength: 3 – 5 sets for each main exercise chosen; supplemental exercises can vary from 6-12 reps for 3-4 sets depending on data from evaluations (i.e. are there any weak points that need additional training to augment normal movements). NOTE: The training volume in this stage may be limited to the time frame for each workout, as well as the number of sessions per week.
load	Estimate a client's one repetition maximum from the hypertrophy stage (e.g. Squat – highest weight for 10 reps divided by .71. This will give a specific number for each movement. Start the strength cycle with approximately 80% of this number for basic movements. As an example, if the highest weight used was 145 divide this by .71 - estimation/calculation for a estimated maximum weight is approximately 205. This will be your reference for this exercise. Next – multiply 205 times the % chosen for the load (.80): this will equal approximately 165.
speed of movement	Use 2-0-1 tempo for strength; 4-0-2 for hypertrophy.
intensity	Load, volume, rest periods and tempo have all changed, therefore intensity is very high during this stage.
rest periods	Three minutes minimum between sets for strength; 60 - 90 seconds between sets for hypertrophy. Allow at least two minutes for between exercises.

NOTE: After this stage it is advisable to perform selected tests to verify/monitor the progress of each client. Stability in all movement performance must be verified BEFORE moving to the next stage of training. The trainer has creativity here to develop specific, individual tests or utilized standard strength/agility/skill tests. The data from your periodic testing reinforces the idea of individualizing each and every program for every client.

Level 3: Skill-Related Fitness (SRF)



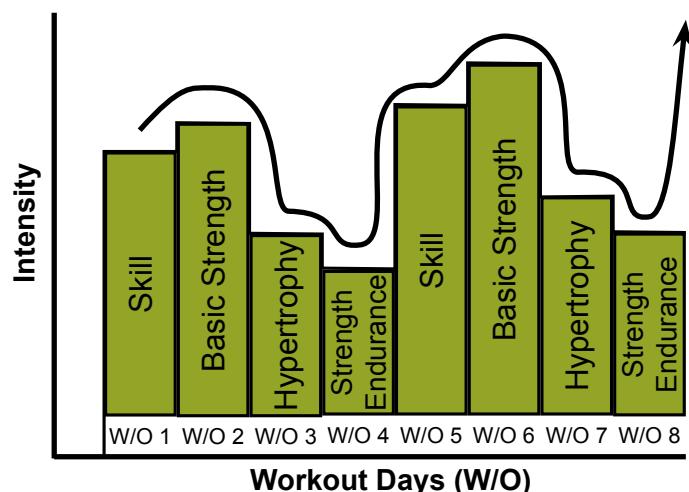
Substantial time has been spent building a solid foundation of structural integrity (approximately 7 months). Theoretically, the client's force producing system has adapted to substantial stress in a reasonable amount of time and is now ready to increase training intensity to more advanced levels. Recall the categories of fitness, i.e. health-related versus skill-related. Optimizing the components of both categories in a training program must be organized accordingly, meaning each must be addressed based on initial assessments and periodic testing throughout the foundational training program. At this level of training, the client is ready to advance to higher intensity training, (more advanced skill-related training protocols, movements, and philosophies). Speed, type, and intensity of movement, as well as combinations of various training protocols, can now be implemented to advance training to a higher level.

Application: Remember skill-related training is much more advanced in terms of stresses on the musculoskeletal system. While basic heavy strength training is extremely taxing, skill-related types of training require substantial foundational training first, before embarking on this type of training. Slowly introduce SRF components and allow adequate time for motor learning and CT adaptation to this type of stress. Use very basic movement patterns at this introductory stage – clients may be substantially stronger, but implementing new stresses (multi-planer, multi-directional movements performed at various speeds) requires additional care and attention to ensure proper execution of all movements as well as decreasing the risk of injury. Use only low-level skilled movements and slowly move to more advanced exercises. Again, consider high level athletes who train for years to perform at a certain level. Clients with little experience in this type of training must advance with caution and learn proper execution of all SRF components before increasing intensity. For more information on this type of training, please refer to NESTA's SAQ certification (Speed, Agility, and Quickness).

Also recall the components of skill-related training: agility, balance, coordination, power, speed, and reactive abilities. It is at this point in training that sports-related fitness training can be incorporated into the program (sports-related fitness is a combination of health and skill-related

fitness). This is specific to the various training regimens that include using jump training, agility ladders (or any type of agility training), sprint training, kettlebells, all medicine ball routines (slow to ballistic movements) or any "new" tool to facilitate training and/or increase adherence, decrease boredom, etc.

It is also at this point where we introduce another concept of variability in training called undulating or non-linear periodization (Kraemer, 2007). Before, with most novices, only a few fitness qualities could be trained simultaneously. With a strong foundation built, additional stressors (to include how much, how long and what type) need to be varied, due to the body's ability to adapt to stress (GAS). Level 3 training (SRF) can be varied from workout to workout, with a different goal for each session, varied accordingly over time, to continue progress in a number of areas. This type of training not only adds considerable variation and enjoyment to training, but it can elicit continued progress in a number of areas as well as promote substantial recovery while training fitness qualities. Most trainees have heard the term 'cross-training' in the fitness community. This term comes from the concept of non-linear periodization, utilized decades ago by Olympic Weightlifters as well as track and field athletes. Once again, it is not a new concept. It is, however, misused in the fitness community, due to the lack of scientific knowledge in structural adaptation of the human body. This concept entails varying the type of stress throughout each microcycle (week of training) in every scheduled mesocycle



through all advanced training cycles. Review of NESTA's new training pyramid shows a variable or undulating schedule of types of strength categories trained. For novice and intermediate trainees, varying skill training, basic strength, hypertrophy, and strength endurance throughout each microcycle (within every mesocycle) can stimulate growth beyond that of standard training, however, ONLY when a foundation has been well established.



think about it

Basic exercise physiology teaches us that the adaptations that are the result of the stress of exercise happens during the recovery period. Now that that client has entered the Skill-Related Fitness level, the intensity has increased dramatically (Remember biomechanics? Increased speed means more force is needed decelerate the movement - therefore higher intensity). With increased intensity comes increased need for recovery. It is not reasonable to expect clients to maintain this high intensity every workout. Hence the importance of Non-Linear Periodization.

Non-Linear Periodization

Another benefit to non-linear/undulating periodization is the selection of training protocols for each workout, based on the client's physical/emotional/psychological condition on that particular day. Any condition that may hinder performance for that workout needs to be addressed accordingly to ensure the proper stress is elicited during the workout. Once again, analyze the client's condition (lack of sleep, improper nutrition, work/family issues – any distress that may increase a risk of injury), optimize the training protocols for that day to maximize/optimize energy, time efficiency and/

or adherence levels as well as minimize risk of injury.

A breakdown for this cycling protocol structure/example is:

- Monday, Wednesday, Friday training days (one microcycle)
- Each training day trains a different type of strength
- A generalized protocol can be utilized for two to three mesocycles before entering a peaking phase, to establish a stronger foundation of skill-related fitness, to further a client's general and specific fitness preparation
- Variation in the number of training days specific to what is a priority can be programmed into the peaking mesocycle(s) to reach known goals of each client
- This protocol can also be used with as little as two training days within a microcycle
- This protocol can also be used as a maintenance program, i.e. once a client has reached a certain fitness level in ANY category it (fitness) can be maintained for a period of time until a change is necessary or, ideally, before stagnation occurs.

Example of a general level 3 microcycle:

type of exercise	Skill-related fitness training – low level in-place jumping, ladder drills, multi-planer exercises with medicine balls, body weight, or light resistance performed explosively. Any type of Olympic Lifting/Weightlifting movements are considered skill-related and strength movements at this stage of training for novices.
order of exercise	Basic/maximum strength – high pulls, squats, standing cable bench press, deadlifts, overhead DB presses, augmented with ground-based core training; using greater than 85% of either an estimated or actual tested 1RM of selected exercises.

volume

Basic hypertrophy using all types of equipment (machines, free weight, cables, etc) and high volumes (4-5 sets of 8-12 reps per exercises with 68-80% of highest load previously utilized). Focus is training the entire body.

Level 4: Peaking Phase



This phase of training focuses on a few key goals that were originally set at the beginning of the macrocycle, or added during the course of training. At this point, however, many positive changes have most likely taken place. An analysis of all previous test data must be reviewed to determine the final training protocols to be implemented in order to bring about desired results.

Application: All trainers and trainees must keep in mind that while weight loss and aesthetics are primary goals of most training programs, these particular features are actually delayed benefits that take place after other changes have taken place first. The focus of the peaking phase should primarily focus on performance categories: cardiovascular test scores, strength scores (various types of strength) to include agility tests, maximum strength tests, strength-endurance tests, and power tests. Testing these specific areas also measure each individual's work capacity (tolerance to exercise) and their ability to recovery from exercise. These data support a client's overall program progression and validates any increase in lean-mass and decrease in fat-mass. Measurement of health-related and skill-related fitness components and comparison of these data to specific standards positively reinforces all work completed to date, as well as planning for improving training protocols for the future.

Approximate length of time for the peaking phase will vary between one to two mesocycles (1-2 months). Standard undulating/non-linear periodization is used during the peaking phase, using the same training day protocols as with

level 3. The difference is each training day focuses on a few primary exercises performed at a much higher intensity. Each training day should consist of exercises that stress ground-based, multi-joint, multi-planer, whole-body movements. These types of movements should be similar to real life movements as discussed in previous chapters. An advantage to this type of training is both the level of creativity and selection of movements that can be utilized.

Example for this phase/level:

Skill Day

type of exercise	Similar to level 3 – any med ball exercises that are explosive and highly dynamic; kettlebells, all agility programs (cones, ladders, adjustable hurdles, etc), or modified Olympic Lifts/Weightlifting.
order of exercise	Use those exercises that require substantial focus and coordination first in the workout followed by those requiring less focus. Order can also be in a circuit-like fashion as well. Requires observation and assessment on a 'micro' level.
volume	3 – 5 sets of variable number of repetitions for each selected exercise.
load	Varies with exercise and strength levels of client. Loads are usually light to ensure explosive type of movement.
speed of movement	Fast or explosive
intensity	Very High
rest periods	varies with goals of phase of training – short to long depending on type of exercise.

Basic Strength Day

type of exercise	All multi-joint and ground-based movements to include pushing and pulling types of movements. Examples include a heavy loaded squat movement; some type of deadlift; 2 upper body push and pull movements (e.g. squat, bench press, deadlift, standing underhand row).
order of exercise	Large muscle group to smaller muscle group; lower body to upper body; alternate lower body, upper body, lower body, upper body.
volume	Low (2-3 sets of 2-4 repetitions)
load	Greater than 90% of estimated maximum weight.
speed of movement	Tempo = 2-0-1
intensity	Very High
rest periods	Long (>3 minutes per set)

Hypertrophy Day

**Follow same protocol as in level 3 using one major exercise per major muscle group for 4-5 sets of 10 reps with 1 minute of rest between sets. Can use variation of machines and free weights

Strength Endurance Day

**Follow protocols for SE as used in level 3. The trainer can utilize a circuit for all exercises to increase level of intensity.

At the end of the final level, use one microcycle to test each category of strength using standard tests developed for determining fitness standards for age and gender scores. These scores are also used to set new goals for a more advanced macrocycle to further increase fitness levels.

Resistance Training Program Design - Final Thoughts

Once the first 2 levels have been completely mastered, the client and trainer can use more creativity to develop an updated program design, specific to many variables used for program adherence (type of equipment, likes/dislikes of certain exercises, etc.). Nevertheless, the trainer must always establish a client's foundation first to ensure an adequate base of strength and conditioning, before utilizing exercises/movements that are popular and/or trendy. Correct motor patterns, CT network strength and work capacity are essentials elements in EVERY trainee's training regimen, including advance level trainees. Adhering to the basics of science is paramount for achieving goals and continued success.

Cardiovascular Training Basic Progressions

Purpose of CV Exercise

All forms of exercise, when applied properly, will provide improvements in heart and lung function. Some circuit training workouts with weights and various bodyweight exercises can mimic a cardiovascular workout. However, it is important that the body undergo various forms of stress to be able to maximize benefits to the musculoskeletal system as well as the internal organs and unseen functions of the body. It's not altogether understood through research, but there are specific benefits of mental clarity, elevated mood or contentment, and immune system support, in addition to improved function of the heart, lungs and circulatory system, that can only be achieved with continuous, longer duration activity - or the use of cardiovascular training intervals (or variations) to improve health, fitness and performance.

There is no perfect cardiovascular training program. It is important that the guidelines shown in this chapter be used to help design an appropriate cardiovascular training program in order to ensure long term progress (any stimulus

above current levels will provide short-term improvement but will not last if not applied and periodized properly), avoid injury (to either the musculoskeletal or the endocrine system), and to provide guidance and motivation for individual client interest and adherence (through intelligent program design). These guidelines follow the FITTR principle, where F stands for Frequency (days per week), I stands for intensity (% maximum capacity), T stands for time (duration of cardiovascular workout), the other T stands for type (mode of exercise) and R stands for rate of progression.

Warming Up

The warm up period should be performed first in transition from rest to an exercise state by gradually increasing the intensity level until the goal intensity is reached. This will require 5-15 minutes, on average. If an individual has specific muscular or movement dysfunctions or imbalances, time should be taken to perform the necessary flexibility or mobility and muscular activation exercises *prior* to a general cardiovascular warm-up. This warm-up period will increase cardiac output and blood flow, along with an increase in muscle temperature. This will elevate muscle enzyme activity. The

warm-up should begin around 30% intensity and finish at around 60-70% intensity, depending on the goal(s) of the exercise session that follows. How do you gauge intensity? Through the use of RPE, HR monitoring, facial expressions seen from the client or how he or she moves. For more objective feedback on intensity, rely on a HR monitoring device. This will be explained in further detail shortly.



Warming Up

Frequency	Intensity (HR and RPE)	Time/Duration	Type/Mode of Exercise
Prior to each workout	Increase gradually from 30-70% or to goal intensity	5-15 minutes	Flexibility/mobility or muscular activation exercises followed by general cardiovascular warm-up

Cooling Down

Frequency	Intensity (HR and RPE)	Time/Duration	Type/Mode of Exercise
Following each workout	Decrease gradually from workout intensity down to 30-40% intensity before ceasing activity	10-20 minutes	Continuous recovery level intensity exercise

Cooling Down

The cool down period should be performed last in transition from exercise to a state of rest at the end of the workout session, start by gradually decreasing the intensity level to between 30-40% intensity for 10-20 minutes on average. This will promote the efficient removal of metabolic waste and return HR and BP values toward normal. This will also help to avoid venous pooling, where blood has been localized to muscles heavily used during exercise.

Breathing During Cardiovascular Exercise

Breathing should be controlled and relaxed lasting at least 2 or more seconds on the inhalation (in through the nose) and exhalation (out through the mouth) phases. This is true during recovery or light activity. During recovery or light intensity exercise, the individual should be able to prolong the exhalation phase longer than the inhalation phase. When the mouth begins to open more visibly and the individual is unable to breathe through the nose or talk in complete sentences without pausing (also known as the “talk test”) the individual has moved from aerobic to anaerobic metabolism as the primary phase of energy production. Even during anaerobic metabolism and moderate to high intensity work it is important for the client to work to control breathing, to supply a steady supply of oxygen and to avoid excessive strain on the heart or excessive rises in blood pressure. It is important for beginning exercisers who have not exercised regularly (at least 3 days per week) for the past several months to stay “aerobic”, until a baseline of low level conditioning can be established. Exerting at moderate (70-80%) to high (80% or above) intensity levels too soon in an exercise program can create a greater likelihood of injury to connective tissue and muscle, which has not had time to adapt to the new stimulus over a period of several weeks. Additionally, the endocrine system response may be compromised with an inability for the body to be

able to repair not only muscle tissue, but the immune system as well. The same efforts that can help the body can also hurt the body if not applied properly. Remember that exercise is intended to stave off illness and disease, not invite it by working out too intensely. Weight loss goals and desired body changes cannot outweigh the greater need for total body health.

Most people are in a hurry to get fit or healthy. It took a long time to get unfit or unhealthy, so it should not be surprising that the body will need sufficient time to adapt both internally and externally for long term health, fitness and performance benefits.

Heart Rate and Rate of Perceived Exertion

The following table should be used to help define various perceived exertion and heart rate training concepts. Heart rate can be a useful indicator of the intensity of effort and the body's physiological adaptations. Heart rate monitoring is an important component to determining cardiovascular fitness as well as a form of guidance in training to help determine appropriate FITTR variables. Monitoring of HR should always be used in conjunction with RPE to ensure that an optimal level of stress is achieved to obtain consistent positive adaptations toward improvement.

Knowledge of how the heart works, heart rate variations due to training, stress and health problems, will enable the user to take more responsibility for his or her training. Training that is too low in intensity may lead to a lack of results and if it is too intense, can lead to overtraining - resulting in fatigue and downward spiraling improvement. Unlike using RPE, the heart does not lie. It shows the body's response at the time of activity (acutely). The continuously measured heart rate gives a very accurate picture of the individual's physical condition and how his or her condition changes. It is, in a manner of speaking, a reflection of the load.

Heart rate monitoring can be used as excellent

biofeedback to monitor body stress at any time, as the heart rate monitor displays the reactions of the heart to different factors both reliably and as accurately as an electrocardiogram (ECG) test would. The user can now listen to their own rhythm of their own body, to help regulate workout intensity.

In using heart rate monitoring as a tool for measuring intensity, the trainer must decide which form of measurement is most appropriate. For beginning to moderate level individuals, utilization of the heart rate reserve (HRR determined by using the Karvonen Equation) method for determining heart rate training zones may be more accurate than the traditional practice of determining training intensity as a percentage of maximum heart rate only.

$$\text{Karvonen Equation} = [(220 - \text{Age} - \text{RHR}) \times \text{desired training intensity \%} + \text{RHR}]$$

Traditional Method for Determining Training

$$\text{Heart Rate} = 220 - \text{Age} \times \text{desired training intensity \%}$$

The Karvonen Equation and determination of heart rate reserve (HRR) may be more accurate for beginning to moderate level exercisers because it takes RHR into account, for a more accurate picture of aerobic conditioning. Oxygen consumption is a primary measure of exercise intensity and the heart rate reflects how efficient the body is able to utilize oxygen. However, the traditional method may be just as accurate for athletes or those with higher fitness levels as the heart rate reserve method.

The table on the next page provides more information regarding using RPE and HR to determine appropriate exercise intensity.

Tool	Description	Benefits/Drawbacks
Rate of Perceived Exertion (RPE)	Borg's scale to determine rate of perceived exertion by individual exerciser on a scale of 1-10. Used for regular checkup with trainer and client to determine client's feelings/ subjective response about the intensity of exercise.	Beginning level clients may have a hard time determining the difference between a light intensity exercise or workout and a high/heavy intensity one due to a lack of exercise experience. However, coupled with use of heart rate monitoring, this can be a very effective tool for determining appropriate exercise intensity levels.
Resting Heart Rate (RHR)	Measure resting heart rate (RHR) using a heart rate monitor or with the hand on the radial artery just after waking for a period of at least 60 seconds. Determine the average over three days. If RHR declines consistently, then individual conditioning is improving. If the RHR increases on any given day then a lighter workout should be scheduled. If the RHR is measured higher than 10-15% over average on any given day the workout should be conducted in the recovery zone or not at all. Working out in the 50-55% intensity zone has been shown to increase immune system activity as long as the individual is not feverish or already sick.	Resting heart rate can be an important tool in gauging an individual's response to exercise and stress on a daily basis. Excessive stress due to a lack of sleep/ rest/recovery, poor nutrition, and/or excessively intense workouts may create an undesirable rise in RHR. In order for RHR measurement to be effective it must be measured consistently, each morning at the same time while lying down and before rising. If the RHR is not improving it is not wise to engage in consistently high intensity/heavy exercise until RHR can be normalized or decreased. The average individual's RHR is between 60-70 bpm with high performing endurance athletes in the high 30s or low 40s.
Maximum Heart Rate (MHR)	Maximum heart rate (MHR) is a theoretical determination of the maximum heart rate for any individual by subtracting the individual's age from 220. This number is then used as a variable in determining appropriate heart rate training zones for cardiovascular exercise. The MHR will typically decline with age but may increase if VO ₂ MAX/ cardiovascular capacity improves as shown in the Polar Fitness Test or by measurement of a VO ₂ MAX treadmill test administered and supervised by a doctor.	Like any measurement of HR, the MHR is a variable to be used in determining appropriate exercise programming. The heart rate should never be the goal of any exercise session or program. The heart rate is feedback from the intensity of the session. It should never be the goal of any individual to "increase" their heart rate to meet a given goal. The heart rate is one measurement of the intensity of exercise. On a high energy day, an individual may occasionally report feeling great with a low heart rate and on a low energy day report feeling poor with a very high heart rate. Use this tool wisely and carefully.
VO₂MAX	Determining VO ₂ MAX provides the most accurate available measure of an individual's maximal aerobic power. This indicates how many ml of oxygen the body is able to transport and use per each kg of bodyweight in one minute.	Having a doctor supervised treadmill test to perform a stress test and measure of VO ₂ max is the best way to determine the body's current level of cardiovascular health and fitness. However, it is not always possible to have this test performed for each individual. If an individual male is 45 years or older or a female 55 years or older it is the trainer's job to urge the client to have a doctor supervised treadmill stress test performed. Once the test is performed, heart rate training zones are accurately known without need for mathematical formulas.

<h3>Heart Rate Reserve (HRR or VO₂R)</h3>	<p>The Heart Rate Reserve (HRR or VO₂R) is the difference between RHR and MHR. An individual with low RHR and a high MHR will have the highest functional reserve. To determine the HRR, subtract the RHR from the MHR. A 20 year old male's MHR is 200 bpm. If his RHR is 50 bpm then his HRR is 200-50=150 bpm. To use the HRR to determine an appropriate heart rate response for the desired training intensity, multiply the HRR x desired training % (between 40-100%). If the goal desired training level is light (60-70% intensity) then multiply 150 bpm x .60% and 150 bpm x .70%. The numbers are now 150 bpm x .60 = 90 bpm and 150 bpm x .70 = 105 bpm. Then add the RHR back to both numbers. 90 + 50 = 140 bpm and 105 + 50 = 155 bpm. Therefore, his expected heart rate training zone at 60-70% intensity is 140-155 bpm. This computation formula is also known as the Karvonen Equation.</p>	<p>As in the example to the right, a well-trained, young athlete may have a HRR of 150 bpm or more. The HRR will decrease as RHR increases and MHR drops due to an increase in age. Determining heart rate training zones by use of the HRR (use Karvonen Equation) is not a stand alone tool. Rate of perceived exertion must be used in conjunction with the expectation of heart rate response during exercise. A heart rate monitor should be worn at all times by the individual exerciser with the watch on the trainer for close observation of client response. It should be noted that the beginning exerciser or the individual who does not feel well will report an RPE different than the heart rate response shown on the monitor. If this is the case, the intensity should be maintained at a level consistent with RPE. Heart rate monitoring is perhaps the most effective tool for measuring exercise intensity, but it is not perfect.</p>
<h3>Polar STAR™</h3> 	<p>The Polar STAR™ program is a training aid that enables the user to prepare appropriate exercise programming and intensity levels. The program recommendations are based on the Polar OwnIndex® fitness test conducted using a Polar FT80 heart rate monitor or its equivalent. This test is based on oxygen uptake capacity and can be used as a very accurate measurement of VO₂ in the absence of VO₂MAX measurement from a doctor supervised test.</p>	<p>The program advises the user to determine current fitness levels by using the Polar OwnIndex® fitness test (measures RHR for 255 beats and computes VO₂MAX in conjunction with variables of weight, height, age, gender, and current activity level) or by entering values determined from direct measurement of VO₂MAX. The user then chooses the goal of the cardiovascular training program (maintenance, improvement or maximization) and defines the number of workouts he or she can perform weekly. The program will recommend a certain number of programs per week (3 or more) of varying duration (25 minutes to almost 2 hours) and intensity (60-90%). It also provides caloric expenditure for each goal and the actual exercise session, when the heart rate is being monitored.</p>
<h3>Polar OwnZone®</h3> 	<p>The Polar OwnIndex® fitness test will determine appropriate heart rate training zones (Polar OwnZone®) at different intensity levels once weight, height, age, gender and activity level are entered or a VO₂ direct measurement value is entered.</p>	<p>It is recommended that each individual determine their OwnZone® at the start of each workout to train at the appropriate intensity. The user can track duration, heart rate target zone, time spent in the training zone and the time of day or the training goal (calories or time) of the current workout. After training, the electronic diary displays information gathered from the workout as well as a weekly summary. The diary contains the number of workouts (exercise counter), total duration of all workouts (time), caloric expenditure and the actual values compared to target values. The weekly feedback shows the user how close they have come to meeting the weekly goal (by percentage). No mathematical formulas are required as the Polar monitor does all the computation. Other than a true VO₂MAX test, the Polar OwnZone®'s training zones are as accurate as any VO₂ submaximal test in determining appropriate heart rate training zones.</p>

Types/Modes of Cardiovascular Activity

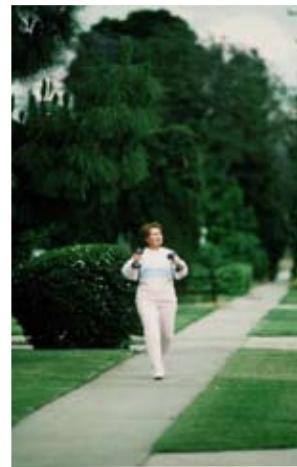
Everyone has an opinion about the best form of cardiovascular exercise. Just like resistance training, there is no one best exercise. Sometimes the best exercise is the one the client will do, as long as the risks or drawbacks do not outweigh the benefits. For this reason, it is important for each individual to understand the demands, limitations, benefits and drawbacks of each of the major forms of cardiovascular exercise inside and outside of the gym. It is the trainer's job to explain these variations to the client during the first few training sessions, as most time spent on cardiovascular activity will be spent without the trainer's supervision. Using the Polar HRM diary to keep track of cardiovascular data can be very useful for review prior to or following a strength training session. Whichever form(s) of cardiovascular exercise is(are) used it is imperative that a reasonably healthy individual either walk, jog or run combined with at least one or two other forms of cardiovascular exercise to provide different stimuli, avoid overusage of specific muscles and provide a psychologically different venue for purposes of motivation and maintaining interest in the activity. It is advised to engage in sports activity only after a baseline of cardiovascular conditioning, strength and mobility can be established. This baseline is up to the professional interpretation of the trainer with the best interests (1st) and needs (2nd) of the client in mind.

The various types/modes of cardiovascular activity may include:

Walking

Each individual must demonstrate the ability to perform prolonged walking without fatigue before engaging in other more strenuous exercises such as jogging, running or sports that require more intense activity. Here the emphasis is not a training heart rate (THR) but on continuous activity of longer duration to build up endurance levels and increase circulation and the efficiency of various hormonal processes. Walking is an ideal activity for both therapeutic and health benefits due to the mental relaxation it offers

with the opportunity to reflect on feeling and thoughts of the day. It is not uncommon to perform more efficient thinking and thought processes while venturing outdoors or walking indoors on a treadmill than while sitting at a desk or computer.



Jogging

Walking becomes jogging when the individual moves at a speed and form that requires "flight" between foot strikes. This could be as low as 3 or 4 mph or closer to 6 or 7 mph, depending on the individual. It has been determined that the net energy cost of jogging is about twice that of walking and requires a greater cardiovascular response. There is much greater stress on joints, muscle and connective tissue as speeds increase due to increased impact forces on the body. However, it must be noted that the body was made to be able to tolerate such forces as long as the individual is able to jog with appropriate form and on variable surfaces with appropriate shoes. Jogging may not be advisable for individuals with specific physical muscular or joint dysfunctions or injuries or who are particularly overweight. Shoes tend to wear down internally long before external wear can be observed. For this reason, any shoes worn regularly with high activity should be replaced every 3-6 months, every 6-12 months with regular moderate activity and at least once a year for regular light activity. Any individual who jogs or runs regularly should be encouraged to purchase running shoes from an establishment with qualified professionals who will watch the individual jog/run to help determine the appropriate shoes to be worn.

Running

Jogging becomes running when the activity is performed at a sufficiently high level that the intensity can only be performed for between a few seconds or several minutes for the average person. Running is one of the highest energy-

consuming forms of activity/locomotion. An individual must cycle at least twice as long as running to obtain a similar cardiovascular effect. Competitive athletes are able to sustain high running speeds for significantly longer periods than the average fitness enthusiast.

Running requires speed of movement where both feet are off the ground in between foot strikes. This requires a very high level of exertion and requires that the ability of the individual be high enough to not only accelerate under control but to stabilize and decelerate appropriately and safely, while maintaining control as well. Natural muscular shock absorption reduces with fatigue and the impact is increased dramatically. Much like jogging or any other activity, if the individual cannot land softly to reduce the forces created from their own momentum and be able to maintain satisfactory form then the intensity level or speed should be significantly reduced until coordination and control can be established. It should not be expected that everyone will run the same and there is no perfect technique. However, it is important for the individual to :

- 1) Lean slightly forward to allow gravity to help pull the body forward during gait



- 2) Look forward about 10 yards to help maintain appropriate running posture and vision forward
- 3) Stride naturally to avoid overstriding and putting excessive stress on the body (uphill running at a 10% or greater grade can help increase stride length naturally)
- 4) Perform a natural arm action with wrists and elbows gently brushing the side/shirt with elbows flexed at approximately 90-110 degrees (depending on speed of movement and stride length) and the hands closed around an "egg" to emphasize a slightly closed but relaxed grip (all out sprinting may advocate an open palm with wrist/forearm in neutral position)
- 5) Perform slight downhill running (10-15% or lesser grade) to naturally increase stride rate or frequency of strides (lunges will not help with stride length or stride rate but will provide functional strength)
- 6) Work on overall body strength with a well-designed resistance training program (lower body, core and upper body) to help the individual increase strength and coordination to find their own running form more efficiently (teaching efficient running form in an individual lacking sufficient overall strength will merely complicate problems for the individual over time)

Differences Between Impact Forces Due To Various Activity Surfaces

Activity Surfaces	Concrete/Sidewalk	Asphalt/Road	Hard Pack Sand/Dirt	Wood Floor	Cinder Track	Rubber Track/Floor	Grass	Loose/Soft Sand/Dirt/Bark
Impact Forces on Body During Landing*	High	Mod-High	Mod-High	Mod	Mod	Low-Mod	Low-Mod	Low

* While harder surfaces may be harder on the body during landing, softer surfaces require much higher levels of coordination and muscular conditioning to be able to exert sufficient force and control during exercise/exertion due to a surface that tends to "give".



Swimming

Gravitational forces are reduced in water to reduce the impact of exercise. Swimming can be a very useful tool for recovery from land exercise to help joints, connective tissue and muscles recover adequately. The high resistance of water can help increase strength in the many muscles that are not used with typical cardiovascular activity. Like recumbent biking, swimming may be a very suitable starting activity for an overweight or obese individual. Some HR monitors can also be used underwater for measuring intensity and body response to training.



Cycling

Cycling indoors (on an exercise bike of course) or outdoors can provide beginners with an easy to perform activity with little coordination or skill demand and cycling can also be used as a tool to get off one's feet from moderate to high intensity walking, jogging or running. A recumbent bike requires leg extension toward a forward position, while seated in a reclined position (as opposed

to a normal seat position on a bike), and can be a very useful cardiovascular tool for individuals who are particularly overweight or who may have difficulty with other pieces of equipment. It should be noted, however, that the recumbent bike can be very "hamstring dominant" due to the flexed hip position with the legs extended. The upright bike (normal seated position) utilizes more quadriceps involvement and can involve the glutes significantly when riding out of the saddle (seat). The seat height should be positioned so that the individual has a slightly flexed knee at the bottom of the cycle stroke with the foot on the pedal. The ankle should plantarflex on the upswing and dorsiflex on the downward swing phase of the cycling motion. An overly flexed knee can result in lesser force production and an overly extended knee can result in injury. Cycling shoes are not necessary unless desired or the client engages in intense outdoor cycling. Using a heart rate monitor while biking can provide feedback on speed and distance in addition to caloric expenditure and heart rate response to training.

Elliptical Trainer

The elliptical trainer is a favorite of many at the gym. The elliptical trainer is easy to use and reduces the impact forces of the body at landing due to gravity during walking, jogging or running activities. However, the elliptical trainer should be used as an alternative and not a primary activity if possible. Many elliptical trainers (although not all) shorten the stride range of motion with each stroke. It is important that the client not "bounce" and maintain feet firmly on the plates. This may increase the intensity of the exercise and the tension or elevation levels may need to be reduced. Like any exercise, if it is enjoyable for the client, he or she should be encouraged to use it properly. But, barring injury or physical disability, the client should seek to utilize some form of impact training as well in order to maintain or increase functional strength and bone density.

Rowing

Rowing can be a great alternative cardiovascular exercise as it includes a healthy proportion of

upper and lower body muscular endurance. Technique is key with this motion. Consulting with a rower is advisable to learn efficient rowing technique, in order to optimize this exercise.



Sport

Sports activities require greater levels of energy expenditure, coordination, conditioning and skill. It is imperative that individuals have the necessary base of conditioning before playing sports that require multiple changes of direction played at high speeds or more complex movements and joint range of motion/overall mobility. It is much more difficult to maintain a consistent heart rate or exertion level while playing sports or other game activities. While this is true in most life situations, the activity often goes for several minutes or hours and can be very stressful to beginners or to average level fitness enthusiasts.

Training methods for various forms of CV exercise

There are various forms of cardiovascular exercise intensity that can be chosen, once the appropriate exercise type or form has been chosen. Some forms are known as:

Long, Slow Endurance Exercise

Long (45 minutes or more), slow (60-70% intensity) exercise training is generally used to follow a higher intensity training session from the previous day to allow the body time to recover and recuperate. This form of training is crucial for not just endurance athletes, whose

sport involves activity for 45 minutes or more in length with little recovery time, but also for the general fitness enthusiast, too, who seeks to maintain a higher metabolism. Long, slow endurance type exercises do not overwork the body's systems by keep performance demands at a low- to moderate level. Such lower intensity cardiovascular workout sessions also help to give the body time to replenish glycogen stores which may take 36 hours or more to replenish after a high intensity workout.

High Intensity Continuous Exercise

There is a growing body of research that supports continuous, high intensity exercise to improve VO₂MAX and lactate threshold (OBLA). Such efforts should be performed at around 80-90% intensity for 25-50 minutes, following an adequate warm-up period. It should be noted that such intensities can be more harmful than good for the beginning to moderate exerciser, as the endocrine system and connective tissue need several weeks or months of light to moderate training to adapt to avoid injury or illness before higher intensity exercise should be undertaken. The body systems that cannot be seen should not be forgotten.

Interval Training

Interval training makes use of repeated exercise bouts with brief recovery periods in between. A longer cardiovascular exercise work interval (75-85% intensity for 1-3 minutes) with shorter recovery period (equal to or less than the work period OR until a HR of 120 bpm or less is achieved) is more suitable for aerobic conditioning and a shorter more intense interval (85% or greater intensity for 15-60 seconds) with a longer recovery (3-5 times the length of work period OR until a HR of 120 bpm or less is achieved) is more suitable for anaerobic conditioning. The determination of intervals should be based on the individual's current conditioning and goals. Individuals should start with aerobic conditioning intervals repeated 4 or more times then progress to anaerobic conditioning intervals repeated as many as 10 times or more, depending on the goal and conditioning of the client. If the

individual is unable to maintain or improve intensity the interval work should be stopped. The last repetition of any exercise or form of exercise, regardless of the goal or individual, should always be the best repetition. The goal should be to see the client or individual improve with each repetition, not decline. Appropriate design of work-rest ratios is crucial for adequate adaptation and to avoid overtraining. It is recommended to avoid the automatic intervals on most cardiovascular machines, unless the interval intensity and duration of activity can be changed during exercise or before beginning the program.

Designing CV Exercise Programs

Once the client's overall goal has been determined, the trainer can help design the appropriate cardiovascular exercising program to meet his or her wants and needs.

Advise the client to use the rate of perceived exertion (RPE) throughout each bout of exercise to ensure training at the appropriate planned intensity. It is expected for intensity to gradually increase as the workout progresses, just as it is expected for the client's capacity to handle higher intensity exercise, to increase over time (within the mesocycle). High intensity exercise should always be followed with recovery or light intensity exercise the next exercise session.

Encourage the client to use a HRM that can not only measure heart rate, but also one that determines the appropriate heart rate training zones, based upon the resting heart rate response for a fairly accurate measure of VO₂MAX (other than VO₂ max testing itself). Again, the HRM and RPE should be used together to provide optimal feedback.

Choose an exercise that will fit the desired intensity goal. It is advisable for beginners to start with walking, swimming and cycling. Moderate to higher level exercisers may choose to start with jogging, running or a sports activity. Remember, no form of cardiovascular exercise

is best, so choose a variety of stimuli.

The table on the following page can be used to help design an effective cardiovascular exercise program from day 1 through an entire training year.



Training Level	Training Calendar	Frequency	Recovery Intensity (40-60%)	Light Intensity (60-70%)	Moderate Intensity (70-80%)	High Intensity	(80-90%) Competitive Athlete (90-100%) (Optional)	Time per Session	Type/Mode of Exercise
Aerobic Base/ Recovery (Beginner)	Weeks 1-8 Months 1-2	3-5 total sessions/ week	1-3 sessions/ week	1-3 sessions/ week	0-1 sessions/ week	N/A	N/A	12-30 minutes	Continuous Activity
Aerobic Endurance	Weeks 9-17 Months 3-4	4-6 total sessions/ week	1-2 sessions/ week	2-3 sessions/ week	1-2 sessions/ week	N/A	N/A	20-60 minutes	Continuous Activity
Anaerobic Threshold Training	Weeks 18-30 Months 5-7	4-6 total sessions/ week	0-2 sessions/ week	1-2 sessions/ week	1-2 sessions/ week	1-2	N/A	20-90 minutes	Continuous Activity or Interval Training
Anaerobic Power (Athlete)	Weeks 31-47 Months 8-11	4-7 sessions/ week	0-2 sessions/ week	1-2 sessions/ week	2-3 sessions/ week	1-2	0-2 sessions/ week	20-120 minutes	Continuous Activity or Interval Training

FITTR principles applied to cardiovascular exercise training

It is generally recommended to engage in cardiovascular exercise at least 3-4 days per week in order to experience cardiovascular changes and morphological changes, such as weight loss. The cardiovascular program design table is divided into four training levels (mesocycles) to be used as a guideline.

Rate of progression is up to the professional, subjective interpretation of the personal trainer. A higher performing individual with a current base of training may be able to move up to the Anaerobic Threshold Training Level to start. Some individuals will have short term goals that must be met within 4-12 weeks and it will be up to the discretion of the trainer to determine if it is wise for the individual to advance into the higher levels of cardiovascular training at the onset of training.

It is expected that 3-4 weeks out of the training year, or the last month of the training year, be used to allow the client time to either play light

sports activity or engage in other light activity. This is to allow the body time to recuperate and to rejuvenate from the previous training year. In this way, the client will then engage in the beginning weeks of the training cycle yet again, the following year (new macrocycle); this will mean that the program design has to reflect higher levels of conditioning and performance capabilities. Only then will the client be able to progress adequately from month to month and year to year.

Overall Recommendations for Exercise

The recommendation from the ACSM and CDC is that EVERY U.S. adult should accumulate 30 minutes or more of moderate-intensity (3-6 METs) physical activity on most, preferably all, days of the week for a total of at least 3.75 hours of cumulative weekly exercise activity.

Optimal exercise is a balance between the FITTR principles. Frequency, Intensity, Time (Duration), Type (Mode), and Rate of Progression. The intensity and level of exercise exertion should always be based on an individual's fitness level

(as determined through assessment) and the goal(s) of the exercise toward improvement of health and/or fitness and/or performance.

It takes a minimum of 6 weeks on average to achieve a noticeable change in cardiovascular fitness. Less fit individuals see progress more rapidly. More active individuals will take longer to see positive adaptations. An average change in adult cardiovascular fitness is 12-15% in 10-12 weeks with moderate intensity exercise performed 3-4 sessions/week for 30-40 minutes/session.

Failure to plan is planning to fail. Failure to plan for periods of low, moderate and high intensity exercise along with occasional recovery workouts can lead to undertraining with poor results and little metabolic or morphologic adaptation or, even worse, overtraining. Overtraining can result in injury or reduction in ability to fight illness or disease due to a weakened immune system and fatigue from workouts that are consistently too long and/or too strenuous.

Functional Training 101

Over the past ten or so years, the term “functional training” has become a popular catchphrase in the fitness industry. Other terms such as “integrated training” and “optimum training” are almost used interchangeably. These terms are heard uttered by personal trainers, athletic trainers, yoga instructors, Pilates instructors and even group exercise instructors. However widely used, “functional” is often misunderstood, and even more misused.

Our goal today is to determine what functional training is, why it is important, and provide some examples.

The term function seems a little confusing. For the benefit of this course, we are going to term “functional” movements as those movements the body is biomechanically engineered to do in everyday life.

Notice that this definition has two elements we need to understand: how the body is engineered and what is the body designed to do

in everyday life. Most individuals in our society don’t live their lives using their bodies the way it is engineered to be used. Our bodies are designed to move, to go hunt and gather food, and to avoid predators. We’re meant to walk, run, climb, lift, etc. Unfortunately, the same prosperity that makes us such a wealthy society is what’s slowly corroding our bodies.

Furthermore, our bodies were not made to sit in chairs. They certainly weren’t designed to sit behind a computer screen all day. When we finally get up out of our chairs and attempt to use our bodies in a “functional” manner, injury often results. Why? Obviously, somewhere along the line, the machine broke down.

So basically, we’re engineered for a lifestyle we no longer maintain.

Remember in Chapter 1, about the Kinetic Chain? Human movement, while often looking simple, is the result of a complex series of events utilizing several of the bodies’ systems. The three main body systems that produce movement are the nervous system, the muscular system, and the skeletal system. The brain sends signals for a muscle to contract which in turn moves a bone about a joint axis. These three systems are often referred to as the “Kinetic Chain.” Kinetics is the study of forces, so the “Kinetic Chain” is the chain reaction of these three systems that cause the creation of force from within the body. So if there is an injury, it is often because somewhere in the chain, something has failed in its natural responsibilities.

Now that we have determined that functional training is training that stimulates our bodies to move the way it is naturally engineered (not necessarily how we treat our bodies in everyday life), how do we determine if an exercise is functional? Most trainers who study functional training would say that sitting on a leg extension machine and extending your knees would not be considered functional. Hopefully you would agree. However, it may be a stretch to say that we can picture any of our ancestors kneeling on a stability ball and doing curls, and this is considered functional by some. Why?

To answer the question of how functional training differs from other forms of training, we must first ask another question. If functional training is meant to mimic what our bodies are meant to do, we must ask ourselves – how are our bodies affected when we do these movements? Consider the following:

Functional Training is multi-planar.

i.e. the movement is not isolated or guided by an outside force. In life, it isn't often that you would sit down, with your back supported, and kick a weight off your shin in a guided path (unless you are in the gym).

Functional Training typically requires more neuromuscular control than non-functional.

Quite simply, the more you stimulate your nervous system, the better your brain is able to communicate with your musculoskeletal system and the better the physiological adaptation will be.

Functional Training incorporates many full-body movements.

Our muscles are not designed to work in an isolated fashion – even though this is the most popular way to train them.

Functional Training is dynamic movement under control.

When we move in everyday life, we must be able to decelerate, stabilize and accelerate the movements in the body. This is done by eccentric, isometric, and concentric contractions respectively.

Functional Training stays within the biomechanical limitations of the body (as all exercise should).

In other words, a trainer must have a good understanding of both joint and muscle structure as well as function, to prevent injuries from occurring.

Remember!! Progression, Progression, Progression!!! Be certain to create workouts for clients that their kinetic chain can handle. If they can't control the movement, make the exercise easier (by changing one or more variables) until proper control is maintained. Once mastered, increase intensity appropriately.

For greater details on Functional Training as well as many sample exercises, click on image below.

EXAM ALERT

What is functional training? What is a functional movement? What plane(s) of movement is/are common with functional training? Be able to identify “functional” exercises.



Conclusion

The guidelines for program design are based upon a solid foundation of scientific information. However, they are principles not laws. Therefore, the guidelines should be paired with both flexibility and a special emphasis placed on the goals of the client.

Additionally, the physiological and perceptual responses to exercise may vary considerably from person to person. People adapt to training at different rates and levels. What works for one person may not work for another! The most appropriate exercise program for a particular client is one that is most helpful in changing their lifestyle, improving their health, provides enjoyment of exercise and gets them to their goals.

Exercise Instruction

Microassessing Clients

Exercise instruction, when done properly, requires that trainers microassess movements, as an ongoing best-practice. From the onset, trainers have to know all of the anatomy and functional methods to train clients. Once exercises have been selected as part of the program design, trainers instruct clients on the proper sequence of movements, positioning and movement specific concerns. When we describe all of the elements of the *instruct* phase, we are really summarizing *microassessments* of movements- both in an overall way and from the client's movements, specifically.

At NESTA, we have developed both our system of personal training and our core philosophies based on science. We promote consistent themes as keys to our PFT program., from discussions about natural sciences, to the art of program design. Assessments have been mentioned before, as were macro and microassessments. Macroassessments are the more formal assessments, such as biometrics, used to monitor responses to an exercise program. On a microassessment level, we would be referring to the nuts and bolts of personal fitness training - because this is where we evaluate “*each rep of every set*” .

You will be teaching, coaching and instructing people to exercise in situations where there may be little or no past experience of regular physical activity in their background. Try to picture how difficult this could be for a client. Again, our clients don’t know HOW exercise works, but they will generally trust our knowledge, if we have done our job as professionals. This need continues into the realm of exercise instruction. In fitness circles, we can use words like *extension* and *adduction*, but it is not typical of our clients to be the same way in their communications.

Therefore, we have a lot of work to do. We have to do all of the background work, to determine the needs of the client and to assess their current health values. Then, we select exercises and develop a program design. We set out to teach our clients new movements, armed with all that we know about forces, program design and professionalism.

There can be a tendency to either over-think this part of fitness leadership, or in the case of less-professional trainers, a level of apathy or negligence when working with a client. To help summarize exercise instruction, we would need to include an advanced ability to simply *describe* exercise movements, in layman’s terms. We would also include *observation and evaluation*, as required for proper instruction. This is the microassessment component, once again. Lastly, we would then *instruct* the client on the proper execution of a desired movement. This may be occurring when first demonstrating an exercise for the client, or to redirect the client into a corrected movement pattern. This ability requires that observation and evaluation be constant. If your descriptions of the exercise are not clear, you may also be able to see this from the client’s body language or facial expression. It is a refined skill, but a necessary one for success.

You should recall that the *instruct* aspect of the NESTA system of personal training, as it is one of the four keys to being a NESTA PFT. This key competency and non-negotiable expectation of the PFT is a standard, much in the same way that we promote observing the *golden rules of personal training* or doing an exercise demonstration (mandatory) for the client, each time.

Describing new movements to clients is best if it is direct and simple. Your language should be non technical and clear. Clients can be curious about your methods. It is important to be able

to provide scientific rationale for those times when questions arise. This assures clients that you are being mindful of their goals. You will describe movements, then follow the description with a demonstration. If clients fail to execute a movement properly, or are working in a manner that requires intervention, the need to *re-describe* the movement may also be needed.

During observations and evaluations, the awareness is shifted to be more that of the trainer, and expectations are verified through close observa-

tion. This requires that you know what to expect initially, from the onset, when the exercise was selected for the clients' program design.

Instruction occurs at an ongoing pace for both the trainer and client. Clients learn to communicate more effectively and respond more positively to your instructions, over time, whereas your perspectives on instruction will be more subjective and related to client-centered goals and the big picture.

Exercise Instruction Guidelines

To determine which exercises are the best for the client's needs and the subsequent instruction of the exercise, the PFT always must keep three things in mind:

1) *Goal*, 2) *Starting Position* and 3) *Motion*. What is the intended goal of the movement? Instruct clients for how you want them positioned, and emphasize proper movement during demonstrations.

goal	Discover goals and needs of the individual <ul style="list-style-type: none"> • Obtained through depth of questioning from health history questionnaire • Goals must be specific enough to determine appropriate exercise based on need
	Assess individual anatomical limitations and current ability <ul style="list-style-type: none"> • Observed in static and dynamic postural assessments • Continually re-assessed by trainer observation of individual's general movement
	Establish desired motion to meet individual goal or need <ul style="list-style-type: none"> • Ensure that motion is not contraindicated by individual limitations • Choose exercises with the most significant benefit and least risk
starting position	Determine direction of resistance opposing desired motion <ul style="list-style-type: none"> • Usage of free weights or BW exercise always utilizes exercises which oppose gravity • Usage of machines, tubing, cable systems, etc., will vary in their direction of resistance depending upon positioning and motion Position starting point opposite resistance <ul style="list-style-type: none"> • Choose starting position based upon individual levels of coordination and control • Exercises must be mastered in the following manner before progressing to a new exercise or increasing exercise difficulty <ul style="list-style-type: none"> Stable to Unstable (i.e., push up on the floor before on a ball)* Static to Dynamic (i.e., plank or bridge before a crunch)* Slow to Fast (i.e., concentric-only movements breed injury and joint dysfunction)* Simple to Complex (i.e. knee extension before a squat)* • Each progression is dictated by ability to perform movement and irrespective of load.
motion	Monitor joint positioning and stabilization of every repetition in the following order: <ul style="list-style-type: none"> • Spinal positioning is of the greatest importance regardless of exercise selection or goal • The joints involved in the movement performed • Remaining joints (entire body) Facilitate proper path of joint motion <ul style="list-style-type: none"> • Maintain alignment in direct opposition to resistance and avoid rotation or movement which does not directly oppose resistance • Determine and guide the range of motion. Range Of Motion (ROM) has three main variables: Active Range Of Motion (AROM): individual muscular ability to move Passive Range Of Motion (PROM): movement of the joints due to an external force Resisted Range Of Motion (RROM): the mover's ability to move while loaded

Having determined the proper way to choose and apply an exercise, a few of the major exercises are listed below, along with a description of the muscles involved and methods for efficient performance. With any exercise, it is advisable to have a trainer monitor and observe technique and form. In the case of lifting heavy loads a spotter is always required for the safety of the lifter and those nearby. Olympic lifts (squats, cleans, snatch, etc.) also require a spotter when the load is heavy. Whenever loading occurs through the spine (shoulder press, Olympic lifts) requiring a complex number of joint movements, the exercise is known as *structural*. This differs from a *compound* exercise, which also incorporates movement of multiple joints (DB chest press, leg press, etc.) but is not necessarily loaded through the spine. Simple exercises are also known as single-joint exercises.

As their name suggests, the motion occurs entirely at one joint (DB biceps curl, knee extension, etc.)

Lower Body Exercises

All personal fitness trainers need to be aware of the more common exercises. Again, this is not an all-inclusive list. This section is meant to demonstrate the basics of proper technique as well as the rationale for designing exercises utilizing biomechanics principles.

Program design is the joining of the client's goals and the exercises selected by the personal trainer. When choosing exercises and designing the client's fitness sessions, keep in mind their health history, goals, and proper progression.

leg press

goal	To work the major muscles of the Hips and Thighs <i>Prime Movers:</i> Gluteus Maximus and Quadriceps (Rectus Femoris, Vastus Intermedius, Vastus Lateralis, and Vastus Medialis) <i>Secondary Movers:</i> Hamstrings, Calves <i>Stabilizers:</i> Hip Rotators, Trunk Stabilizers	Exam Alert: What are the primary muscle groups? It is important to press with what part of the foot? What is the proper position of the pelvis? What is proper knee alignment? What direction is the force of the leg press pushing her into (i.e. flexion, extension)?
starting position	<ul style="list-style-type: none"> Shoulders should remain back against the pad, with a neutral spine The pelvis should remain in contact with pad at all times Foot position will depend on femur length (most will be comfortable between hip and shoulder width - try different foot positions until individual is comfortable) 	
motion	<ul style="list-style-type: none"> Work through a controlled full range of motion without locking out the knee (hyper-extending) Knees should track over the second and third toes Feet should not externally rotate more than 10-15 degrees unless knee is not anatomically capable of aligning with the toes (knee varus – knock kneed) No posterior pelvic tilt on descent Press with whole foot (not just ball of foot) 	
notes	The leg press differs from a conventional squat in that the start position has the client in about 90° of hip flexion. There is much less range of motion and innervation of the gluteus maximus as the legs reach full extension. Turning the feet inward or outward does not put more emphasis on one quadriceps or calf muscle over another. Internally or externally rotating the feet results in internal or external rotation of the entire leg. Since foot rotation cannot occur without rotation of the entire leg, this rotation can potentially cause excessive stress at the knee and/or hip.	

squat

goal	<p>To work the major muscles of the Hips and Thighs <i>Prime Movers:</i> Gluteus Maximus and Quadriceps <i>Secondary Movers:</i> Hamstrings, Calves <i>Stabilizers:</i> Hip Rotators, Trunk Stabilizers</p>	<p>Exam Alert: What are the primary muscle groups in a squat? What determines the depth of a squat? For a healthy individual, how many degrees of knee flexion would be in this exercise? What is the alignment of the body at the bottom position of a squat? What is the proper eye focus on the squat?</p>
starting position	<ul style="list-style-type: none"> •Vary foot position depending on the mechanics of the individual with feet approximately shoulder width apart or slightly wider •External rotation at the hip should not exceed 30 degrees •Maintain a neutral spine and cervical alignment (activate TVA - Transverse Abdominus) •Eyes should be level with horizon •Bar placement should be approximately on posterior deltoids and across the trapezius (above T-1 and below neck) 	
motion	<ul style="list-style-type: none"> •Knees should track over second and third toes, with weight balanced between the fore foot and heels - No extraneous eversion or inversion at the foot •Maintain controlled, even movement - No movement side-to-side •Maintain neutral spine through the whole range of motion - Watch for anterior/posterior tilt of the pelvis as one descends into a squatting position •Depth of squat dependent on goal as well as the mechanics and skill of individual. The limiting factors are typically knee tracking and maintenance of neutral spine (i.e. these are the areas which are most commonly sacrificed when one squats deeper). These are also the areas which have a higher risk for injury with deeper squats. 	<p>Spotting for a loaded squat should be done from behind with spotter's hands on anterior deltoids to cue upright trunk.</p> 
notes	<p>The squat is a structural exercise and is often thought to be the most significant lower body exercise since it incorporates greater muscular involvement of the hip flexors and extensors and knee flexors and extensors than any other lower body exercise. It is important to note that an individual must be able to perform an effective BW squat before loading in this exercise. Inability to perform an effective BW squat may be indicative of significant weakness or tightness, requiring a simple isolated exercise to address a potential weakness in the kinetic chain..</p>	 VIDEO click here

lunge

goal	To work the major muscles of the Hips and Thighs <i>Prime Movers:</i> Gluteus Maximus and Quadriceps <i>Secondary Movers:</i> Hamstrings, Calves <i>Stabilizers:</i> Hip Rotators, Trunk Stabilizers	<p>Exam Alert: What are the primary muscle groups in a lunge? Why is it important to drop straight down rather than forward and down in a lunge?</p>
starting position	<ul style="list-style-type: none">Maintain a neutral spine and cervical alignmentChest should remain elevatedFeet are staggered front-to-back with an exaggerated step but maintaining normal hip width	 A photograph showing a woman in an orange shirt and black shorts performing a lunge. She is in a deep lunge position, with her left foot forward and her right knee touching the ground. A man in a white shirt and khaki pants stands behind her, providing guidance or assistance. They are in a gym setting with various exercise equipment visible in the background.
motion	<ul style="list-style-type: none">Knees track over second and third toesWeight balanced between forefoot and heelsLower load or BW in a controlled manner and return with control to the starting positionWork through a controlled full range of motion (individual ROM will vary)	 A photograph showing a woman in an orange shirt and black shorts performing a reverse lunge. She is in a deep lunge position, with her right foot forward and her left knee touching the ground. A man in a white shirt and khaki pants stands behind her, providing guidance or assistance. They are in a gym setting with various exercise equipment visible in the background.
notes	Lunges have often been thought to be stressful to the knee joint. Stress to the knee is most significant during forward walking lunges due to the difficulty of controlling the movement and avoiding unnecessary forward movement and undesirable stress at the knee. Reverse lunges can aid in this endeavor. Focus upon stationary lunges with good form may be necessary to ensure that the individual drops down in line with gravity and avoids excessive forward or backward movement during the downward phase of the lunge. It is important to be less concerned with the positioning of the knee in relation to the foot and more aware of the body's total direction of movement in line with the forces that are involved in the movement.	

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knee extension

goal	To work the quadriceps (knee extensors) <i>Prime Movers:</i> Quadriceps <i>Stabilizers:</i> Abdominals	Exam Alert: What are the primary muscle groups in a knee (leg) extension? How are the knees aligned on the machine? For what client goals is this exercise suitable?
starting position	<ul style="list-style-type: none">Line up knee with pivot point of the machineLine up pad where it is most comfortable for individual (on shin not foot or ankle) with the patella centered so the axis of the knee is lined up in direct opposition to the applied force (avoid external or internal rotation)Feet should remain in a neutral positionMaintain a neutral spine (TVA activation) and cervical alignment	
motion	<ul style="list-style-type: none">Utilize controlled, full range of motion (varies with individual) into knee extensionNo pelvic movement	
notes	The knee extension may be contraindicated for an individual with significant knee trauma or injury. Since the axis for this movement is the knee it is of crucial importance that the knee as the axis can handle significant loading. This exercise can be particularly beneficial for hypertrophy gains in the quadriceps region or for isolated activation, but the knee must remain the greatest factor in decisions for utilization of this exercise. Standing cable knee extensions may aid in decreasing shearing forces on the knee. Full range of motion for the rectus femoris is not possible in the seated position since the rectus femoris also aids in hip flexion with the individual already in a significantly flexed hip position.	

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prone leg curl

goal	To work the hamstrings (knee flexors) <i>Prime Movers:</i> Hamstrings <i>Secondary Mover:</i> Gastrocnemius <i>Stabilizers:</i> Abdominals	Exam Alert: What are the primary muscle groups in a knee (leg) curl? How are the knees aligned on the machine? For what client goals is this exercise suitable?
starting position	<ul style="list-style-type: none">•Position lower extremity pad around Achilles tendon area or where it is most comfortable for the individual•When properly aligned, the pad will not move up and down the leg•Knee joint should be directly below the pad that the thigh is resting upon•Line up the pivot point of the machine with the axis of the knee joint•Patella should centered and pointing directly toward floor (avoid external or internal rotation)•Maintain neutral spine (TVA activation)	
motion	<ul style="list-style-type: none">•Utilize controlled, full range of motion (varies with individual) into knee flexion•Maintain a neutral spine and cervical alignment - No hip motion (No Anterior or Posterior Pelvic Tilt)	
notes	The prone leg curl does not allow for full activation of the hamstrings since hip extension is necessary and not possible in a prone lying position on a machine. The hamstrings act primarily in a functional setting as a hip extensor and stabilizer.	

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standing calf raise

goal	To work the calves <i>Prime Movers:</i> Gastrocnemius and Soleus <i>Stabilizers:</i> Ankle/Foot Complex, Abdominals and Pelvic Stabilizers	Exam Alert: What are the primary muscle groups in a standing calf raise? How is this different from a seated calf raise? What is the approximate ROM on the down phase of the exercise?
starting position	<ul style="list-style-type: none">Place feet facing forward on platform with feet about hip width apart (avoid internal and external rotation)Knee should be held (not locked) in extension (not hyperextension)Maintain neutral spine (TVA activation)	
motion	<ul style="list-style-type: none">Utilize controlled, full range of motion (varies with individual) into dorsiflexion (approx.. 10 - 20°)Maintain a neutral spine and cervical alignment - No hip motion (No Anterior or Posterior Pelvic Tilt)	
notes	<p>An individual should be able to perform a BW standing calf raise and achieve at or near 45 degrees of plantarflexion and 10-20 degrees of dorsiflexion (in most situations) with good form before adding additional loads.</p> <p>Seated calf raises differ from standing in that a seated calf raise will emphasize the soleus while a standing calf raise will emphasize the gastrocnemius. This is because the gastrocnemius is a two-joint muscle (it crosses the knee and the ankle). In a seated position, the knee is flexed. Hence the gastrocnemius is shortened and cannot activate well due to active insufficiency.</p>	

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Trunk Exercises

crunches

goal	<p>To work the abdominals <i>Prime Movers:</i> Rectus Abdominus <i>Secondary Movers:</i> Internal/External Obliques <i>Stabilizers:</i> TVA, Pelvic Stabilizers</p>	<p>Exam Alert: What are the primary muscle groups in a crunch? Be able to name other exercises which work these muscle(s). What motions are required for proper activation of the rectus abdominus?</p>
starting position	<ul style="list-style-type: none">• Lay individual supine with hands across chest, on floor, or behind neck (do not pull on neck – the further the hands from the midsection, the more the intensity of the exercise increases)• Maintain cervical alignment	 A man is performing a crunch exercise on a large white exercise ball. He is lying supine with his feet flat on the floor and his knees bent. His hands are clasped behind his head. He is leaning forward, bringing his upper body towards his knees. The ball is supporting his lower back and midsection.
motion	<ul style="list-style-type: none">• Maintain contraction in abdominals and flex spine bringing rib cage toward pelvis (flexing lumbar and thoracic spine only)• Return slowly to the starting position while maintaining contraction in the abdominals• Perform a controlled, full range of motion	 A man is performing a crunch exercise on a large white exercise ball. He is lying supine with his feet flat on the floor and his knees bent. His hands are clasped in front of his chest. He is leaning forward, bringing his upper body towards his knees. The ball is supporting his lower back and midsection.
notes	<p>Crunches can be performed on a ball, the floor, a bench, and many various surfaces. A posterior pelvic tilt must occur in conjunction with spinal flexion if significant innervation of the rectus abdominus is to occur. For this reason, the knees should remain flexed to allow for greater control of pelvic movement and decreased stress to the lumbar region of the spine. Whether the floor, bench, ball or some other surface is used is goal dependent and specific to the needs and level of the individual.</p>	

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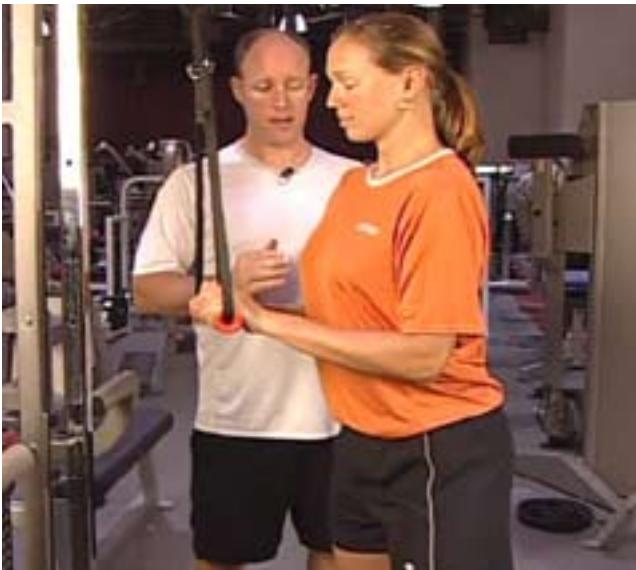
hyper-extension bench (45°)

goal	To work the Spinal Extensors <i>Prime Movers:</i> Erector Spinae, Hip Extensors (Hamstrings and Glutes)	Exam Alert: What are the primary muscle groups in a hyper-extension? Be able to name other exercises which work these muscle(s). What portion(s) of the spine should extend in this exercise?
starting position	<ul style="list-style-type: none">Position individual so that top of pelvis is lined up with the top of the pad (anterior sacroiliac spine or ASIS must be just above axis of machine)Individual crosses arms on chest and slowly brings trunk towards pelvisAvoid hyper-extension of spine beyond normal range of spinal extension (if extension occurs only at spine and not hips then hyper-extension will be avoided)Maintain cervical alignment	
motion	<ul style="list-style-type: none">Perform full, controlled range of motion (varies with individual - Flexion/extension of thoracic and lumbar spine only with stable hips OR Flexion/extension of hips with neutral spine)	
notes	Keep in mind that when the individual allows the torso to travel toward the floor as much as possible (hip flexion), the first 30-45 degrees will target erectors of the spine with little activation of the hip extensors. Therefore, minimal to no loading should occur due to the inability for the spine to support such forces in this position. The final 10 to 50 degrees (varies with individual) of motion with a neutral spine will target the extensors of the hip. To allow full innervation of the spinal erectors, a full range of both spinal flexion and extension must occur.	

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Upper Body Exercises

standing triceps push-down

goal	To work the Triceps (elbow extensors) Prime Movers: Triceps Brachii Stabilizers: Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, And Subscapularis	<p>Exam Alert: What is the proper shoulder position in a triceps push-down? Elbow position? Wrist position?</p>
starting position	<ul style="list-style-type: none">•Grasp bar with hands about shoulder width apart•Flex forward slightly at the hip•Maintain fixed elbow position at the sides of the body through the entire movement•Maintain a neutral spine and cervical alignment	
motion	Perform full, controlled range of motion (varies with individual)	
notes	Particular care must be taken to avoid extension at the lumbar spine throughout the movement. An excessively heavy load may cause the individual to attempt to achieve a full range of motion by arching (extending lumbar and/or thoracic spine) to gain a greater advantage and putting excessive stress upon the discs and connective tissues of the spine. Elbows must remain fixed if maximum benefit is to be gained. Wrists may either be neutral, supinated or pronated for similar benefit to the triceps brachii. Rotation of the wrists will not affect triceps activation or development.	

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lateral raise

goal	To work the middle deltoid Prime Movers: Middle Deltoid, Supraspinatus Stabilizers: Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis	<p>Exam Alert: What are the primary muscle groups in a lateral raise? Which muscle is primarily responsible for the first 30° of shoulder abduction? In what way will changing body position change the exercise?</p>
starting position	<ul style="list-style-type: none">•Grasp DB with a neutral hand position (palms face downward)•Maintain a neutral spine and cervical alignment	
motion	<p>Abduct arm to approximately 90 degrees or less (avoid shoulder impingement) and lower to within a few inches of hips</p> <ul style="list-style-type: none">•Perform full, controlled range of motion (varies with individual)	
notes	<p>Depending upon positioning of the body or rotation of the shoulder, shoulder raises will innervate either the anterior, middle, or posterior deltoids differently. Bending forward at the hip until the upper body is roughly parallel to the floor while abducting arms out to sides will focus primarily on the posterior deltoids. Keep in mind that approximately the first 30 degrees of shoulder abduction in the frontal plane is the job of the supraspinatus, and the remaining motion is assumed by the deltoids. Spotting should occur underneath the forearm.</p>	

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front lat pull-down

goal	To work the Latissimus Dorsi <i>Prime Movers:</i> Latissimus Dorsi, Biceps Brachii <i>Stabilizers:</i> Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis
starting position	<ul style="list-style-type: none">•Position hips directly under boom arm so bar line falls in front of individual's head•Horizontally abduct shoulders to 90 degrees with forearms grasping the bar at an approximately 90 degree angle in relation to the upper arm•Lean back slightly•Maintain a neutral spine and cervical alignment
motion	<ul style="list-style-type: none">•Pull bar down towards the upper chest and bring arms into the side of the body, maintaining the forearms vertical and parallel to one another at the bottom phase of the movement•Return slowly under control to the starting position•Maintain constant tension at the upper phase of the movement by not allowing the arms to completely extend or "hang"•Perform full, controlled range of motion (varies with individual)
notes	<p>Studies have shown that performing a lat pull-down movement by pulling behind the head and neck toward the shoulders puts excessive stress upon the anterior shoulder and possibly the cervical spine as well. In addition, greater innervation and activation of the latissimus dorsi is achieved from a front pull-down, not a behind-the-neck pull-down. The risks are too high with minimal benefit for a behind-the-neck pull-down. If the individual leans too far forward in a front pull-down, the exercise involves the lats increasingly less and the rhomboids increasingly more. Leaning back too far may also cause unnecessary curvature of the spine and create the need to devote too much neurological energy into maintaining spinal position, to the detriment of the lat development.</p>



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seated cable row

goal	To work the Latissimus Dorsi <i>Prime Movers:</i> Latissimus Dorsi, Biceps Brachii <i>Stabilizers:</i> Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis	
starting position	<ul style="list-style-type: none">Maintain a slight bend at the knees while standing with pulley directly in front of the bodyLean forward to grasp the bar, then sit down on pad with the legs slightly flexedPlace feet on foot rest to stabilize bodyRetract shoulders slightlyMaintain a neutral spine and cervical alignment, do not lean forward or backward during the exercise (clients may only lean forward slightly while bending at the knees or standing up to grasp or replace bar)	
motion	<ul style="list-style-type: none">Pull bar toward ribs, only so far as is possible, while maintaining a neutral spine and keeping forearms in line with pulley/movementPerform full, controlled range of motion (varies with individual)	
notes	Grip on the bar in the cable row may vary, just as long as joints are able to stay in line with the movement and excessive internal rotation at the shoulder is not produced. The individual must not rock back and forth or extend and flex at the spine during the movement. Legs must be flexed at a comfortable angle.	

one arm DB row

goal	To work the Latissimus Dorsi <i>Prime Movers:</i> Latissimus Dorsi, Biceps Brachii <i>Stabilizers:</i> Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis	
starting position	<ul style="list-style-type: none">Position hands directly below shoulders and knees directly below hipsAlign trunk parallel to the floorPosition foot on floor on same side as the arm performing the rowMaintain a neutral spine and cervical alignment	
motion	<ul style="list-style-type: none">Pull DB toward the ribs and slightly brush side with elbow (as size of individual will allow) if possibleMaintain forearms approximately perpendicular to floor during entire movementLower DB in a controlled manner through same path of motionPerform full, controlled range of motion (varies with individual)	
notes	<p>It is important that the individual position their body appropriately prior to grasping DB. If shoulder continually drops during downward phase of movement the load may need to be decreased. In order to avoid excessive stress upon the spine and allow maximum innervation of the lats, a neutral spine must be maintained with particular attention toward avoidance of twisting, rounding or excessively arching the spine.</p>	

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arm curl

goal	To work the Biceps Prime Movers: Biceps Brachii, Brachialis, Brachioradialis Stabilizers: Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis	
starting position	<ul style="list-style-type: none">•Grasp DB or barbell to allow for carrying angle (supinated grip)•Let elbows relax at side of body•Maintain a neutral spine and cervical alignment	
motion	<ul style="list-style-type: none">•Maintain elbow at side of the body through entire movement•Maintain a neutral spine and cervical alignment•Perform full, controlled range of motion (varies with individual)	
notes	The differentiation of the DB curl and the barbell curl is an open-chain exercise for a closed-chain exercise. Maintaining proper posture, elbow and wrist alignment is more difficult with a barbell due to its fixed position with an inability to move without affecting multiple joints. Avoid swinging of the arms (involves shoulder flexion) or swaying back and forth (hip or back extension) to avoid injury and maintain stress upon the elbow flexors and forearm musculature. Wrists must remain supinated in order to ensure proper activation of the biceps brachii. Stand behind the client to make sure their spine is aligned and their elbows do not move into full extension.	

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chest press

goal	To work the chest Prime Movers: Pectoralis Major, Triceps Brachii, Anterior Deltoid Stabilizers: Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis	<p>Exam Alert: What are the primary muscle groups in a chest press? What is the proper spotting position for this exercise? How is this different from a barbell bench press?</p>
starting position	<ul style="list-style-type: none">Lie supine on the pad or bench (with eyes directly below bar with bench press)Maintain pelvis firmly on pad at all timesPress feet firmly on floorMaintain a neutral spine and cervical alignment	 A man is seated on a weight bench in a gym. He is holding two dumbbells with both hands, arms extended straight out in front of him. His feet are flat on the floor, and his back is straight against the bench. He is wearing a white t-shirt, orange shorts, and white sneakers.
motion	<ul style="list-style-type: none">Allow arms to extend slightly before full extension (do not lock elbows)Lower DB or barbell to a position approximately 10 degrees below parallelPerform full, controlled range of motion (varies with individual)	 The same man is shown again on the weight bench, but now his arms are bent and the dumbbells are positioned near his chest, showing the mid-range of the exercise.
notes	<p>The most significant difference between a bench press (barbell) and a DB chest press is that the bench press does not allow for a full range of shoulder adduction and thus does not fully innervate the pectoralis major. The bench press places a great deal more load upon the triceps brachii. The DB chest press is an open-chain exercise and allows for much greater innervation of the pectoralis major fibers. If an individual chooses to perform a chest press while lying on a ball or similarly unstable surface, care must be taken to ensure that the entire spine is supported (neck must not hang off unsupported). The chest press can also be performed with cables. The cable chest press (or pressing with resistance tubing) will allow for incline, flat, and decline press in one exercise. Resistance tubing and adjustable dumbbells are great options for trainers who travel to client homes or for home gyms. Trainers are to stand over the client and spot at the wrists, however if the weights are too large you may need to spot at the elbows.</p>	<p>VIDEO click here</p>

incline bench press

goal	To work the chest Prime Movers: Pectoralis Major, Triceps Brachii, Anterior Deltoid Stabilizers: Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis	<p>Exam Alert: What are the primary muscle groups in an incline bench press? How is this different from a flat bench press?</p>
starting position	<ul style="list-style-type: none">When lying on a pad or bench the eyes must be directly below the bar or DBMaintain pelvis firmly on pad at all timesPress feet firmly on floorMaintain a neutral spine and cervical alignment	
motion	<ul style="list-style-type: none">Extend elbows and adduct shoulders just prior to full extension (adduct shoulders just prior to the touching of dumbbells in a DB incline press)Lower weight in controlled manner along same path of motion until elbows drop approximately 10 degrees below parallel and repeatPerform full, controlled range of motion (varies with individual)	
notes	<p>The essential difference between an incline press and a flat chest press is that the further the shoulders raise into flexion toward a more inclined position, the greater the involvement of the deltoids. There is some emphasis upon the sternoclavicular fibers of the pectoralis major. Most of the increased difficulty in this exercise is due to less involvement of the pectoralis major, as the deltoids gain a mechanical advantage, moving further upward into shoulder flexion. When compared to performing a flat bench press, doing an incline press at more than 10-20 degrees results in minimal pectoralis major innervation. For the bench presses (regular, incline, decline), the personal trainer should stand over the client with hands prepared to lift the bar in the center. When lifting the bar on and off the rack, one hand should have a pronated grip and one in a supinated grip. This prevents a heavy bar from slipping forward onto the client.</p>	

decline bench press

goal	To work the chest <i>Prime Movers:</i> Pectoralis Major, Triceps Brachii, Anterior Deltoid <i>Stabilizers:</i> Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis
starting position	<ul style="list-style-type: none">When lying on a pad or bench the eyes must be directly below the bar or DBMaintain pelvis firmly on pad at all timesPress feet firmly on floorMaintain a neutral spine and cervical alignment
motion	<ul style="list-style-type: none">Extend elbows and adduct shoulders just prior to full extension (adduct shoulders just prior to the touching of dumbbells in a DB decline press)Lower weight in controlled manner along same path of motion until elbows drop approximately 10 degrees below parallel and repeatPerform full, controlled range of motion (varies with individual)
notes	The essential difference between a decline chest press and a flat chest press is that the deltoids become increasingly less involved when doing the decline version. A decline press should not be performed below approximately 20-30 degrees below a flat chest press (greater shoulder extension in a decline press relative to the body). A decline press can cause considerable stress to the lumbar spine when lying on a decline bench. A decline chest press may best be utilized with use of a cable or pulley rather than placing the body in an awkward position with unnecessary trauma to the tissues of the spine and core musculature.



cable crossover

goal	To work the chest <i>Prime Movers:</i> Pectoralis Major, Triceps Brachii, Anterior Deltoid <i>Stabilizers:</i> Rotator Cuff Musculature: Supraspinatus, Infraspinatus, Teres Minor, And Subscapularis	 A woman in a red shirt and black pants is performing a cable crossover exercise. She is standing with her feet shoulder-width apart, facing a cable machine. Her arms are extended straight out to the sides, holding onto the handles of the cable machine. She is looking down at her arms.
starting position	<ul style="list-style-type: none">•Grasp handles and align trunk so the resistance is opposing desired motion•Maintain a neutral spine and cervical alignment	 A woman in a red shirt and black pants is performing a cable crossover exercise. She is standing with her feet shoulder-width apart, facing a cable machine. Her arms are extended straight out to the sides, holding onto the handles of the cable machine. She is looking down at her arms.
motion	<ul style="list-style-type: none">•Allow arms to extend out just prior to full extension•Adduct shoulders similar to a DB chest fly•Perform a controlled, full range of motion (varies with individual)•May utilize either a neutral or pronated grip	 A woman in a red shirt and black pants is performing a cable crossover exercise. She is standing with her feet shoulder-width apart, facing a cable machine. Her arms are extended straight out to the sides, holding onto the handles of the cable machine. She is looking down at her arms.
notes	Due to the added mobility of this exercise through usage of cable resistance, it is imperative to ensure that the proper path of motion is followed. This will also act to decrease risk of injury to the shoulder, elbow and spine, while promoting maximal innervation of the pectoralis major fibers.	

Other Training Modalities

Yoga

While the origins of yoga go back thousands of years and has evolved greatly over that time, the goal remains the same - it is a system of exercises which help the individual control mind and body. In doing so, yoga improves flexibility, core strength, balance, breathing, posture and much more. For greater details on the subject of yoga as well as a sequence of yoga poses and exercises, click on image below.



Pilates

Popular with professional dancers for many years, Pilates has gained tremendous popularity in the past decade. The origins date back to World War I and Josef Pilates who created the exercises while in an internment camp. The goals of a Pilates workout include: better body awareness, improved posture, better neuromuscular control and increased core strength. For greater details on the foundations of Pilates as well as the sequence of Pilates original 34 mat exercises, click on image.



Conclusion

Regardless of the exercise chosen, it is imperative to take joint motion and biomechanics into account before choosing an exercise. Exercises must be thought of in terms of the desired bodily motion prior to the desired bodily aesthetic or strength-related goal. There are countless ways of adding load to a motion, but the proper path and stability of the motion must be maintained. Think of differing resistance modes in this manner:

Machines

One characteristic of most fitness machines is that they typically have only one degree of freedom; in other words, they follow a fixed path, with little room for multi-planar movement. Some machines allow for two degrees of freedom or greater motion at the joints. Machines can be very helpful for beginners who may lack the coordination or nervous system recognition to perform a particular BW or free weight exercise. Machines can also be helpful for achieving isolation in certain therapeutic settings or for hypertrophy. Regardless of the goal, knowing the desired motion will always come first, and then the search for the machine to fit the motion can occur. Many machines were built upon the ability to "feel" the muscle, rather than the science of joint movement and the forces that act upon it. Take this into consideration and choose machines wisely to meet the goal of the individual.

Cables/pulleys

Cables and pulleys have the greatest ability to promote adaptive responses - more than any other form of resistance training. Due to this enhanced capability for mobility, there is a lack of stability and the individual must already have a considerable amount of control over the movement prior to loading. Loading must occur in direct opposition to the desired movement, with minimal risk to other joints and bodily tissues. Cables and pulleys have a great degree of versatility but require a great deal of coordination and muscular control.

Free weights/BW

Using free weights or the use of one's own body always opposes the forces of gravity. Gravity is the main force of resistance acting upon the body with or without the loading of free weights. For this reason, all free weight and BW exercises must align movement with gravity or injury and/or trauma can result and muscular gains will be lost. Free weights and BW exercises require the greatest amount of control and thus leave the body most susceptible to injury.

There are numerous ways to vary exercise and joint movements beyond what is explained here. It is imperative that the concepts of joint movement are properly understood and that biomechanical forces are recognized, before implementing any variation or new exercise into an exercise program for any individual. No individual is beyond the laws of physics.

Safety, Injury Prevention & EMERGENCY CARE

chapter 11

Safety

When we say safety, we are talking about the whole, complete personal training experience. From the safety of the programs you design to the control of safety concerns in the operating environment. Our message, to “*do no further harm to the client*”, is not stated casually or with any less importance than other topics in our program manual. Safety is something that needs to be considered before there is a problem from the lack of safety awareness.

The type of training that you do will determine whether or not you are working in a fitness club or in other types of training environments (home gyms, outdoor training). A PFT has to know all of the relevant safety information for each and every setting where training occurs. This means assuming responsibility for the safety of both yourself and your client, at all times.

Sometimes not viewed as important, or a priority, it is a mistake to underestimate the need for safety in personal training. Think about it - we typically ask/require clients to sign a waiver to release any responsibility for injuries (this should be in one of your business forms), only to then put them squarely in the middle of an environment where accidents can, and do, happen.

So there are a couple of different ways to view safety. How safe is your equipment? Do you provide the proper amount of space for all of the activities you ask of your client? Is the area clear of debris or objects, in the event of a fall? Do you train your client within safe

physiologic limits? Nearly every aspect of being a PFT involves safety. Since it is common for fitness clubs to maintain safety policies for the safety of all members, each PFT should also follow this rationale. Using the fitness club model of safety as an example, most modern clubs are equipped with AED's and a staff of First Aid/CPR/AED certified personnel. This is the only way to ensure that the safety needs of any client are able to be met. Therefore, all trainers, regardless of experience or tenure, should expect to maintain current First Aid and CPR/AED certifications. In cases where it is not required, it either soon will be (by changing regulations and laws) or should be (independent contractors are an example).

The longer you work as a trainer in the industry, the greater the odds are that you will encounter an emergency situation, sometimes arising from sports play in fitness clubs, or people just being active, in general. When people exercise in close proximity to each other, the need to help an injured party may extend beyond safety concerns of just your client. In other words, you may find that you will be required to intervene where or when a safety concern has turned into an injury. For this reason, it is important to be able to help someone in need, while staying mindful of policies that protect all parties involved. In the USA, most states have Good Samaritan laws that protect first responders, when certain provisions are met.

One such provision is the standard of care that comes with being First Aid/CPR/AED certified. When properly certified, you are protected legally from injured parties while rendering aid to the best of your trained abilities. Again, these policies vary by location, and it is

the PFT's responsibility to both know and implement safety standards into their practice. This is just another way of how we show clients (or bystanders) that we care.

First Aid/CPR/AED Training

The need for trainers to be able to help an injured client is not unusual. For this reason, we recommend that all PFT's (including candidates) should carry current certifications for Basic Life Support (BLS) by taking a valid course. It is important to learn how to treat emergency situations in an acute sense. In the USA, the American Red Cross is one standard provider. In other territories outside of the USA, agencies like the Red Crescent (or similar) offer this type of training.

EXAM ALERT

When you encounter a situation that is beyond your field of experience or professional expertise, what should you do? In the event of an injury or emergency situation what should you do as a personal trainer?

The Personal Trainer and Emergency Situations

Regardless of how careful a personal trainer may be in obtaining as much information as possible with the PAR-Q and health history questionnaires or how knowledgeable and attentive a trainer might be in the application of biomechanics and kinesiology, injuries and medical emergencies may still occur. Again, they may not just occur with your client, but someone within your reach.

The job of the personal trainer is to use all resources available to ensure the safety of their clientele. This includes being aware of safety

rules and regulations, which may also involve everything from evacuations to reporting unsafe conditions or equipment. There is benefit in being proactive with safety in mind; this helps to promote preparedness. In the event of an injury or emergency, the personal trainer MUST remember the following:

Do not attempt to diagnose an injury or condition

Never prescribe or give medication to a client

Do not attempt to treat an injury or medical condition beyond the expectations listed in the pages of this chapter

Always gain medical consent and refer out when circumstances or client health issues are beyond the abilities of the trainer

The following injuries and conditions will be described, along with methods by which to prevent and initially treat such injuries and conditions:

- Musculoskeletal Injuries
- Cardiovascular and pulmonary conditions
- Open wounds
- Heat or cold-related illnesses
- Metabolic abnormalities

EXAM ALERT

Which musculoskeletal injury is characterized by trauma to the muscle or tendon? Which musculoskeletal injury most often requires medical attention?

Musculoskeletal Injuries

<p>Contusion: A bruise caused by a blow to the muscle, tendon, or ligament; caused when blood pools around the injury and discolors the skin.</p>	<p>Preventative measures for musculoskeletal injuries:</p> <ul style="list-style-type: none">• Proper warm-up prior to activity (review Chapter 4)• Appropriate programming for ability level (review Chapter 8)• Usage of proper equipment including the appropriate shoes and padding as necessary• Employment of the proper stretching modalities before and after activity as necessary (review Chapter 4)• Avoidance of training or activity on unsafe or improper surfaces (ice or slick pavement, etc.)
<p>Stress: A temporary deformation of a muscle or tendon. This type of injury is very short in its duration and intensity of pain and tissue deformation.</p>	
<p>Sprain: Damage to ligamentous tissue. Typically an acute injury due to ligament laxity or trauma. Characterized by pain, swelling and bruising of the affected joint. First Degree: A stretch of ligamentous tissue. Second Degree: A partial ligament tear. Third Degree: A complete ligament tear.</p>	
<p>Strain: Damage to tendon or muscle tissue due to overuse or abuse. Typically a cumulative injury. First Degree: A stretch of tendon or muscle tissue. Second Degree: A partial muscle/tendon tear. Third Degree: A complete muscle/tendon tear.</p>	
<p>Stress Fracture: A break in bone due to non-traumatic, cumulative stress on bone. This is an injury that commonly requires medical attention.</p>	
<p>Chronic Low Back Pain: Chronic pain in the lumbar region of the spine requires careful diagnosis and observation by a doctor or specialist. It is the job of the personal trainer to strengthen core musculature and properly design a program that ensures maximum flexibility of hip flexors, and other hip/low back muscles in order to not exacerbate the client's condition.</p>	
<p>Dislocation: Displacement of joint structure due to excessive force. Do not attempt to treat. Immediate medical attention is necessary.</p>	
<p>Tendonitis: Inflammation of the tendon. Repeated tensing of a tendon can cause inflammation. Eventually, the fibers of the tendon start separating, and can even break, leaving behind debris which induces more friction, more swelling, and more pain. "Sub-acute" tendonitis is more common, which entails a dull ache, some tenderness, and worsening with repetitive activity.</p>	

EXAM ALERT

What are the preventative measures for musculoskeletal injuries?

Preventative measures for

musculoskeletal injuries:

- Proper warm-up prior to activity (review Chapter 4)
- Appropriate programming for ability level (review Chapter 8)
- Usage of proper equipment including the appropriate shoes and padding as necessary
- Employment of the proper stretching modalities before and after activity as necessary (review Chapter 4)
- Avoidance of training or activity on unsafe or improper surfaces (ice or slick pavement, etc.)

Effective treatment for

musculoskeletal injuries:

The P.R.I.C.E. method is most effective when administered immediately following acute injury or as swelling continues. Common theory is to only ice within 24-48 hours following injury. However, P.R.I.C.E. methodology should be continued to provide relief and healing as long as pain and swelling occur. Use ice in most cases where pain and swelling occur (confirm with doctor or specialist). Use heat in most cases where pain and tightness occur only after it is not tender to the touch and discoloration is dissipating (confirm with doctor or specialist). Heat should not be used within the first 48-72 hours after injury.

Protect the injured area from further stress or trauma by avoiding activity involving the affected area

Rest the body so that it has time to rejuvenate and heal

Ice affected area with ice cubes in a plastic bag, frozen peas which can form to cover a joint, or ice pack. The length that ice should be applied varies for the size and body fat percentage of the client. Generally, the most widely acceptable length to apply ice is 20 - 25 minutes. Follow a

20 to 25 minutes on - 60 minutes off - 20 to 25 minutes on cycle for 1 to 3 cycles, depending upon the injury and repeat as necessary. Time is necessary between icing to protect the skin and tissue against damage from the extreme cold.

Compression limits swelling and speeds the healing process. An ACE bandage wrap around the affected area works well. This may provide the greatest impact in reducing inflammation.

Elevation of the injured area reduces swelling and is most effective when the area is raised above the level of the heart.

Application:

You may have also heard of the acronym RICE. This stands for Rest, Ice, Compression, Elevation. The steps are the same as PRICE's, with the exception of the prevention and support.

EXAM ALERT

When should the PRICE method be administered to a musculoskeletal injury? What is the time frame that is most applicable for ice treatment on a knee injury with inflammation? When should heat be applied to a musculoskeletal injury? What is the most significant benefit to applying compression to a new injury?

EXAM ALERT

Be able to identify the various cardiovascular and pulmonary conditions.

Cardiovascular and Pulmonary Condition

Arrhythmia: Abnormal heartbeat due to change, deviation or malfunction of heart's electrical system.

Ventricular Fibrillation: Threatening condition where heart no longer beats but "quivers" very rapidly, 350 bpm or more. Person must receive defibrillation within minutes to avoid sudden cardiac death.

Tachycardia: Abnormally fast heart rate (form of arrhythmia), more than 100 bpm.

Myocardial infarction: Another word for heart attack or death to heart muscle due to lack of oxygen from a blood clot in a coronary artery.

Brachycardia: An unusually slow heart beat, less than 50-60 bpm (form of arrhythmia)

Cardiac Arrest: Sudden stoppage of the heart, a defibrillator is necessary to revive the heart

Hypotension: Unusually low blood pressure (below 90/60). Low blood pressure is only indicative of an unhealthy condition if the individual experiences frequent dizziness or syncope (fainting). This condition is usually treated with medication.

Hypertension: Unusually high blood pressure, 140/90 or above, and commonly associated with narrowing of arteries. Usually treated with medication.

Valvular heart disease: Fault or abnormality of one or more of the heart's valves (tricuspid valve – from right atrium to right ventricle; pulmonic valve – from right ventricle to pulmonary artery; mitral valve – from left atrium to left ventricle; aortic valve – from left ventricle to aorta and out to the body) and characterized by stenosis (narrowing) and regurgitation (blood flow in wrong direction between heart chambers).

Mitral valve prolapse: A condition in which the flaps of the mitral valve (also known as bicuspid and connects left atrium to left ventricle) are too large and cannot close properly. As a result, blood may leak back to the left atrium (regurgitation) when it should flow only into the left ventricle.

Asthma: Narrowing of airway making breathing more difficult due to environmental, exercise, or allergy related factors. Exercising in cold, dry air outside during the winter can be hazardous because they can contribute to exercise induced asthma.

Hypoventilation: Reduced depth and rate of breathing providing insufficient oxygen and often found in conjunction with obesity or sleep apnea.

Hyperventilation: Abnormally deep or rapid breathing in excess of needed oxygen. Usually caused by fear, panic, or anxiety.

Myocardial Ischemia: Insufficient blood flow to part of the heart.

Shock: The organs and tissues of the body are not receiving an adequate flow of blood. This deprives the organs and tissues of oxygen (carried in the blood) and allows the buildup of waste products. Shock can result in serious bodily damage or even death. Treatment includes keeping the patient warm, with legs raised and head down to improve blood flow to the brain and treating the underlying condition which led to shock. Shock always requires immediate medical attention.

EXAM ALERT

For a client with cardiovascular disease, what suggestions can you make as a personal trainer for preventative care? Would you suggest a highly advanced cardiovascular and training program?

Preventative care for cardiopulmonary conditions and diseases:

- Proper diet and nutritional intake (Chapter 5)
- Utilization of consistent cardiovascular and resistance exercise as appropriate for training level and ability (Chapters 8 and 9)
- Sleeping approximately 7-9 hours for proper rest
- Decreasing lifestyle stressors and finding methods for stress relief

Remember that the most significant impact a personal trainer can have upon an individual with a pre-existing cardiopulmonary disease or condition is to help that individual with a program that involves the proper cardiovascular and resistance exercise to aid heart functioning and oxygen utilization and stimulate immune system function. The trainer must always obtain medical consent from a doctor or physician before working with a client who has a known or possible cardiopulmonary condition or disease.

EXAM ALERT

What device sends a shock through the heart to reset its electrical current when a person enters cardiac arrest? What is the minimum amount of training required to use a defibrillator?

Treatment for cardiopulmonary conditions and diseases:

Dependent upon medical consent or supervision with exercise program and lifestyle habits.

Use of CPR or a defibrillator by a trained person with AED/CPR certification following a heart attack in an unconscious victim. A defibrillator is a device which sends an electric shock to revive a stopped heart or reset a fibrillating (quivering) heart. Many gyms are now equipped with an AED (Automatic External Defibrillator) to defibrillate the heart. The American Red Cross and American Heart Association approves usage of this device with little more than a few hours training, and must be acquired as an addition to a CPR certification.

EXAM ALERT

What term is defined as a break in the skin from a sharp object such as a knife? What should you do if an accident occurs and a body part is torn away from the body?

Open Wounds

Laceration: A jagged, irregular or blunt breaking or tearing of soft tissue from the mishandling of tools or machines. The wound is typically deep and bleeds profusely.

Abrasions: Breaking or removal of the skin by rubbing against hard, rough surfaces.

Incision: Breaking of skin by a sharp object such as a knife. Bleeding is usually rapid and heavy and the possibility of damage to muscles, nerves and tendons should be considered if the incision is deep.

Puncture: A piercing wound that causes a small hole in the tissues. There may be considerable internal bleeding despite little external bleeding and a doctor should be consulted for the possibility of tetanus in all cases.

Avulsion: A forcible tearing or partial tearing away of tissues. It occurs in such accidents as gunshot wounds, explosions, animal bites or other body-crushing injuries. Bleeding is heavy and rapid. If a body part (a finger, tooth or toe, for example) has been torn away in an accident, it should always be sent along with the victim to the hospital (placed on moistened gauze and cooled), since there is a possibility that it can be reattached.

- If the open wound is significant enough that it cannot close on its own and/or bleeding continues after several minutes, emergency care must be administered by a medical professional.

EXAM ALERT

What should you use when you help a client clean a wound?

Heat or Cold-Related Illness



think about it

Make sure your clients are drinking enough water before, during and after their training sessions. Especially when doing cardiovascular exercise, encourage several water breaks or drinking while exercising. It is okay to give clients take-home instructions like drinking water, because it affects both their time in the training session and their overall health.

Preventative care for open wounds:

- Wear appropriate activity-specific protective gear
- Keep work and workout areas clean and free of dangerous machinery or sharp objects that may protrude or interfere with activity
- Be observant of activity area for possible unsafe surfaces or locations

Treatment of open wounds:

- Wear appropriate protective gear to prevent the spread of disease in the presence of blood. Always wear gloves when cleaning a wound or when exposed to another person's body fluids!
- Application of sterile dressing and direct pressure to stop bleeding and help the wound to clot.
- Clean wound once bleeding has stopped with soap and water or hydrogen peroxide to avoid possible infection.

Heat exhaustion (hyperthermia): Body overheating due to high heat and excessive humidity and/or sun overexposure and characterized by profuse sweating, excessive thirst, with cold and clammy skin. Treatment includes laying the individual down in a cool place with head below heart and the ingestion of plenty of cold water, while attempting to cool head and neck with the liberal application of ice or cold water.

Heat stroke (severe hyperthermia): A life threatening emergency due to extreme overexposure to the sun with a 104 degree or greater body temperature. Characterized by possible insufficient sweating (which may inhibit the body's ability to lower core body temperature), confusion, dry and flushed skin, irritability and rapid heart rate. Treatment includes placing individual in a cool environment or into a cold or ice bath, and drinking plenty of water, and apply ice or water to head and neck in conjunction with a fan, or cool breeze to reduce temperature.

Hypothermia (late stages of frostbite): Decrease of body core temperature below 95 degrees Fahrenheit, due to extreme overexposure to freezing temperatures, cold winds and/or excessive dampness. Decreased consciousness occurs at core temperatures below 90 degrees Fahrenheit. Hypothermia is characterized by numbness and fumbling when attempting to speak.

Muscle cramps: A sudden involuntary muscle contraction most commonly found in deconditioned or overly fatigued individuals. Most common causes are an electrolyte imbalance, overuse, dehydration, injury and strain. Other possible causes are inadequate blood supply, nerve compression, or potassium loss.

- Prepare for worst case scenario prior to its occurrence
- Gradual acclimatization for extreme temperatures

Treatment:

- Hyperthermia or heat exhaustion and heat stroke: Move individual into cool, dry area and sit down; apply ice or cold water bath if necessary; and drink plenty of cold water to return core temperature to normal.
- Hypothermia or frostbite: Apply pressure or blow on the spot. Contact emergency care if individual core temperature is at or below 95 degrees Fahrenheit.
- Muscle cramps: Rest from activity and take time to hydrate, and apply approximation techniques, direct compression or gently move area affected by cramping through an easy, controlled full ROM to restore proper circulation and usage of affected muscle(s).

EXAM ALERT

Be able to differentiate between the various heat and cold related illnesses. How can heat or cold related illnesses be avoided?

What term is used to describe light-headedness or dizziness, followed by fainting or loss of consciousness? Increase in thirst is an indication of which metabolic abnormality? What is hypoglycemia?

Preventative Care:

- Maintain proper hydration and nutrient levels ahead of situation involving possible extreme temperatures or intense exertion
- Warm-up properly prior to activity as necessary
- Wear appropriate gear or equipment such as waterproof or layered clothing in extreme weather and efficient footwear

Metabolic Abnormalities

Syncope: Fainting or loss of consciousness. Light-headedness or dizziness precedes syncope and is best treated by taking a moment to sit or lie down without exerting oneself. Paramedics or emergency evaluation is needed immediately upon loss of consciousness, regardless of the individual's state following loss of consciousness and regardless of the brevity of unconsciousness.

Hypoglycemia: Low blood sugar reaction from undereating or excessive exercise with too much insulin in the blood and not enough sugar to reach the muscles and brain for normal functioning. Hypoglycemia is characterized by sudden hunger, dizziness, drowsiness, shakiness, and sweating and is usually treatable with simple sugars such as fruit juice or candy.

Hyperglycemia (diabetes): High blood sugar content related to an inability to produce or process insulin efficiently. Frequent hunger, urination and thirst are warning signs of diabetes of hyperglycemia. Treatment includes the need for insulin injections in some cases and regular eating intervals every 2-4 hours with the proper balance of macronutrients to avoid rises in blood sugar. Eating sugar alone will affect diabetic individuals negatively but avoiding carbohydrate is neither an answer nor a solution to the diabetic.

Chronic Fatigue and Fibromyalgia: Fatigue lasting six months or longer in consecutive duration with other known possible medical conditions excluded through clinical diagnosis. The person has at least four of the following symptoms: substantial impairment in short-term memory or concentration, sore throat, tender lymph nodes, muscle pain, multi-joint pain without swelling or redness, headaches of a new type, pattern, or severity, unrefreshing sleep and post-exertional malaise lasting more than 24 hours.

Preventative Care:

The causes and origins of metabolic abnormalities are not always known and cannot always be identified with a beginning point or distinguishing moment. Steps can only be taken to maintain immune system health through the proper exercise and nutritional programming. The other 165 or so hours a week (there are 168 hours in a week) are left to the individual.

The question is... How can one avoid the pitfalls of metabolic abnormalities and utilize every precaution to ensure the LEAST likely probability (some things are just out of the control of either the individual or personal trainer) that disease or illness will occur?

EXAM ALERT

What is the best way to immediately aid an individual having a hypoglycemic reaction?

Eat a healthy diet. This cannot be overlooked once a metabolic disease is present. Nutritional habits can make or break the progress and stability of health for an individual. For this reason, an individual with metabolic abnormalities must seek the advice of a registered dietitian and not just their doctor or trainer.

Allow for the proper rest. If the body is tired or worn down, no nutrition, exercise or medication will be able to make significant gains or progress. Sleep preferences will vary, but research shows that 7 1/2 to 9 1/2 hours is ideal. With illness or disease, this may increase.

Exercise. The proper exercise program design helps to regulate blood sugar levels and strengthens the immune system. Just like any special population, particular care must be taken to observe responses via RPE and HR tracking, using a heart rate monitor and checking on perception of client effort frequently. When the body is weak, it does not take a great deal of effort to raise the heart rate or tax the musculoskeletal or immune system due to bodily energy shifting focus upon fighting the disease or condition. An experienced and knowledgeable personal trainer is needed in these situations.



think about it

If anyone shows the signs and symptoms of a metabolic abnormality, make sure they are already under treatment of a doctor. If the symptoms are new and they increase during activity, activity should be discontinued until the client has seen a doctor. Remember, you cannot diagnose medical conditions, but you can help recognize them.

Effective Treatment for Metabolic Abnormalities:

Syncope: If an individual loses consciousness at any time, it is the responsibility of the personal trainer to stay with them until help arrives and call 911 regardless of whether or not the individual has regained consciousness and "seems ok." Judgment upon ability to resume normal activity without going to the hospital must be reserved for emergency professionals. Otherwise, the personal trainer must make certain that the individual continues to lie down if possible and continues to sip water to avoid further dehydration.

Hypoglycemia: If an individual experiences a hypoglycemic reaction, the personal trainer must ensure that the individual receives juice, candy or some other sugar source to supply quick energy to the system, currently deprived of carbohydrate. It is most advisable to end the workout until another day once a hypoglycemic reaction has occurred.

Hyperglycemia: If an individual experiences a hyperglycemic reaction (diabetics could experience either high or low blood sugar reactions), the sugar content of the blood is too high and plenty

of water should be ingested to balance the excess sugar. Fluid replacement via an IV (as used in hospital settings) may be necessary, as well as insulin. If the body is not producing enough (the client will likely be aware of this) insulin, injections or medications might be used. This is best when left for qualified professional medical personnel if the client is unable to manage the condition in the acute sense.

Chronic Fatigue / Fibromyalgia: If an individual experiences a severe episode of chronic fatigue or fibromyalgia due to overstressing the system through exercise or some other medium which induces a heightened state of fatigue, then immediate rest, fluid and the ingestion of non-allergy producing foods will give the highest metabolic response, but will take time to show benefits. Neither the symptoms nor the treatments for chronic fatigue and fibromyalgia produce immediate or quick results; they all require time to take effect.

Conclusion

It is the duty of the personal trainer to become educated in the areas of training safety and preservation of health, just as it is the duty of any at risk individual or individual in need of greater health to allow themselves to be educated by a professional personal trainer and medical professional either if or when necessary. Whenever a situation has escalated beyond the control of both the individual and personal trainer, the aid of a doctor or emergency professional must be sought after immediately.

Exercise Psychology

So far, our approach to your learning the science of personal training has been related to just the physical attributes of personal training. Now we will look within the persona of our client in order to learn more about what is going on inside their mind in relation to performing exercise. We're not looking to make a psychologist out of you, but instead, we're looking at ways to understand our *client's* psychology. There is a lot to learn when we consider the need to understand the psychological aspects of exercising. First, we have to define what exercise psychology (EP) is - and how it's different than what is known as *Sports Psychology (SP)*. But we have to also understand what drives people to exercise or what makes an exerciser compliant versus non-compliant. And as you've probably already guessed, we must be able to understand the client's motivation. We also have to learn about the effects of exercise on one's psychological state of well-being. This is a broad range of topics to cover!

What makes exercise psychology so unique is that it draws from a few different scientific fields and can include anything from psychology and physiology to neuroscience. Some of the more prominent areas of study include examining the relationship between exercise and stress as well as self-efficacy and self-esteem.

Experts in the field of sport psychology have taken a different direction away from the more individual areas involved in exercise psychology and instead are focused more on interventions that promote physical activity or even the cultural perspectives that also seem to play a role in one's decision to participate in a physical activity (PA) program or exercise regimen.

Behavior-change theories and problems associated with exercising adults - include such topics as motivation, exercise adherence, eating disorders and addiction to exercise . These are also very active areas of interest for researchers, psychologists and even personal trainers currently working in the fitness industry.

Exercise psychology can be defined as the study of psychological issues and theories related to participating in exercise. Still, considering all of the labels, there can be some confusion between the two domains.



To define sport or exercise psychology, we could use a typical textbook definition and say that it is the study of people and their behaviors in sport and exercise activities and the practical application of this knowledge. But details deeper within this topic can not be limited solely to that description and we will explore more dimensions of this topic throughout this chapter.

With so much involved in learning exercise psychology, it is also important to remember that some of its inter-related concepts will not pertain to every trainer. We will therefore focus more directly on the following:

Making a clear and obvious case for learning exercise psychology (application of literature)
The history of exercise and sport psychology
The psychological attributes and issues that are related to exercise psychology and nutrition
Psychological factors that affect performance
Modes of instruction and how to provide instruction
Knowledge of motivation from the client
Increasing exercise compliance/adherence
Behavior modification strategies
The cause/effect of psychology related to illness, injury and disease

Making the Case for Exercise and Sport Psychology

Why do we even need to acknowledge or study exercise psychology? At times, our success in the fitness industry is based on the need to understand our client in order to get them to a positive outcome goal. Both sport and exercise psychology involve what is known as ‘sub-domains’. When we look at all of the possible topics related to exercise psychology, we would have a long list, covering sub-domains or topics such as arousal, anxiety and stress. While these sub-domains are all valid points of understanding, they can fall under the study of a specialist in just one area, in this case that might be sport psychology. Other topics, such as competition and cooperation, are also more appropriately left for only a trained Sport Psychologist to focus upon.

But there are more areas of exercise and sport psychology that DO apply in fitness environments, and within the co-active relationship between the trainer and his or her client. Feedback, reinforcement and intrinsic motivation (to name a few psychology-related topics) play a pivotal role in the relationship dynamic between coach and client. At times, being able to improve performance has a direct correlation to the relationship between the fitness professional and the client, overall. The relatable topics explored far outweigh those that are not as relevant. This is the challenge for us all - to go beyond learning the foundations of exercise psychology enough to help us work effectively with clients with respect to understanding their psychology.

For most fitness professionals, there comes a time when we have been involved with a client that can challenge our understanding, our beliefs and even our judgements - and these elements of the trainer/client relationship have dimensions of psychology themselves! It would be a mistake to discount their relevance to the dynamics of a trainer/client relationship. Some newer, less experienced trainers mistakenly believe that their perspective is the only one to consider, because they are coming solely from the trainers' vantage point. The first rule of thumb that will help most trainers to understand that everyone is, in fact, different. What does work for one client is not likely to fit the same for each individual. This is simply an example of the plasticity of people, and it is one of the reasons that knowing your client's psychology is so important with your practice. Trainer/client bonds are powerful when they are functioning properly.

In fact, among fitness professionals, it's the exclusive bond that trainers have with their clients that may be responsible for how we are perceived among the general public as leaders and trainers. This is another trainer-driven psychological characteristic or trait.

Therefore, both the trainer and the client benefit when we can focus on understanding our client's psychology. This is the most valuable tool to help clients through the stages of change. These are usually seen in parallel to making positive lifestyle changes for those using exercise as a vehicle of making change happen. In fact, our profession already has this “down to a science” and we call this The Transtheoretical Model.

“Given the increasing prominence of exercise in such contexts as corporate fitness, wellness, and preventive and rehabilitative health programs, and the increasing attention to the psychological aspects of such programs, it seems appropriate to include the word exercise in the title rather than assume everyone knows such activities are implied in our definition of sport”. In this way, exercise psychology is often categorized as an extension of sport psychology. As the authors ((Hackfort & Birkner, 2005) contend, “sport psychology has differentiated into specialized areas with sport and exercise psychology now regarded as branches”

-Gill

But why do we even care about exercise psychology in the first place? The mission or “call to action” for trainers, in our current state of the fitness industry, requires that fitness trainers practice to promote positive attitudes about exercise and the development of long-term exercise habits. This is the primary mission of conceptualizing the emerging field of applied exercise psychology as a whole. In other words, we have to organize our data, study it, and then apply it, in order to be successful.

Even though the most likely reasons for not exercising have been studied for many years, to date, researchers and practitioners have still not found interventions that effectively and permanently change health-related behavior. So we have a lot more to learn about those who participate in physical activity. Perhaps a good starting point is to learn the personality traits that drive someone to get or stay fit.

Academically, it makes sense that exercise psychology is often grouped in the same discipline as sport psychology. But not everyone who exercises plays sports. Not all who you train will be wanting or able to participate in group activities. So application of this material will largely depend on what type of training environment you are working in.

Some trainers perform a “mixed bag” of job activities on any given day. So if you have a need to teach or lead any type of group activities, you might also benefit from learning some aspects of sport psychology, as well as exercise psychology - but such learning is not the focus of this chapter. We are going to focus more on exercise psychology in its most strict definition. Trainers who need additional learning about group dynamics may find more benefit in learning a curriculum that emphasizes group exercise principles (the NESTA Group Exerciser Specialist is one such example).

Practicing psychologists and physicians will often prescribe exercise for their clients and patients, respectively. As an example, for those individuals prone to anxiety attacks or depression, the results seem to be favorable -

and the emerging research of the past 20 years seems to support this. In other words, not only does exercise affect one’s psychology, but the same is also believed to be true in reverse. Psychological states influence different facets of the exerciser or physically active individual.

Unfortunately, even graduate-level training programs fall short of teaching how to effectively help a client to modify their exercise behavior, so the challenge for the trainer is very real and great. Still, it is widely believed that psychologists working in therapeutic environments can help clients significantly more so, when they are able to incorporate exercise into the treatment options used.

Some trainers have been operating without fully understanding the connection between consistent exercise (PA) habits and how this can be influenced by the personality traits and psychological processes unique to each client. This connection is important for more than physical conditioning alone, as positive mental health should serve to support exercise behaviors.

If we are to consider all factors needed for the client to understand before engaging in positive health behaviors, then our scope widens. Getting started is the first obstacle for most - but part of our mission is to also create an understanding of how exercise is important throughout the lifespan. Therefore, we might also expect to see that willpower, persistence, determination, motivation and the aim (i.e. goal) to achieve something as inter-related factors. These psychological dimensions are rooted differently for each client.

The link between good mental health and exercise has been garnering support over time and this is because experts in the field of psychology have supported this link. Now we see a specific art, within this discipline or science, which has evolved from an effort to try to understand all of these issues, concerns and dimensions that exist in physical activity environments. Collectively, we refer to this as “exercise psychology”.

The History of Exercise Psychology

While we know that exercise psychology is derived from sport psychology, the field of sport psychology has also seen its own challenges on the path to acceptance within the domain of psychology. Currently it has, at the very least, come to be viewed as a distinct science.

Many trainers (and often professional psychology practitioners, as well) regard exercise psychology as psychological work with athletes. This approach tends to divert focus from all of the unique research, practice and literature of sport psychology. Today there is a place for this knowledge gained in the daily activities of the personal trainer.

So, while the two have similar themes - yet distinct differences by definition - the underpinnings of all relationships with clients are best understood when we look at the big picture, so to speak. This perspective can be traced back to the work done in the past by both psychologists and experts within the realm of sport collectively.

To make things a little more complicated, we need to be aware of what the key differences between sport and exercise psychology are, too. There are several commonalities between the two kinds. But what really differentiates sport and exercise (therefore sport and exercise psychology as well) is the qualitative shift regarding performance and competition - which fall more appropriately under the topic of sports psychology. To understand this better, think about the dynamics involved when working with a team of athletes in competition versus the one-on-one structure of a personal training dynamic.

When compared to sports psychology, EP tends to shift the emphasis of application to go beyond these conceptual discrepancies mentioned so far. But methodologies, goals and purposes further delineate it from SP.

Still, exercise psychology is a part of health psychology, just as sport psychology is a part of performance psychology. However, exercise psychology is more concerned with positive health outcomes, while sports psychology has its goals mainly in performance outcomes, as stated by Portenga and his colleagues.

Just before the turn of the 20th century, the connection linking exercise and psychology was established in discussions given by philosopher and psychologist William James. In James' view, it was important to recognize exercise and its role in supporting such mental attributes as sanity, serenity, approachability and even good-humor.

Period 1	The early years	1893 to 1920
Period 2	The Griffith era	1921 to 1938
Period 3	Preparation for the future	1939 to 1965
Period 4	Establishment of academic sport psychology	1966 to 1967
Period 5	Multidisciplinary science and practice in sport and exercise psychology	1978 to 2000
Period 6	Contemporary sport and exercise psychology	2001 to present

There have been six distinct periods in the history of exercise psychology and the evolution of sport psychology. Periods five and six represent the most amount of change in the field, due to advanced testing protocols and technology.

Later, research would also establish a link, theorized previously, regarding the link between depression and exercise. Whereby it was suggested that a moderate amount of exercise was seen to be more helpful than not doing any exercise at all in this management of depression symptoms.

Exercise didn't get as much attention or importance as an area of study until the 50's and 60's, when journal articles referencing research began to appear. Later, in 1968, the International Association of Sport Psychology presented several position statements at a gathering of sport psychologists in United States.



Continuing in this vein was the work of William Morgan, who wrote even more on the specifics of the relationship between exercise and other 'various' items tied to

psychological interests such as mood, anxiety and exercise adherence. Although considered vital to understanding EP now, Morgan was clearly ahead of his time.

So, we see that sport and exercise psychology have a lot in common historically and theoretically. The American Psychological Association has a division specifically related to both sport and exercise psychology (division 47). A goal-oriented personal trainer will want to know how the differences between the two types are viewed by experts within the field of psychology, and how they affect their daily work with clients in terms of application.

The application of exercise history

According to Anshel (2007), exercise psychology evolves around the following topics:

Motivation
Barriers of exercise
Exercise adherence
Exercise dependence (addiction)
Exercise's relationship with mental health issues
Interventions
Cognitive and behavioral strategies and their effect on exercise
Personality traits and characteristics of exercisers

Exercise psychology aims to encourage healthy exercise behaviors or tries to use exercise as a possible mechanism or pathway to achieve better health (both physical and mental.) Regular exercise behavior is intended to enhance and maintain the exerciser's well-being and health. Exercise psychology concerns with the effects of exercising on the quality of the individual's life. In this way, the realm of exercise psychology must be viewed in light of both its cause and effect in relation to the client.

In the development of their psychological skills and capabilities, this can be almost as difficult to achieve for some as much as their physical capabilities. Most aspects of working co-actively with a client will require an understanding of how our client presents themselves normally. This includes their traits or their steady state. When described this way, we can easily see that we are also referring to personality, typical responses and attention levels. These are dimensions of your client's *psychological core*.

This might also include stress management skills, the level of intensity tied to their concentration, or even the approach used for setting challenging - but at the same time - realistic goals. These are all *psychological characteristics*. For most clients, these can be learned and developed. They contribute to the performance and the well-being of the client, thus we have to know more about them and keep them operating in the background of our mind-set or approach if we are to make proper use of their application.

Psychological attributes and issues related to exercise

The lifestyle of the modern man involves much less physical activity than what is seen as optimal by researchers and health professionals. We sit a lot, many people work practically without even being able to stand up for hours. We don't have to walk to work or school; we drive a car or use public transportation. Not only our work or professional life, but also how we seek

entertainment has very little to do with physical activity. Watching TV or surfing the internet hardly requires any physical effort.

It is important to note, that inactivity in itself is not responsible for obesity, which is very common. Especially in the USA, where nearly 65% of the adult population is overweight and the obesity situation among children is even worse. One in two children is – simply put – “fat”. Being overweight is not only an aesthetics matter or problem. Obesity is associated with other conditions, such as diabetes, cardiovascular problems, generally poor health, just to name a few.

Psychological attributes related to nutrition

Here we will look to make the connections between nutrition, psychology and your ability to be a successful trainer. How does this all fit together? If we know that a majority of our client's success will be the result of reaching positive outcomes. Therefore our ability to get our client to their goals (results) is pivotal. In short, with nutrition in mind, we have to understand many of the psychological factors for clients with challenges to their food intake and nourishment. We can help clients when we train them in our controlled environment, but what they do outside of the hour spent with the trainer can undermine progress very easily if poor nutrition were to be an obstacle or barrier for the client.



Most people are somewhat aware of what it means to eat healthy. Still many of us rarely eat food that would be considered good for our overall health. Think of the possible mental aspects involved when teaching a client to follow an eating plan. As trainers, we are up against some formidable, engrained habits. In the USA, our abundant intake of salt, preservatives and carbohydrates is pretty well known. Nutrition is covered more in another chapter, but suffice it to say that we all should be able to understand and acknowledge the obvious.

At times, we will need to coach our client to understand that improper eating habits can add to the negative effects of a sedentary lifestyle. Obviously, most clients know this, but that is where everything seems to break down. It is not enough to simply know the increased risks for various chronic diseases and illnesses. We have to coach or train our clients for change.

The Psychology and Physiology of “Sedentary and Obesity”

When combined, a sedentary lifestyle and obesity could easily be blamed for poor health, lower life quality and lower satisfaction with the one's perceived happiness.

Research is showing us that ego, self-esteem and levels of autonomy are negatively affected by obesity. Furthermore, Saito and his colleagues found in their study (2009) that obese patients can be effectively treated with a holistic medical care team in which physicians, registered dietitians, exercise trainers, and clinical psychologists were involved. The effects resulted not only in weight loss, but also in more

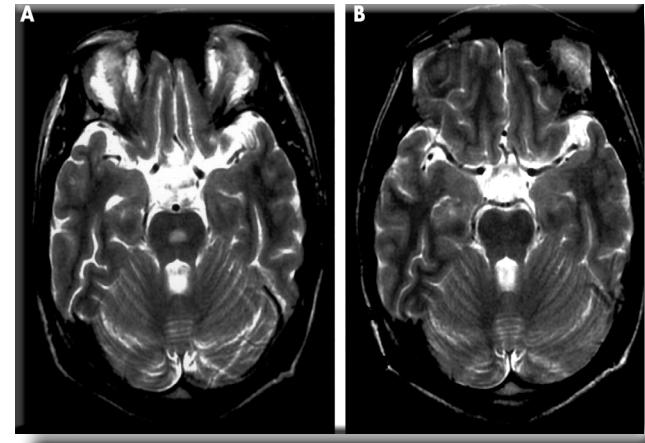


positive ego-states and better levels of autonomy. Exercise is being used as part of the solution or as an intervention strategy. This is a promising indicator of hope, derived from experimenting with a holistic approach to impact positive mental health.

What is the mechanism of how PA works to improve the body and its function? Regular exercising has two benefits. It works as a preventative and at the same time as a therapeutic measure. Exercise behavior is viewed as part of the so-called “Magic four”, which provide the individual with a longer life and better health status. The four factors are the principles of proper nutrition, sufficient sport or exercise participation, maintaining optimal body weight and a non-smoking lifestyle. Obesity and inactivity are virtually implied in this list.

We can then perhaps agree that regular physical activity has positive effects on the physical, psychological and social sphere of the person. This has significant correlation to the psychological profile of your client - and maintaining proper body weight through PA has direct ties to managing nutritional intake.

In the USA, it is estimated that nearly 10 million women present with an eating disorder. For men, the figure is much less, but still it is a mistake to assume that eating disorders are isolated solely among females in the general population. Eating disorders are present in nearly 1 million males.



In this MRI image, a male patient exhibiting symptoms suggestive of anorexia nervosa reveals different imaging of the brain stem itself. In the image on the left, there is a significant lesion in the subject; 6 months after intervention, a normal scan is seen on the right.

We should also point out that the term “eating disorders” could easily be transposed to read “disordered eating”. By and large, disordered eating is statistically far more common than what is seen in the figures representing eating disorders as a whole. It is also less severe. But estimates put this phenomenon as a concern for nearly 65 million women in America. This number is staggering and means that, as a trainer, you are more than likely to encounter clients who are eating in a disordered manner. Still, disordered eating is generally viewed as less serious than a true eating disorder.

Disordered eating may include following strict food rules, eating the same “safe” foods every

Case study:

Your client is a young, teenaged female. She has been arriving for her sessions on time and ready for her workout with a good attitude and plenty of energy. Many times you’ve noticed that your client has a lack of energy once you are about half-way through her program design or session. Most of the time, your client seems to hit the wall, and she begins to struggle getting through the second half of her workout, yet the client reports adequate sleep and normal intake of food. As a concurrent theme to your training relationship with this client, she occasionally will ask you what you know about supplements, specifically those that are promoted to help with weight loss. The client confirms taking such supplements but is losing weight at an alarming rate (more than 1-2 pounds per week). What are some of the possible realities of this situation before you?

day, calorie restriction of less than 1,200 calories per day, obsessing or thinking about food for more than 50 percent of the time, compulsive or obsessive calorie tracking, daily or frequent weigh-ins, eating a lot of low-calorie foods, and adopting a vegetarian diet solely for the purpose of weight loss.

One survey conducted recently revealed that 65% of the survey's respondents described themselves as being overweight or obese. In this way, it isn't very surprising that a similar percent are apparently afflicted with behaviors similar to what we consider disordered eating among people who are trying to loose weight. Among American women, eating disorders are among the top 10 most frequent causes of disability. Anorexia nervosa, one of the most serious disorders among young females, is complex and will remain the focus of research for many years to come.

But what we do know of it now, is enough to put all trainers on alert for this problem seen among those who join fitness clubs to support extreme weight loss efforts. In fact, many afflicted with anorexia nervosa fit a profile worth noting. Most instances occur immediately after serious dieting, which somehow gets out of control. The profile also includes such identifiers as coming from stable homes, successful in career pursuits, and relatively affluent. It is also typical for someone suffering from anorexia nervosa to deny their behavior and/or to fail to acknowledge that their appearance - sometimes described as skeletal - is anything to be alarmed at or even unusual. Some will still even insist that they are overweight in this state.

When we examine the causes of anorexia nervosa or bulimia (a disorder in which a person binges on large amounts of food, followed by efforts to purge the food through vomiting or other means), we also have to understand what the research is currently telling us. That even though there are verifiable physiological or biological causes for these disorders, we can not overlook the influence of social roots in their manifestation. Trainers and coaches working in the field already know this.

In addition to physiological or biological roots, it is also believed that those presenting with anorexia nervosa and or bulimia demonstrate that they process information about food differently from that of healthy individuals when scans of the brain can be observed.

Researchers maintain that people with anorexia nervosa and/or bulimia tend to be preoccupied with their body weight and will therefore take to heart the thought that one can never be too thin. This might help to explain why some eating disorders tend to increase as developing countries become more westernized and dieting (restricting calories) becomes even more popular among the general population. We are not saying that your client is likely to have an eating disorder, but to be aware that the possibility exists.

Some psychologists have suggested that eating disorders can be the result of overly demanding parents or other family problems in the client's life. The complete explanations for anorexia nervosa and bulimia will probably remain elusive for some time.

But since we know that these disorders seem to come from both biological and social causes, that successful treatment will probably encompass different strategies. It's important to remember that as a personal fitness trainer, we do not diagnose or treat an eating disorder. And this is probably best, given that even discussing such topics can be difficult.

Working with clients on these particular concerns may be inappropriate if you are not sufficiently trained to do so. Always refer your clients who present with eating disorders, to a qualified professional who can help or intervene professionally.



Strategies to improve Body Dysmorphia Disorder

Talk to a specialist – not necessarily a family doctor or GP. Help your client to find an eating disorders counselor, psychologist, or psychiatrist. Even better, find one who specializes in body dysmorphic disorder.

Have your client talk to friends and family. Suggest that they attempt to explain how they feel and think; Encourage them to be open about fixing their body image problems or body dysmorphic disorder.

Promote the importance of the client treating themselves well. Encourage clients to get enough sleep, eat nutritiously, and exercise regularly.

Learn how to direct their thoughts to something else when they start thinking of themselves as obese or unattractive. Fixing body image problems is easier when your client can think positively about him or herself.

Help your client to realize that what they hear becomes their belief system. If they're told that they are overweight or unattractive, then they'll grow to believe that – regardless of their appearance and weight. Fixing body image problems involves recognizing what your client may have heard in the past and what's true for right now.



Goals

Goals should include the values of the client, as well as the ascertainment of the fitness professional. Performance is not only about setting goals and working towards them. Often an evaluation is needed to see if things are going in the right direction, if any modifications are needed and how satisfied both the client and trainer are with the process.

Many clients can seem to be quite unrealistic in their expectations when they first begin a training program. Therefore, it will be your job to make sure that the goals they establish are small enough that you can be certain that they will be successful. You are going to do little to enhance their self-efficacy if they do not experience success. Finally, your clients should set goals that are more behavioral than outcome-oriented because they have more control over their behavior than they have over a particular outcome.

Performance-related psychological issues are summarized from the aforementioned study of MacNamara, Button and Collins (2010). According to the authors, the most important and relevant psychological characteristics of physical performance are the following:

Motivation
Commitment
Goal setting
Quality practice
Imagery
Realistic performance evaluations
Coping under pressure
Social skills
Competitiveness
Vision of what it takes to succeed
Importance of working on weaknesses
Awareness

We have to be aware that performance will not always be as expected, as peaks and low points occur and everyone is prone to have a bad day, at times. The characteristics above not only contribute to proper, but also to unsatisfactory, performance. Let's make it clear with the following example: we have a client who works as hard as he can, but he simply cannot understand the need to work on his weaknesses. Will this affect his performance? Of course it will, and this non-compliance might decrease his chances to reach the level of conditioning he would like to be capable of.

How psychology influences modes of instruction for trainers

Modes of exercise instruction have to be viewed in light of the motives and knowledge we have of our client and their psyche. Effective instruction takes into account the *individual characteristics* of the client, the *personality traits* and *working style* of the trainer, *contextual factors* and the *goals* that are set. It also has to have a certain flexibility to achieve maximum effectiveness.

We generally can observe two fundamental instruction strategies trainers use, the demanding and the cooperating behaviors. Demanding trainers usually make decisions on their own, while the cooperating instructor's style involves their clients in the decision-making process as well. The two modes also come with different motivational techniques. The demanding trainer feels responsibility for controlling and coordinating the efforts and behavior of the client, as well as their motivation and the needed modifications of their undesired behaviors. Therefore they feel they need to control the client, because without control they would be passive and put forth less effort.

While the demanding trainer issues rewards and punishments in order to keep client behavior under control, the cooperating trainer has a more positive outlook on the characteristics of their clients. He does not feel that they are lazy, passive and unmotivated, if so, it can sometimes

be attributed to bad client experiences from the past. Motivation, possibility of development and taking responsibility are present in every client (or can be developed). Currently, one is more likely to see trainers who believe in a cooperating style.

We need to be aware of instruction modes that involve effective nonverbal communication. Nonverbal communication is often far more important than its verbal counterpart. The two aspects of communication have to be congruent for us to be regarded as authentic personalities. If we communicate something verbally, but our nonverbal communication says exactly the opposite, we should not be surprised if our clients do not react as we expect.

Nonverbal communication involves three important aspects relevant to our work: body language, proxemics, and the way we say things. Body language covers posture, physical appearance, gestures, touch cueing and facial expressions (paralanguage).

Proxemics is a term used to describe how people communicate within the use of their personal space. We have to be aware that cultural differences significantly influence this kind of communication with others, and we must respect that.

Paralanguage, the way we say things, includes the pitch, volume and intonation of speech. As a fitness instructor you have to provide the client a safe environment and an enjoyable exercise experience. To ensure that kind of experience, you have to be an expert communicator. You have to be comfortable communicating with different clients, which also means different personality types. You may need to change your communication and instruction style according to the other person's characteristics and needs. Instructions should be personalized. You should never forget that you are working with individuals who have distinct traits, beliefs, expectations and reactions to your instructions. You will have to use modes of instruction according to the characteristics of the given client to ensure the best possible effect.

Psychology related to motivating the client

As we have seen before, motivation is one of the main psychological processes behind exercise behavior. A lot of trainers fail to understand the importance of motivating their client, or take an overly simplified attitude towards motivation. The concept is complicated and there are certain features to be known and understand in order to be not only an effective trainer, but also an effective motivator for the client.

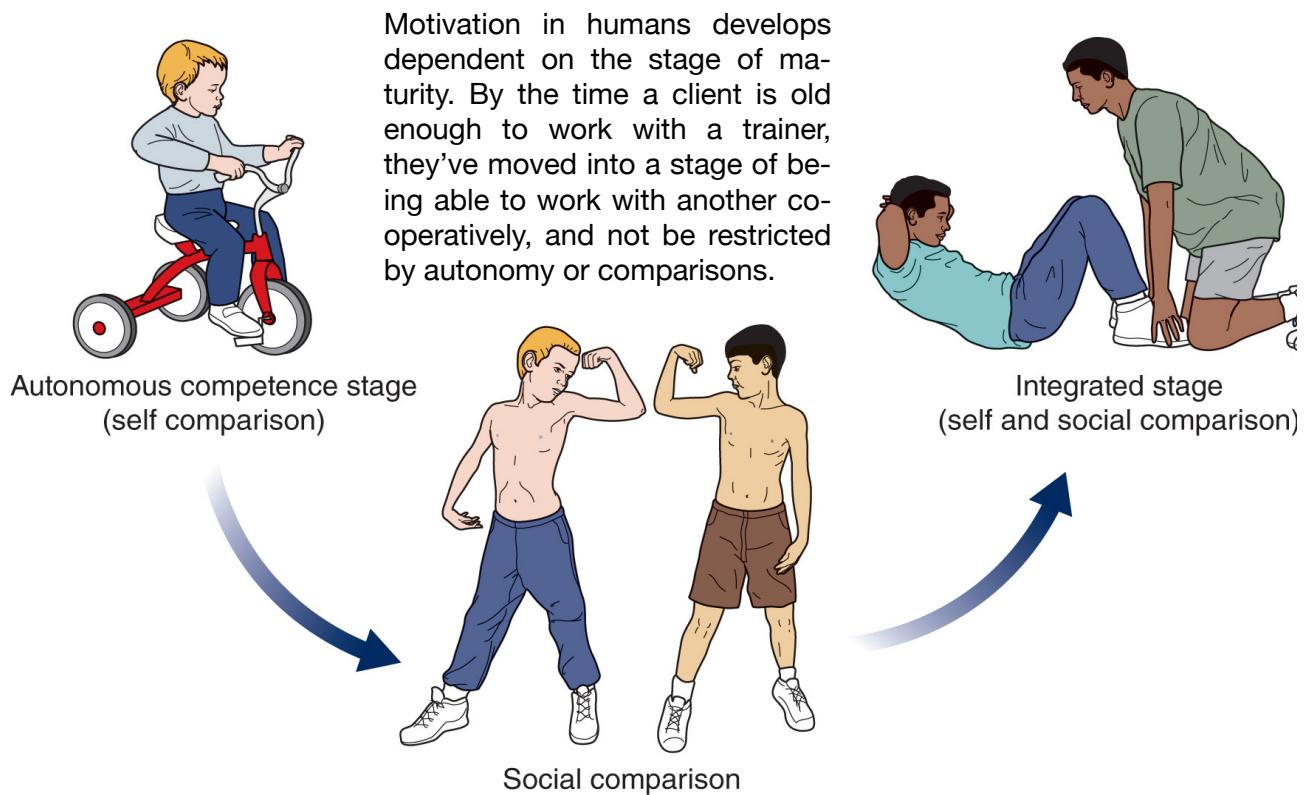
Motivation is a key attribute for personal trainers. The development of the personal training profession has changed over the years, requiring more from trainers. Because exercise science has become more accessible to the general public by way of the Internet, personal fitness trainers are being tapped as much for inspiration as they are for the knowledge and information they possess. Being able to act as a motivational figure to your client can take an exhaustive amount of energy and effort. Therefore it's important to hone your motivation skills to ensure your training methods are the most effective they can be.

We have to be aware that 50% of the clients will drop out of exercise programs after 6 months (Kravitz). We cannot keep every single client, but we should try to reduce the amount of those who are lost through negligence or incompetence from the trainer, or those who leave due to a lack of motivation.

Personalize the goals for each of your clients.

Try to avoid basic, generalized goals such as losing weight or gaining muscular size. Instead, goals should be very detailed and you will want to discuss specific measurable goals for the client to ensure that your client can clearly understand a summary of their precise desires to achieve. Instead of losing weight (general), find out how much weight each client would like to lose (specific). Define personal goals and map out a schedule of activity to achieve those goals in specific periods of time. Keeping goals personal helps you connect with clients on a deeper, more intimate level. Remain confident and true to your own unique personality. Your natural charisma and energy levels tend to be of great influence to clients, who are typically looking to you as their leader.

Understand that clients look to personal



trainers for knowledge, inspiration and for opening doors to enhanced levels of health, fitness and wellness. Project these attributes at all times and you will be more likely to facilitate a clients' belief in your leadership and your abilities - and most importantly - a client's belief in him or herself. Showing how much you enjoy your job and your client is easily done by using encouraging words, congratulating them on all goals and accomplishments - regardless of whether they are great or small - and continue to challenging clients to strive to achieve their personal goals.

Expand the client's vocabulary. Bring the client up to speed with strength training vernacular. For instance, tell your client the difference between "active stretching" and "passive stretching". Increase the client's confidence by explaining strength training phrases and terms and by using this vocabulary in corresponding conversations.



Motivating clients is most definitely an art form that takes practice. Many trainers will make mistakes along the way. Treating the client as the subject of an experiment, is one common mistake seen in the field. When this style is deployed, the trainer only punishes or rewards the client, mostly the former. This method can also have some positive effects, but the main problems with this approach are the simplifying effect and the short time frame of interaction.

Additionally, the biggest concern is remembering that your clients are individuals who deserve the utmost respect, positive feedback and a positive coactive relationship. The trainer is there to help the client to better themselves. It is very difficult to get positive outcomes from a trainer who is always yelling, punishing and humiliating their client. Yes, some people do respond favorably to this technique of motivation or treatment, but the majority of clients won't fit into this category.

"Great job today, I think you're ready for an increase in speed!"



"This is great! My trainer thinks I'm doing a great job!"

1 Decision to send a message about something

2 Encoding of the message by the sender

3 Channel through which the message is transmitted to receiver

5 Internal response by the receiver to the message

4 Decoding of the message by the receiver

Another very simple, but inappropriate motivational approach is seen in trainers who believe in a particular motivational approach and expect each client to respond to it accordingly. This technique is only about the instructor. But the one-size-fits-all approach disregards the unique characteristics of the client.

A common belief among trainers sometimes when an exerciser is not doing everything the way the instructor ordered, is that he or she lacks motivation and is rebelling. This is not true, as certain clients want to learn in their own way and are very motivated and determined to do so. To consider this as lacking motivation is a great misunderstanding, which can have a detrimental effect on the effectiveness of training and the relationship between the client and the trainer.

After seeing a few examples how not to motivate our clients, lets take a look at how motivation really works.

First, we need to be aware of what we want to achieve, and what we must do to motivate the client. The basic question is quite simple: How can I compel a client to change their behavior?

Psychologically, motivation is seen to have two fundamental dimensions: direction and intensity. Direction shows us how much a person actively seeks challenges, how and why they avoid them, and how they set goals. Intensity is the amount of effort needed for the individual to achieve a certain goal, it describes the person's activity and energy levels.

Motivation has distinct characteristics. These characteristics are easy to understand and every trainer should be aware of these in order to use them as an effective option to bring the best out of their clients.

Extrinsic and intrinsic motivation

Motivation can have two sources. Intrinsically motivated people have their own innate drive to be better, to do something. Competence, success, self-determination and excellence are the keywords for a client who has inner motivation. Extrinsic motivation derives from the feedback of other people, e. g. the trainer. The positive or negative reinforcements from an outer source can reduce or increase the occurrence of a certain behavior. It is important to notice that both intrinsic and extrinsic motivation are working at the same time within most clients. It would be advisable to consider only one and make that the primary focus.



Good motivators provide feedback to shape the behavior of their clients in a desired way. But at the same time, they try to elicit and strengthen the inner drives and motives of the clients. It is possible to undermine the intrinsic motivation of the client when they feel we are trying to control or manipulate them. This has to be avoided. However, extrinsic motivating can act as a reinforcement of intrinsic motivation, when the person feels that extrinsic motivation is a reward of competence.

The second important aspect of motivation is its directness. Both direct and indirect motivational techniques can, and should be used. We can distinguish three basic forms of direct motivation; permissiveness, identification and internalization. The first, “permissiveness” is not only related to praise and rewards, but to punishment as well. For example, “you did an excellent job today, you get a day off” or “you were terrible today, tomorrow you will have to do an extra set.” This method tends to be the result of when the client has no solid rules of behavior and has a weak self. Overusing it will be counterproductive, because clients are more easily motivated by positive feedback.

Identification is based on the relationship between the client and the trainer. In other words, “I’ll do (or don’t do) something, because I like you”. Identification can be seen as a hidden form of obedience. Needless to say, this technique works only when the relationship between the client and trainer is good.

The third form of direct motivation, internalization, uses the beliefs and values of the client instead of external sources. How and when these methods work depend on various factors, such as the personality of both the client and the trainer and the trainer’s expertise in all of these diverse techniques.

Age should not be ignored either. Children are less likely motivated with internalized values, because they still probably lack them. Adults with

crystallized values will not be happy with simple permissive tricks. Indirect techniques target not directly the client, rather they change or adjust the situation or the environment, both physically and psychologically. The sites of exercise, the attitude of the trainer and granting greater control to the client are just a few examples of indirect techniques.



Your ability to motivate your client will depend largely on your leadership style. Your qualities, as well as those coming from within the client combine with the situation and enhance effective leadership.

The next topic to be discussed about motivation is the so-called “locus of control”. Simply put, this means how different people perceive their responsibility for reward and punishment. Someone with an internal locus of control is far more likely to attribute the events of his life dependent to their own behavior. They think that in most cases their performance has clear consequences, either positive or negative. In contrast, a person with an external locus of control is having a tendency to attribute life

events to luck, chance, the influence of others or any situational characteristic.

Very few people have only external or internal locus of control. Most of us have both, but one is stronger, and therefore determines the way we see the world. Certain groups in society, especially those who have lower socioeconomic status, tend to have an external locus of control, while athletes, particularly the good ones, have internal locus of control. Thinking back to the previous point, we can identify the relation between locus of control and effective direct motivation techniques. External control works better with identification, internal control with internalization.

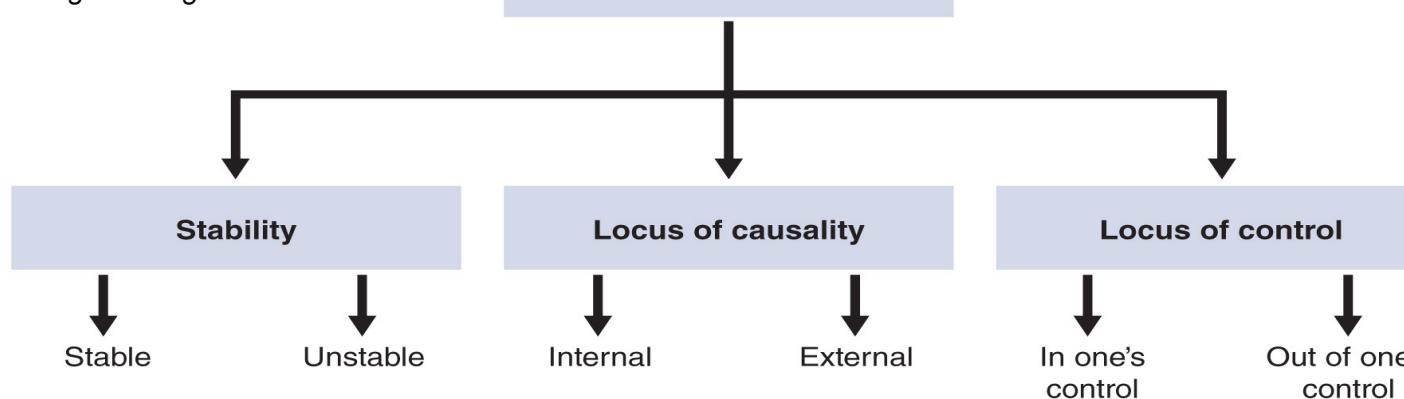
You probably have never realized how much lowering stress levels, keeps injuries at bay. Of course, this isn't a common point of knowledge for a trainer lacking awareness in exercise psychology. Still, three decades of research shows that a combination of conditions puts athletes at a greater risk of injury. These conditions include negative life stresses, an increase in daily hassles, previous injuries, and poor coping responses.

Stress, inadequate coping skills and personality traits do not just make for a bad mood. These factors create an elevated stress response. What does this mean for a client? People who have elevated stress responses suffer from more muscle tension, are more easily distracted, and have smaller attention span. This means your client may not notice that they are not holding their body in the proper form as they execute a movement under your watch as their trainer. Being under stress for long periods of time actually changes the body's endocrine system, making a person more susceptible to illness and slowing down the healing process when we are sick or injured.

We all know stress is unavoidable, but how do we help clients manage life stresses and lower their injury risk? We need to promote

The locus of causality shown here refers to how the individual perceives the cause of success or failure to lie within oneself (internal) or from the environment or situation (external) factors. Traditionally, the locus of causality has been linked to emotions, such as pride or shame associated with winning or losing.

Basic attribution categories



and develop coping skills for the client to use in order to deal with stress. If you think about it, what do we know to be the best approach when life hits us with a big stressor — such as death of a loved one, a move across country or the end of an important personal relationship? We seek professional help. This is normal if our client's coping skills are not up to an acceptable level. An exercise psychologist can both teach every day coping skills and help a client deal with a major life stressors. Taking deliberate steps to try and reduce stress can help lower the chance of incurring more stress through suffering an injury. In short, it is not the trainer's sole responsibility to fix clients in this way.

Anxiety and exercise adherence

The last and probably most important issue with motivation involves the needs of the exerciser. If there is one secret about motivation, it is the need to understand what the individual needs and how we can motivate him to achieve that objective. Since Maslow, we all know the pyramid of needs. Three of these needs are very important to our work as a trainer. The first is the need of arousal. Arousal is the level of excitement in the cortex.

The locus of control is a personality trait. This theory of personality psychology refers to the extent to which an individual believes that they can control events that affect them. This has significant relevance to training clients.

Everybody has an optimal level of arousal, some people lower, some higher. When our level of arousal is optimal, we are neither bored nor too excited; we are able to attain peak performance. Another important need is the need of affiliation. We desire to be accepted, to be cared for. The third is the need of recognition, to feel or competence or the acknowledgement of our competence by others. If we integrate the four key concepts of motivation to our work, we will be certainly more successful and also clients will be happier with our service. The adequate application of motivational techniques requires not only knowledge about them, but also a great deal of insight into the character of our clients.

Understanding how psychology influences exercise compliance and how to improve it



First, we have to define compliance and adherence, because both concepts are equally important for the client. Compliance is the act of complying with a demand or proposal, while adherence refers to the ability to be consistent with the task. (Milroy, O'Neil, 2000) Both aspects are heavily associated with motivation level, whether extrinsic or intrinsic.

Adherence is based on the belief that participating in exercise activities will result in better physical fitness and health. It ceases when a certain health-related objective or a desired body image has been reached. The level of perceived health also influences adherence to exercising. The third personal factor of adherence is self-

motivation and environmental factors like family support, perceived availability of time and access to facilities modify adherence, however environmental factors can mean constraints, too.

Milroy and O'Neil view compliance as an external construct, which can also bring intrinsic rewards. In many cases, compliance to exercise is a strategy to improve the physical and health status of the client, which is related to some authority (e. g. the trainer or medical professionals.)

Research results suggest that only 23% of clients persevere with long term exercise, which means three out of four clients will sooner or later quit and leave the training relationship altogether. To improve compliance of clients it is vital to understand the constraints working against it. The constraints do not have to be real, they might be just perceived, but the results are the same. Based on the work of Milroy and O'Neil, it might be useful to understand the most typical constraints to help our client manage.

Counteracting factors to compliance need to be understood. The most important strategy may be to set specific goals, but apart from that both communication (again) and motivation (again) also play significant roles. Because we have discussed motivation and instructions previously, now we can proceed with goal setting as an influencing factor on compliance.

The first important step is to identify the constraints, concerns or problems of the client. After we have found the source of problems, the next step is to narrow it from vague to clear and specific topics. We have to decide objectives which are realistic (do not forget about client participation in the decision making process). Goals should be supported by effective procedures, e. g. when is a certain goals achieved, which strategies can be used to assist the road to objectives. Goals should be measurable, because it is much easier to provide authentic feedback this way. We should also implement the complete evaluation of the goals and offer follow-up to the clientele.

Compliance does not only have cognitive components, but also very strong emotional factors. People have a natural tendency of needing the safety of their comfort zone. If they feel some threat, either real or perceived, undermines this security, defensive mechanisms start to work and we have a mountain to climb to achieve compliance.

Helping clients change behaviors, using the transtheoretical model as a model and strategy

Helping clients to change their problem behavior is always a great challenge. Many trainers have no or limited knowledge of useful methods or they are not properly using their knowledge. For the PFT, the standard model for behavior change is The Transtheoretical Model, which is a very useful tool to change unhealthy behaviors of clients into healthy ones. The model was developed by Prochaska and can be described as an integrative model of behavior change. The model is based on the intentional behavior of the person (your client) and involves decision making as well. According to the experience of the theorists and researchers who have developed this model, it can be successfully adapted to promote health and to change behaviors that are endangering health.

But as trainers, we are interested in a little more detailed description of the model, because it can be successfully applied to the practice of trainers and instructors to help clients transform their life through the modification of their behavior and habits. The use of the model for exercise-related behaviors is encouraged by its authors and other researchers. The model has a great advantage compared to other models, because it views behavior change as a process and not as an event. Another positive aspect of the model is breaking down the change process into stages. It is much easier to measure results. The model has five stages, which we shortly introduce.

The first stage is precontemplation. Individuals at this stage do not intend to change their problem behavior in the next six months for many reasons. This may be because of lack of information or unsuccessful attempts in the past. Sometimes a client in this level or stage of transition is looking for the direction of a health professional, trainer or coach to intervene.

The next stage, contemplation, brings a more open attitude. People in this stage are intending to change their problem behavior in the foreseeable future; they just have not made up their minds yet. When they do, they are in the preparation stage. Changes for the client are imminent, usually within a month (depending on initial values and the nature of the change, itself), individuals have concrete plans, and how they want to change their problem behavior.

Soon follows the action stage, involving individuals, who have changed their behavior in the last six months. The changes are new and the chance for a relapse is quite high, but certain measures have been successfully adopted.

The last stage, maintenance, involves individuals who have changed their behaviors for at least six months. The new, changed behavior became a habit. The chance of a relapse is considerably smaller than it was in the stage of action.

The Transtheoretical model is successfully used to change behaviors endangering health, e. g. sedentary lifestyle, smoking and dieting. Although there is always a chance that the person will abandon the healthier lifestyle, this model seems to produce better results than other, similar attempts to change problem behavior in clients, according to research findings. (Anshel, 2007)

Apart from The Transtheoretical Model, there are other approaches for modifying behaviors in clients, such as Health Belief Model, Theories of Reasoned Action and Planned Behavior, Self-efficacy Theory, Information-Motivation-Behavioral Skills Model and the Disconnected

Values Model. Further reading about these models can be found in the essay of Anshel (2007).

The cause and effect of psychology related to injuries, illness, and disease

We all know by now that in appropriate quality and quantity can significantly contribute to physical and mental health. On the contrary, too much or excessive exercising has a detrimental effect on health. Exercise can cause dependence, when the person's thoughts are only revolving around exercising, even when he is actually not exercising. Exercise dependence is a form of obsessive-compulsive disorders. The individual's physical, psychological and social functioning is severely affected, he can have withdrawal symptoms. This can cause the client to develop a tolerance to exercising, and therefore he needs more and more to be satisfied with the results.

Psychological skills could also provide invaluable help to overcome this as well as helping recovery. Injury rehabilitation using certain psychological skills like mental imagery or relaxation is reported to having higher adherence rates and speed up recovery. (Hamson-Utley et al., 2008)

Exercising can sometimes lead to injuries. Psychological skills could also provide invaluable help to overcome this as well as helping recovery. Injury rehabilitation using certain psychological skills like mental imagery or relaxation is reported to having higher adherence rates and to also speed up recovery from an injury (Hamson-Utley et al., 2008). As we have seen previously in this chapter, regular exercise behavior has positive effects to physical and mental health. Exercise has immediate effects on the mental health of clients. Below are the most important positive influences:

- Better coping with stress
- Reduced anxiety level
- Prevention or reduction of depression
- Improved mood
- Higher level of confidence
- Better learning abilities
- Better concentration and memory
- Higher work ethic
- Improving creativity
- More relaxing sleep

Although effects can appear immediately, to make the benefits of PA long-lasting, exercise needs to happen regularly. A certain amount of time is needed to develop the long-lasting positive effects and benefits - including a reduction in depression, better neurological functioning and increased stress tolerance. From these psychological benefits come indirect physiological changes as well, like lower heart rate and blood pressure and more optimal endocrine functioning.

Since most trainers do not function in the same way as an Athletic Trainer or one who sees injuries frequently, they may not realize how much lowering stress levels can serve to keep injuries at bay. In general, most people fail to see this connection, overall. Of course this isn't a common point of knowledge for a fitness professional not trained in the influence of stress and exercise psychology. Still, three decades of research shows that a combination of conditions puts athletes at a greater risk of injury - this includes negative life stresses, a perceived increase in the demands of everyday life, previous injuries, and poor coping responses.

Stress, inadequate coping skills and personality traits alone do not just make for a bad mood; these factors create an elevated stress response. What does this mean for a client? People who have elevated stress responses suffer from more muscle tension, are more easily distracted, and have a smaller attention span. This means that your client may not notice that they are not holding their body in the proper form as they

execute a movement under your watch as their trainer.

Physiologically, being under stress for long periods of time actually changes the body's endocrine system, making a person more susceptible to illness and slowing down the healing process when we are sick or injured.

We all know stress is unavoidable, but how do we help clients manage the stress of life and lower their injury risk? Trainers might have more success if they are able to promote and develop coping skills for the client to use in order to deal with stress. And if you think about it, what do we know to be the best approach when life hits us with a big stressor — such as death of a loved one, a change in residence or the end of an important personal relationship? We seek professional help. And this is normal if our client's coping skills are not up to an acceptable level in order to protect them from the harmful effects of stress.

Trainers, like exercise psychologists, can teach everyday coping skills and help clients to deal with major life stressors. Taking deliberate steps to try and reduce stress can also help to lower the chance of incurring more stress through suffering an injury. But it should not be the trainer's sole responsibility to fix clients in this way.

Overtraining

It's not unusual for clients to push and to train according to the slogan "no pain, no gain." Indeed, this could be a worthy idea for a competitive athlete but for our normal everyday client, it tends to lead to overtraining. Overtraining can be defined as an exercise program that leads to "an undesired outcome of fatigue and performance decrements." We know from the GAS that this is very real. Now we also know it may have psychological or mental consequences.

Muscle pain or soreness
Weight loss
Gastrointestinal disturbance
Overuse injuries
Loss of self-confidence
Anxiety
Emotional/motivational changes

The easiest way to see if your client is experiencing overtraining is by assessment — such as taking their resting heart rate after a full night's rest, upon waking up. Some trainers also encourage this practice to be done before the client retires to bed in the evening. Usually, a well-conditioned client will see resting heart rates decrease through positive adaptations to training, but if your program design is overly intense, your client may actually experience an increase in their resting heart rate. Not only would this have a physiological effect, but it most certainly would affect the client's mental states as well.

Most clients don't enjoy (or even feel like themselves) when taking excessive days off from PA, as some believe that it detracts from their ultimate goal. The best feature of recovery, though, is that it can take many forms and giving the body proper time to recover is essential to regenerate emotional and physical energy is generally considered to be the easy part of an exercise program design. Try promoting practicing relaxation techniques such as progressive relaxation, autogenic relaxation, or guided imagery.

Think of recovery as just one supporting factor to reduce stress in all areas of your client's life. For example, if your client is overwhelmed with work life being too challenging or certain relationships are causing them undue stress, try to encourage the client to lessen or alleviate those stressors during those times when they are not working with you. Without this, clients may see stress as a significant barrier. In most cases, this is a contraindication in terms of their

A lack of focus or concentration can lead to an injury; an injury can also cause depression, fear of failure, post-injury performance and other potential barriers to recovery.



goals.

Recovery has three levels: physical, social, and environmental. Eating right, practicing yoga or taking a hike on days off are all practical suggestions for your client to use physically-based strategies in order to better recover. Consider social recovery - meaning that one will participate with people that they like in social activities that are relaxing and rejuvenating. This is often overlooked by trainers because it occurs outside of the environment where work with your client is done.

Environmental recovery can be as simple as changing your training locale. This can also include where the time spent in session with the trainer occurs. A trainer in tune to the needs of his or her client should monitor client reactions and responses to training variables to ensure that the client is not overtraining. This will help to prevent burn-out. The trainer should also try to understand their client's needs as completely as possible.

Focus, from a clients perspective, helps concentration and hopefully, competency. The term "attentional field" is used to describe the thoughts, emotions, and physical responses coming from within the client as well as the outside sights and sounds that they are focusing on. Trainers could view this as the ability for your client to attend to internal and external cues in your attentional field at the same time. This will also require practice and cueing from the trainer. When attentional focus decreases, so does the risk of injury or at the very least, poor performance.

A well-coached client knows where to focus their attention for the best results while

training. Some people find success through an internal focus style; they will concentrate on their form and technique while training, while being comfortable knowing that there may be distractions or activity in their immediate surroundings.

Other clients who lack this experience of feeling comfortable are far more likely to be distracted and thus, injured. In terms of personality traits, those who are more competitive tend do best with an external focus style, focusing on outside sights and sounds right up until the moment of exercise execution. During training, they are also aware that if they over-thinking about anything, they may be misdirecting their focus or concentrating too much.

What type of focus works best for your client? Trainers should be able to analyze past exercise experiences with their client and contemplate the techniques used successfully with them, in order to have a repeat performance. This should seem fairly logical.

One of the simplest ways to improve focus in your client is to instruct them to place their eyes where you want them to focus. To eliminate external distractions a trainer might encourage a client to keep the eyes averted during the time used under load or during a particular activity.

The topic of focus is sometimes viewed as similar to *mindfulness*, or the complete attention on the present. The current body of scientific evidence suggests that the effects of mindfulness impacts the thoughts, emotions and performance of the client.

Focus also reaches into other areas of the dynamics between a trainer and client, including mental toughness, imagery, relaxation and self-talk. For some activities, the exerciser's thought processes must be congruent with their ecology and environment. Having clients mentally 'psyche up' might include challenging some clients with more demanding tasks, while meaning that you may find it necessary to hold others back from levels of progression until you feel that their attentional focus is acceptable.

Promote the idea of focusing only on what your client can control. The only real control your client has will have to come from within, but good feedback and cueing from the trainer is always helpful. In order to help your client to help align their focus, have your client try the following:

Positive: Avoid negative thinking or replace each negative thought with a positive statement.

Process: Focus on what your client needs to do in order to stay engaged and to put forth their best, from training to mastery of technique.

Present: The past is over and positive goal outcomes are to be in the future. What is your client doing at this very moment? Keep them in the moment by encouraging them to focus on the here and now.

Progress: Comparing themselves to others is a no-win situation. Promote the idea of clients focusing only on their own improvement.

Focus may seem simple, but developing the right type of concentration to facilitate focus is vital for each client. A trainer who is fully engaged with their client can create the focus needed to exercise safely and to optimize client outcomes or results.



Summary

At this point your head is probably full with more psychological jargon and details. You may feel a little confused or unclear on some concepts discussed, or not really sure of what you have gained reading this chapter. This information presented here was not intended to be read and understood all at once, especially not for readers with minimal or no previous knowledge of psychology or personal training. We have therefore focused more on the key topics related to issues you will almost certainly encounter during your work as a fitness professional. We suggest that from time to time you come back to this chapter or at least certain parts of it to understand the ideas put forth.

If a fitness professional has more tools to evaluate the client, and if they have additional skills to help understand client motivations or other important behaviors, then the client should have a better experience. We could also take

this one step further by saying that a trainer with more knowledge will be better able to help get clients to their goals in the quickest and safest way possible. Your reputation, as well as your success as a trainer are somewhat influenced by your ability to get your client results - and this is done more easily when we know more about our client's personality traits, their perspectives and their responses to our training directives.

This chapter only gets one's foot in the door and gives you only an introduction to psychological concepts. It is not intended to make you an exercise psychologist. Our objective was only to help you to understand core psychological concepts and their effect on client behaviors, the client-trainer relationship, as well as attitudes towards exercise, fitness and health. If you need further information or help about exercise psychology, please, do not hesitate to look for more reading on the topic or consult a professional who has expertise in this topic.

References:

- Anshel, M. H.: Conceptualizing Applied Exercise Psychology, The Journal of the American Board of Sport Psychology, Vol. 1, 2007
- Gavin, J., McBrearty, M., Séguin, D.: The Psychology of Exercise, IDEA Fitness Journal, 2006 February
- Hamson-Utley, J. J., Martin, S., Walters, J.: Athletic Trainers' and Physical Therapists' Perceptions of the Effectiveness of Psychological Skills Within Sport Injury Rehabilitation Programs, Journal of Athletic Training 2008;43(3):258–264
- Kravitz, L.: What Starts and Keeps People Exercising? www.unm.edu/~lkravitz
- MacNamara, Á., Button, A., Collins, D.: The Role of Psychological Characteristics in Facilitating the Pathway to Elite Performance Part 1: Identifying Mental Skills and Behaviors, The Sport Psychologist, 2010, 24, 52-73
- Milroy, P., O'Neil, G.: Factors affecting compliance to chiropractic prescribed home exercise: a review of the literature, JCCA, 2000
- Portenga, S. T., Aoyagi, M. W., Balague, G., Cohen, A., Harmison, B.: Defining the Practice of Sport and Performance Psychology, Division 47
- Saito, H., Kimura, Y., Tashima, S., Takao, N., Nakagawa, A., Baba, T., Sato, S. (2009): Psychological factors that promote behavior modification by obese patients, <http://www.bpsmedicine.com/content/3/1/9>
- Szabó, A.: Acute Psychological Benefits of Exercise Performed at Self-selected Workloads: Implications for Theory and Practice, Journal of Sports Science and Medicine (2003) 2, 77-87
- Velicer, W. F, Prochaska, J. O., Fava, J. L., Norman, G. J., & Redding, C. A. (1998): Smoking cessation and stress management: Applications of the Transtheoretical Model of behavior change. Homeostasis, 38, 216-233.
- Waumsley, J., Nanette, M.: Physical Activity and Exercise Psychology: Our role in healthy weight management for adults, The British Psychological Society 2011

THE BUSINESS of Personal Training

Chapter 13

Business Fundamentals

As you start to make personal training a career, we encourage you to explore the benefits of setting a strong foundation. This will help by preparing you to make sound decisions about your career, based on having a clear sense of who you are, what your strengths are and what you hope to accomplish.

Specifically, for personal trainers, ways to increase your self-awareness and your knowledge of yourself are good ways to begin the process of building strong business foundations. Many times, people who choose a career as a personal trainer don't enjoy the business aspects and therefore don't take the time to learn what is needed to be successful. Unfortunately, this sort of attitude rarely will lead to career growth for the trainer. On the other hand, trainers who take the time to master basic business knowledge and skills will build solid careers while enjoying a smooth road to success.

Know the variety of environments that independent contractors can work in. Be able to identify possible benefits and drawbacks to working as an independent contractor.

In order to apply your skills that you learn with clients, it is crucial to develop the business skills that give you the knowledge, tools and insights that are needed to make informed career choices. It is always best when we make choices that support both financial and professional growth goals. With this in mind, it is important to remember why you chose personal training as a profession and to stay grounded in the experience as you transform people and improve their health.



Professional trainers are also good at business fundamentals. Take time to learn about yourself and the main elements of running a successful business. Your choices are driven by understanding yourself and your goals.

It is essential for a trainer to assess his or her current state. One of the most important traits that successful trainers have in common is the dedication to knowledge. Self-awareness, part of this knowledge, is the foundation and the beginning point for all trainers. This type of personal assessment should include a list of your personal major accomplishments. To also highlight your strengths, list your talents and abilities, as well as the three things that you do best. After completing this exercise, make a list of your major challenges, and any obstacles or barriers that you have overcome. This part of the personal assessment may be more reflective in nature. Try to list three things that you do the least well and three things for which you want to be remembered. Finish your personal assessment by writing or listing how you would like others to describe you and three things that you want to accomplish in your life.

Be realistic. As an employee of a gym, not ALL of the trainer's clients will be given to the trainer without having to work for them. Know all of the advantages and disadvantages to working for a club or organization.

Think now about your career goals. Making a separate list, include the three attributes of your service that you are the most proud of and be sure to also include a list of items that work well in your service or business; and then be sure to include items that do not work as well in your business or service (if applicable). If you could change anything in your career right now, what would be? How would you want others to speak of your business? If you are new to the trade, construct your answers as if they were active goals and elements of your business vision.

Most personal trainers love what they do. One fact that is not mentioned as often or known about personal trainers is the high percentage of trainers who have failed to become successful in their careers. Although the reasons vary, most failures are rooted in a lack of business knowledge. At first, you might think that acquiring technical skills and a high degree of expertise will ensure your success, but this is only one part of the whole situation. Other key factors include strong interpersonal communication skills, paired with business and marketing skills or strategies.



Starting out with a strong foundation will serve ALL trainers well, as you discover your key strengths and contemplate how to position yourself within the profession.

For personal trainers, interpersonal skills include creating rapport, building relationships with prospective clients, developing an inspirational manner within your client, setting and operating with appropriate personal and professional boundaries and creating a safe space for clients. It is important to develop an awareness of empathy to compliment high standards of professionalism. These skills will help you greatly, whether you run your own business as a contractor or if you work for someone else.

The two primary career tracks for personal trainers are to work for a company or to be self-employed. Within those two paths are a number of possibilities. Some trainers kickstart their careers by working at a fitness club, while others take part-time jobs to train as a way to augment an existing private practice. Some trainers choose a private business model right from the start, and then there are those who prefer to only work as an employee for someone else. You will need to consider the amount of time that you want to work. Some people want to work full time as a trainer while others will choose to permanently stay within a particular field or specialty and then to use personal training as a means of enhancing their business model.

EXAM ALERT

What term is used to describe the population with whom the personal trainer is trying to advertise? What are the reasonable ways of networking to build a personal training business? When using flyers/brochures as a marketing tool, what information should be used? Due to the laws in most states, what form of marketing for a personal trainer to increase their business is NOT recommended by NESTA?



Time is one factor to consider when you are a contractor. Equipment access is another benefit to working in some environments

Employment

Working as an employee provides some potential benefits for the trainer. This includes the possibility of obtaining a full client load with very little marketing and providing a larger scope of services for clients who you train. When a trainer works for someone else or as part of a company, they typically will start out with a ready-made professional image and will typically experience less paperwork than an independent contractor. This may have the added benefit of allowing the trainer to focus more on the hands-on work done with clients. Having access to better and more varied equipment is also a great benefit to working for someone else.

Self-employment

Having your own personal training business is the most profitable option for a personal trainer, although not everyone is well suited for this type of enterprise. It takes a certain personality type to be truly successful in one's own business. The most successful personal trainers are inventive and follow through with their plans. They respect money. They possess considerable expertise in a particular career field and have broad experience in several others. They have very good verbal and written communication skills and are normally considered to be very personable. Successful business owners tend to be positive thinkers, determined, self-disciplined, service oriented and persistent. Remember, most personal trainers operating small businesses that don't succeed are examples of talent without proper business skills.

Advantages of being self employed included having a flexible schedule, independence, being your own boss and the possibility of receiving tax advantages. Most often, personal trainers are more creative and experience increased personal satisfaction and greater sense of achievement when they are self-employed.

Disadvantages of being self employed include the long hours, usually 10 to 14 hours per day. This can include 6 to 7 days a week, of work. When a personal trainer is also a business owner they not only work with their clients, but they are also required to actively market and manage their practice.

Therefore, in the beginning, new trainers may need to devote 2 to 3 hours for business promotion and development for every hour of client interaction. Sometimes the startup costs can be greater than what has been anticipated. Initially, income is usually not steady and there are financial risks. But, most personal trainers agree that the benefits of being self employed outweigh both the perceived or real risks.

Self-employment - Independent Contractors

An independent contractor (IC) is a professional who works for themselves. The IC can choose whether or not to accept in-home clients in the presence of the client's own home or the home of the personal trainer. The IC can choose to rent space in a studio or gym, or even own their own studio or gym. As well, the IC can train multiple clients at one time to increase profits while increasing camaraderie between clients with similar goals and abilities.

For self-employed trainers, the two most prevalent reasons for failure are mismanagement and money (capital). Mismanagement is generally a result of poor planning, not realistically evaluating strengths and weaknesses, failing to anticipate obstacles, improper budgeting and lacking the necessary business skills to prevent failures.

Possible benefits to working as an independent contractor

Choose training rates and fees (Typically ranging from \$40-\$150/hour or more)

Ability to work fewer hours while making more money than as an employee

Pay-outs include rent (no rent fees when working from home or the home of a client), marketing, and professional and health insurance.

Dictate own policies and procedures

Accountable only to the client and oneself

Choose own hours without concern for requirements of an employer

Many clubs or gyms require a certain number of employee hours to maintain employment at a facility (typically 15-20 hours or more per week), and these same clubs or gyms expect set hours of availability in many situations (i.e., morning shift from 5-10am, or evening shift from 6-10pm every day).

Tax incentives, such as write-offs and deductions, for being a business owner

Products or services utilized for purposes of doing business can often save money (check with a tax accountant for more information)

Ability to work in varied locations or the comfort of a gym in home

Possible drawbacks to working as an independent contractor

Time spent in transit

When time is spent traveling from location to location, that time could be offset by working at one gym or location. Otherwise, not only time, but opportunities for earning income may be lost.

Higher tax bracket for being a business owner

Independent contractors are subject to a higher tax bracket than the typical employee. Some taxes can be offset by the legal usage of eligible tax write-offs. All independent contractors should seek the advice of a certified tax accountant.

Greater effort required to gain new clientele

The work necessary for gaining new clientele is solely up to the pursuits of the individual unless they choose to retain marketing assistance. Being assertive and efficient with where the personal trainer chooses to devote time for gaining new clientele is a must.

Increased liability

Since the development and enforcement of policies and procedures is up to the independent personal trainer, liability for injury or accidents lies squarely upon the shoulders of the individual PT. Seeking liability insurance is a must.

Employee – Benefits and Drawbacks

A personal trainer who is an employee works for a club or other organization who typically supplies the location, equipment and most or all client prospects.

In general, if you are comfortable making the leap into marketing yourself as a trainer in your own business, you can expect more job satisfaction and freedom to operate as you please, but not all new trainers have this knowledge or skill. Once a client base is built, a professional trainer may want to consider transitioning to a private practice - but only after weighing both sides of the situation.

EXAM ALERT

Being consistent, assertive and image conscience are all qualities of a professional trainer with effective sales skills. Consider employers, work environment and type of clientele when dressing for a job.

Possible benefits to working as an Employee

Marketing already in place

There is less need to perform external marketing since most employers have already done the necessary work and focus can be made upon “internal” marketing, or marketing of one’s own training with members of the gym or club.

Liability is assumed by employer

In the event of client injury or accident the club is usually liable for coverage, not the trainer (the trainer may still be held liable in the event of negligence – confer with legal counsel for more information).

Client prospects provided

Many gyms or clubs send client prospects to trainers and leave the “selling” of personal training to the trainer or hand the trainer pre-paid clients. It is not suggested to rely on the club to refer clientele , but there are greater odds of being fed clients at a gym.

Employee benefits

Some, not all clubs or gyms may provide 401k investment benefits, as well as medical benefits, accrued vacation and sick leave with pay (benefits will vary). Other benefits include complimentary memberships for employees in fitness clubs, as well as educational workshops offered at little or no cost to the trainer.

Single work location

With employment from a club or gym, there is little need for travel from home to home and location to location costing time, gas and added stress when time could be spent making money.

Built-in support system

This will vary from club to club and location to location, but many facilities have a system of management and mentor support in place to help ensure the success of a personal trainer. The sheer number and success of personal trainers of a given facility should provide a clear view of the likelihood of new trainer success.

Possible drawbacks to working as an employee

Limited income

Due to the inability to increase rates and a normally scheduled rate of pay (often as little as \$10-\$15) the ability to earn a professional income is greatly hindered. This is perhaps the most significant difference between working as an employee and working as an independent contractor.

Constant supervision

While the amount and significance of employee supervision will vary, ultimately, there will be a manager or gym owner with whose policies the personal trainer must comply with if they plan on continuing to work in their gym or facility.

Marketing

The word “marketing” may trigger a wide range of thoughts and feelings, from tremendous excitement to fantasies of instant success to studied disinterest to hand-wringing dismay. Although effective marketing is the cornerstone of a flourishing practice, some practitioners shy away from any type of self-promotion as they associate it with being “pushy”. But sometimes, this lack of promotion comes from a lack of marketing knowledge or limited resources.



Four parts (promotion, advertising, publicity and community relations) of your business/marketing plan each relate to finding your target market.

In every business, the marketing component is the most pivotal aspect of the overall plan. Start by depicting the image that you wish to convey to prospective clients. Next, describe your target markets and clarify your differential advantage. Follow with a competition analysis, including steps you'll take to meet any challenges. The major section is the strategic action plan. Outline your marketing goals for all areas requiring management: promotion, advertising, publicity and community relations. Factor or consider timelines, budgets and rationale for each strategy that you incorporate into your business plan.



Target market

Do efforts and training methodologies/attributes fit the intended market?

Whether the personal trainer intends to train young athletes, senior citizens, or individuals with weight problems, they must be clear in conveying how they can help these special populations or markets and advertise and program exercise accordingly.

Flyers or brochures

Flyers are typically one page with one side only, while brochures typically have print or pictures on both sides and may be folded into parts. Perhaps the most important part of an effective flyer/brochure is a professionally done self portrait that portrays the personal trainer as a profes-

sional, sharp-looking, intelligent individual. This flyer or brochure should also include a short biography along with how the skills of the trainer can provide their "target market" with safe, efficient, and effective personal training. This advertisement should not look as though it has been done cheaply or haphazardly, the potential client must recognize that this is a trainer who is willing to go the extra mile in helping them and has the revenue from previous client success to be able to afford production of such a professional advertisement (image is a crucial part of first impressions).

Business cards

Every personal trainer, whether working for themselves or as an employee, should have their own business cards.

The business card should have the company logo (if there is one, and every IC personal trainer should have a logo!) and not be "too busy" with information or photo overload. Perhaps a slogan, then all the necessary contact information along with the individual's name and title is all that is necessary. Much like the flyer/brochure, the business card is a reflection of the personal trainer whose name appears on it, so be sure the appearance is appropriate and provides the image of a worthy professional.

DBA (Doing Business As) Certificate

(Also known as Fictitious Business Name) Any individual working as an independent contractor with their own company should register their company name with their local county courthouse for recognition as a legitimate business and to avoid crossover in name usage with other businesses in exchange for a small fee. Contact your local county courthouse for information on how to register.

For more information on marketing your services and incorporating your business contact the NESTA office at 877-348-6692 or visit www.NESTAcertified.com.

Where should the personal trainer market their training services?

Networking with local stores or businesses is a great way to get brand name recognition so that your name will become recognized and respected. A local nutritional store or gym may be good places to start. Other possibilities include coffee shops and cafes. It is wise to stick to areas where the trainer wishes to operate and where potential clients can afford training fees.

Networking with other professionals helps in establishing legitimacy by recognition from other health professionals such as chiropractors, physical therapists, massage therapists, and nutritionists. Referrals can then come from the varied professionals to the trainer and from the trainer back to the varied professionals so that all parties involved stand to gain new clientele and a solid referral base. This usually requires consistent effort to meet up with local professionals on an in-person situation or by the personal trainer staying involved by attending local trade shows and keeping their eye open for opportunities to meet and get to know other local health professionals. One never knows who might be a referring individual or potential future client. (Learn more about networking through various programs and opportunities at www.NESTAcertified.com or by calling us at 877-348-6692).

Brochures and flyers can be placed upon cars at local sporting events, but this advertising possibility has produced varied results and is illegal in most states. Better placement for flyers and brochures are at local businesses or as advertisements in free publications that are of little to no cost to the trainer. The trainer may choose to invest in a large advertisement in a major magazine or newspaper, but it becomes more important for the advertisement, much like the business card and/or flyer/brochure to be professional, while appealing to the proper "target market". This process often takes time and requires some research on the part of the personal trainer and a lot of "leg work" to get out and meet people.

The "Rule of Seven" applies greatly. It has been said that a person must hear about a company or business professional seven times (possibly through seven different sources) before response from potential clients/buyers can be expected. The trainer must remain confident that efforts will be met with eager clients and business opportunities while evaluating monthly and yearly one's marketing and advertising strategy.

Launching a website can be a very simple and worthy advertisement for people to obtain more information about a trainer. Godaddy.com can help with the necessary components of exposure to a website, and Microsoft Front Page can get a trainer started on their own website. Paying an outside party to prepare a website is also a viable option.

Sales and Professionalism

Becoming a professional and effective salesperson begins with image and first impressions. The proper attire and grooming must be taken into consideration. While an inner city gym will vary from a high-end suburban health club the personal trainer must make the appropriate efforts to be clean shaven, well-groomed, with clean, appropriate attire that is neither too revealing nor too mysterious. There is nothing wrong with wanting to display a healthy physique, but it is quite another to flaunt one's attributes. Confidence and cockiness are not the same. The personal trainer must be clear about their environment, the type of clientele they expect to receive, and must evaluate the situation to be able to separate themselves from an "ordinary" trainer.

The personal trainer must smile. A "goofy" or "silly" smile is no substitution for an honest, sincere smile from a person who simply enjoys what they do and is happy to be where they are. New clients will gravitate to the trainer whom they feel will help them "feel better" and will help them enjoy working out just as the trainer CLEARLY does by the fact that they smile often and much. This cannot be overstated. The "tough guy" approach may work at times, but it is the sincere, likeable person that draws the most attention.

The personal trainer should always look people in the eye, and remain in view whenever they are communicating with a potential client, or training one. Consistent eye contact and remaining in view of the client or potential client helps keep the client focused upon the concept that the trainer is the solution to their problems by always appearing to “be there”. As well, it is wise to remain at or below eye level, much like communicating with a child, to avoid intimidating another individual. While intimidation may gain some clientele or keep it, it will only go so far until the client may begin to feel that there is a lack of concern over their well-being and progress.

The ability for the personal trainer to be confident and assertive is crucial. A person will “always miss 100% of the shots they don’t take!” Likewise, the trainer must continuously put themselves in positions to meet people where they can offer their expertise. This means walking around the gym or standing in a place with a purpose. Simply being present or saying hello is not sufficient. The personal trainer must make it clear, in their own unique way, that they are present to help and have the utmost concern for the well-being and safety of the people around them.

The approach must be consistent. When it comes to approaching potential clients on the gym or workout floor a simple approach often works best.

Question #1: The First Approach

“Hello, how are you?”

The person approached always answers this greeting whether or not they are pleased to be approached and the response matters less than the fact that they have now acknowledged the presence of the personal trainer (whether this is the exact question that is asked is not important, only that it be a friendly greeting). As well, there must be an open ended question asked by the personal trainer to keep the individual who is

approached involved in the conversation. This sets the stage for the next question. It is not a conversation yet, but it will be.

EXAM ALERT

If a potential client is in the middle of an exercise, when should the personal trainer make a suggestion on exercise technique? What is the best way for teaching an individual how to perform an exercise correctly?

Question #2: The First Approach

“What are you working on?”

This question provides the answer that the personal trainer must consider before offering any advice or suggestions when observing an individual perform an exercise. Wait until the individual has finished their exercise set before posing any questions or offering any suggestions. What the personal trainer believes the person should be aiming to achieve by the motion they are attempting versus what the individual feels the exercise accomplishes may well be very different. What looks less like a lat pulldown attempt and more like a leaning back row is likely to be perceived as a picture-perfect lat pulldown by the individual performing the exercise and they may look at the trainer as though the trainer should have figured this out. Once again, the response is only information for the trainer so that they are clear in WHAT suggestion to make.

Question #3: The First Approach

“Can I make a suggestion?”

Surprise, surprise, almost no one ever denies a suggestion. This is less intimidating than telling someone that they are wrong or even implying that what they are doing is incorrect. This is merely a suggestion which the individual is free to decide whether or not to accept. The

trainer must then show the individual a “different” way of performing an exercise aimed at the goal the individual has previously stated when asked “What are you working on?” Then the trainer assists in monitoring the range, path and technique of the motion performed while giving verbal cues just as they would if the individual were their client.

Question #4: The First Approach

“How was that for you?”

If the answer to the trainer’s question is positive, they have done their job. If the individual is not interested in training (they will bring it up) or not intrigued (they will appear distracted or bored) the trainer has not done their job. If the individual continues to ask questions or is visibly impressed, the trainer has succeeded. No further advice should be given at this point. The First Approach is a “teaser” or a way of drawing initial interest. The trainer must then decide, based upon the effectiveness of their performance in the approach if this individual is worth pursuing or leaving the opportunity for another day. Never walk away from anyone without getting their full name and giving them yours. Remembering something significant about the individual will help next time the personal trainer sees them again, and will provide for further conversation.

The personal trainer shouldn’t have to “sell” – but must ask for it! There are countless ways of approaching the point of asking for the sale or determining if an individual wishes to continue training. Some are effective and some are not. There is NO perfect approach. Also, the approach should not be “canned” and appear that the trainer is reading from a script that was obviously not their own idea. Most individuals are smart enough to see that they are “being sold” and that the trainer does not have their best interests at heart.

If the potential client is interested in training THEY WILL ASK about training and the trainer will only have to answer questions. Open end-

ed questions that lead the client to a deeper response are best. For example, “How satisfied are you with the results you are getting from your program?” “How do you measure your success from your workouts? First get information then give information.” This information is vital to closing the sale. The selling should come from the performance of the trainer from the beginning of the first appointment or approach to the end of the conversation or meeting. “Inviting” an individual to train with the personal trainer helps move them into action. Their interest may or may not be obvious. Most are fearful to ask questions or are unaware of which questions to ask.

It is important that the trainer be honest, sincere and professional in their approach to the sale. Expect to learn from each potential client opportunity, and utilize the lessons learned for future opportunities. People change their minds and they talk to others, so the trainer must keep this in mind and not hard sell if they want to maintain a professional reputation and receive future referrals and repeat business. Hard selling is rarely successful and often leads to buyer remorse.

*Hopefully, you see the need to intervene here... but how do you go about it? Is this exerciser at risk for injury?
Your knowledge and your approach are extremely important here!*



The last thing a professional personal trainer or any professional wants is an individual who has purchased services and later regrets having made the purchase. The personal trainer should be prepared for possible objections that are likely to arise when asking for the sale. Common objections range from not having enough time, to an inability to afford services, or the need to

check with their spouse. If the personal trainer has done their job, there should be no objections. Objections that are offered means that the trainer needs to work on their ability to influence and needs to resell the benefits to the individual. Work on the ability to ask the right questions. Be responsive and respectful to the client's needs by learning to listen more than speaking.

A prospect may often talk themselves into personal training. Here is an example of a response if someone says, "I can't afford it". The personal trainer may respond with, "Yes, it's not cheap, but what is your health worth to you? If you could buy a bottle which provided lean muscle, an efficient heart, lower cholesterol, more energy, a better sex drive, and more quality sleep, what would you pay for it?". Hard selling is for one-time only sales and not good business for a service related position, like personal training.

Always ask "What are your thoughts about training one-on-one?" or "When would you like to start training with me?" Then wait. The personal trainer should wait for an answer and not speak again until the client has given one and only one of two choices – yes or no. They will hem and haw and talk to themselves at length waiting for the trainer to bail them out with a response. They must choose. A professional only asks once and waits for a final answer. The only other possible words the trainer may choose to use are "The choice is up to you." Throw it in their court.

To command higher fees a successful trainer must master the art of influence and polish their sales skills. The personal trainer must strive to close the sale at the first meeting and learn to anticipate client needs and answer questions even before they have been asked.

Contact

Voice mail messages

Keep them professional. No funny messages. No music. Just get to the point. The name of the trainer's company or their own name, and a request for name, phone number and a brief

message followed by a statement that the trainer will get back to the caller within 24 hours. All call backs should occur within a 24 hour period or a potential, current, or future client may be lost.

Call backs

How often should the personal trainer continue to call an individual who has called them or expressed some interest in training? The trainer should call until the individual has been talked to personally or the trainer gets tired of calling. Whether or not the trainer gets tired of calling should be dependent upon the interest or intent of the individual being called. Only one message should be left upon the first phone call and never again until the trainer has personally talked to the individual. A phone log should be kept to vary calling times until they have been contacted. The contact, once made, should be short and to the point to the effect of "Hello, my name is Steve, Susan's personal trainer, and I was calling because Susan said you have an interest in personal training..." Now the ball is in their court, so to speak, and the individual will tell the trainer whether they are interested or not, or the extent of their interest. This saves a lot of time, shows professionalism, and gives the impression that the trainer means business and has no intention of wasting the time of the potential client or their own time.

NESTA recommends calling a potential client until voice contact is made.

The Training Session

How early should the personal trainer arrive prior to the first, or any training session?

At least 5-10 minutes early whenever possible. This allows time to be fully prepared with a smooth transition to the beginning of any and all training sessions. Too many trainers give themselves no time between clients and have a



Your client is paying for their time, and it is not professional to be tardy. Remember that a PROFESSIONAL trainer does is always time-sensitive

client standing nearby waiting for their appointment which gives the trainer little mental time to prepare, let alone time to grab a snack, use the restroom, or look over paperwork for the session prior or the next session. This preparation time is a must.

A trainer can assume they succeeded in satisfying a client with the service based on what criteria from the client?

How long is a training session?

For the reasons mentioned above, it is imperative that the personal trainer provide 50-55 minutes per session and inform the client that it is NOT a 60 minute session! The trainer should concede that they will give extra time when they can if there is not a client following their session or as scheduling allows. Professionals do not rush from one client to the next. If they do rush from client to client, they are not adequately prepared and cannot properly service the client's needs. Much like all policies and procedures of the personal trainer or any professional, this policy is not up for discussion or debate. There is no need to be rude or unfriendly about this or any policy, simply state the facts. Some trainers choose to perform 30 minute sessions. This is up to the trainer. However, for the same reasons mentioned above, it would need to be a 25 minute session, and neither a 25 nor 30 minute ses-

sion allows much time for accomplishment in exercise programming and proper progression and often makes MORE work for the personal trainer in trying to prepare effective workouts for an even greater number of client hours in a given training day.

EXAM ALERT

If the personal trainer allows for the minimum amount of time between clients to prepare, then how long should a training session be?

Fees

How much should a personal trainer charge for their training sessions?



Fees are commanded based on the trainer's ability to conduct a professional business. Decide upon worth on a per hour (include travel if applicable) basis and maintain that rate without negotiation. Haggling and negotiating is not professional. Imagine asking your hair dresser for a package deal or your doctor to give you the first visit for free. The same standards must apply to personal training. The moment a personal trainer begins to "negotiate" their fees the more their professionalism falls and the more they appear like a used car salesperson. Car sales are based on goods not services. Professional services, such as a doctor, lawyer, or personal trainer, are set and not subject to negotiation.

Fees are a reflection of time spent, not just the training hour. So, while a trainer may choose to charge \$60/hour if they travel 15 minutes away and come back for another session, that is 15 minutes both ways for a total of 30 minutes on top of the training session. For that situation, \$90 would be appropriate. Professionals charge professional fees. If clients do not want to pay training rates they don't have to, there are many low-cost trainers they can choose from. Price should never be a unique selling proposition. There will always be someone cheaper. The advantage to higher fees is training less people, and the highest quality training must follow.

The fee schedule is up to the personal trainer. Keep in mind that most clubs charge \$60-\$80/hour and independent contractor fees should be similar. If a trainer pays rent to a facility, fees may have to increase to reflect that cost. It is of no business for clientele to know what expenses a personal trainer may or may not have. Employees of gyms make \$10-\$25/training session in most cases. A professional personal trainer deserves at least twice as much. Clients, who can afford personal training, want the best service and the greatest results, not the best price. Professional fees should reflect this fact.

EXAM ALERT

Negotiating a rate with a client is not recommended.

How much notice should a client be required to give before canceling a session?

The client must always provide 24-48 hour notice prior to a paid session to receive opportunity to make up the session or avoid forfeiting the session and payment. For this reason, as with any professional service offering, clients must pay up front, in advance of services rendered.



Being a successful trainer means that you must BALANCE your skills with your business vision. Too many trainers make the mistake of not learning the business side of personal training, only to later fail and leave it behind.

Should a personal trainer sell packages or take payments prior to training sessions?

Whether the client pays monthly or per session, payment must be received before the session and the client should always be pre-paid in the event of a last minute cancellation. Some trainers charge at the end of the month for all sessions scheduled in the month to follow. Other trainers choose to offer packages of sessions. The personal trainer should never offer steep discounts on training packages. The only discounts that should be offered are commitments to regular intervals of recurring sessions versus paying for a single session. The single session is not intended to ever be used, it is merely an offering to give the individual the idea that they are receiving a great deal. And they are!

Whichever mode of session payments the personal trainer chooses to utilize, be it monthly or in packages, they should be certain that the frequency of payments occurs at similar times between clients (monthly) or that packages sold are small enough in number that a constant income flow is realized and not the fluctuations in income so many trainers battle year in and year out. The personal trainer should not offer refunds in payment, only service.

EXAM ALERT

It is important to know the amount of time a client should give notice to a trainer when canceling a training session.

Refunds to a client should be made in the form of additional training services.

Should the personal trainer offer free sessions or assessments to draw interest?

No free sessions. A professional personal trainer has devoted a great amount of time and effort in learning their trade and deserves to be compensated accordingly. The only people who offer FREE appointments or sessions in their profession are those who have difficulty drawing interest any other way - which may be an indicator that the problem is not with their exposure, but the lack of service they provide. Once something is offered for free, there is no value to the service. The choice to offer free sessions or assessments is not encouraged.

Chapter Summary

What the trainer chooses to do with the information in this chapter is the choice one must make. One of the greatest elements to being a personal trainer is the freedom, like any entrepreneur or small business owner, to choose their path. The path must be laid clearly and carefully so that the trainer can easily lead their clients to frequent and dramatic success, and so that the personal trainer can make their own job easier by having a road that has already been paved for them, they simply have to follow it.



No pressure, but the road to success is clearly defined. Without taking the proper steps, your suc-

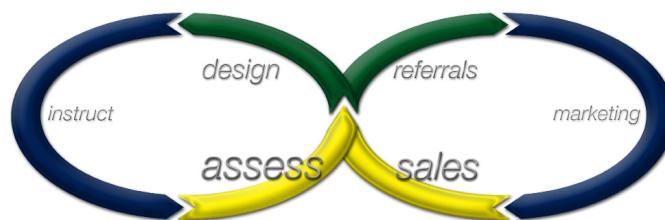
Sales and the NESTA System

chapter 14

Fundamentals of Selling Personal Training

So far this manual has covered the scientific principles behind personal training, the correct application of these principles (assessment, design and instruction), and foundational business principles that a professional personal trainer should understand to be successful. This chapter will strive to put these elements together in a format that will lead you to limitless training success.

Being successful in the business world, while staying true to the principles of being a professional fitness trainer may seem like a paradox. The business world is often portrayed as being heartless, as indeed it can be when trainers set out to succeed without knowing all of the rules involved. The exciting thing is that once trainers do learn the rules, they can tap into key target markets while doing the work that they love.



Back to the Basics

Remember Chapter 1? While being a professional personal trainer is much more than just showing someone how to exercise, to be successful one must remember to step back and look at the big picture... In this chapter, we will not tell you exactly what to say. We can't. What you say to your client will be unique to each person you meet. We will, however, recommend HOW you communicate with some-

one as part of the process, while also explaining HOW to sell personal training to those who you want to work with.

As you meet people who you hope to gain as clients, it is vital to position yourself in a way that allows for you to understand the prospective clients' perspectives. Sometimes, people find themselves squarely in the middle of a fitness consult, when it is about the last thing they would like to be doing. In some settings, a trainer who is not mindful of the big picture might come to view this client as someone who is meeting with you to learn how to use fitness equipment and to get in shape.

BRIDGING THE GAP



Current health & fitness level **A**



EXAM ALERT

Having the proper business skills are the mark of a successful personal trainer.



think about it

An experienced music instructor once described the importance of passion. After many years of teaching music at the college level he had seen many great artists fail. He said that while they had amazing musical talent, they would walk into an audition showing no passion. While they may have played beautifully, they would go into the audition convinced they would not get the part. Their performance would lack passion, and they would prove themselves correct as they walked out the door with their head down. Remember, the first meeting with a client is your audition - show enthusiasm and passion!

But we know that it is MUCH more than that. We have learned that the client may come to us with what they feel they *want*, but this doesn't guarantee that their *needs* are going to be met unless some relationship building is done in order to bridge the gap between where they are now and where the client would like to be.

In the fitness industry, we have done a great job of facilitating physical activity for the general public. But we want to understand the big picture from a trainer's perspective, too. This means that we have to understand how someone is initiated into the process of becoming healthier or more physically fit. In fitness club environments, we manage to corral people into the fold, where we put them on a treadmill and show them equipment set-up, but then we tend to leave the connection broken between why they joined and what their goals are....that is, unless we become their trainer.

Within the context of a fitness consult, remember that the person before you may become a client. It is therefore essential to understand that the first impressions you make are likely to endure throughout the course of the relationship you share with this client. What motivates this person to join a club? Why are they making this change, right now, at this stage of their life experience? For some, it is "doctors orders" (read: medical clearance) and for others, they may have been devastated by comments from a loved one or friend who remarked about something related to their physicality. Either way, you MUST understand that you very well might have someone before you who does not like the idea of exercising, regardless of how this opinion was shaped or formed. Your job is to find out what their motivations are.

It's pretty likely that your client doesn't know it, but they are really coming to you for your ability to make connections. You are responsible for connecting Point A to Point B. You are also establishing a connection to the benefit of training specifically with YOU as their trainer. The difference between you and any other personal trainer may lie in your ability to connect the features of training with you to the benefits the client will see. Another difference will be seen in how you communicate with this client. It is important to show empathy and compassion for the client and their situation, without fail. The level of intensity in your communication is important to get right, from the start, as first impressions tend to endure.

Communication and Sales

Communication skills are also known as “people skills”, because, at its best, communicating involves connecting with people and positive and productive ways. As you enhance your skills in this area, you can expect to increase productivity, reduce stress and improve teamwork. You will also build stronger client relationships and minimize the potential for misunderstandings among colleagues, coworkers and clients. However, the greatest benefit manifests itself in clients who feel at ease and experience high levels of satisfaction with you being their trainer.

Good communication is a two-way process that involves an exchange of ideas, emotions and attitudes. The ultimate goal of communication is to elicit some type of action. The communication skills necessary and effective therapeutic relationships are the ability to establish rapport, listen to answers, effectively utilize communication technology, be patient, make intelligent observations, elicit information, ask open-ended questions, gain cooperation, conduct excellent client interviews, ask for input, assert boundaries, use active listening techniques and show genuine concern. Most of what has just been listed might sound familiar, depending on the descriptions you've used before to describe “what makes a trainer good”.

Professionalism -First impressions

First impressions are powerful -- and often irreversible. Your first interaction with a person sets the tone for future communication. It has been stated that it takes between four and 20 seconds to make a first impression. The elements of a first impression include characteristics such as your appearance, facial expressions, body language, what you say, what's not said, your ability to build rapport, your energy level and the actual messages you convey. A vast amount of information is exchanged, and many judgments are formed at lightning speed in just a few moments.



Your appearance should be professional at all times, with appropriate attire and behavior.

Sometimes trainers unknowingly alienate new potential clients because they don't present themselves positively and professionally. To avoid this potential pitfall, take some time to think about how you present yourself and your work in the vital first meeting. When you're thoroughly prepared and not worrying about how to introduce yourself and what to say, it's easier to focus on being with your clients and listening to them completely.

Avoid pre-judging yourself or your clients. This prejudice can substantially alter your first impression. Focus on building rapport and keeping an open mind. Your confidence in yourself and your abilities increases the comfort of your clients experience.

EXAM ALERT

Client's goals should be met in the quickest and safest way possible.

Building rapport

Rapport is the bond that develops between you and clients; it's based on mutual trust as the core. After you've made a good first impression, rapport can be the single most important factor in whether or not this prospect becomes a long-term client. Rapport develops by being open and demonstrating genuine concern. Some techniques for developing rapport are to

correctly pronounce clients names, use clients names frequently, smile, shake hands, making eye contact, allow ample time for clients to talk, speak with enthusiasm and conviction, be punctual, listen, and ask light personal questions about your prospective client's family, hobby or job.

Listening skills

Although more than half of all communication time is spent listening, very few of us have received training in the most effective ways to listen. In fact, by the time we reach adulthood, many of us have become highly skilled at tuning out messages -- either from well-meaning but overcritical parents or teachers, or from the constant bombardment of media advertisements.

Listening goes beyond hearing. Hearing is simply the physiological process by which the brain interprets information received in the ears. Listening involves taking the time to understand and interpret heard information. Listening means to give the speaker your full attention.

Effective listening skills affect clients in positive and powerful ways. They can help a client to feel at ease. Listening skills can also help diffuse difficult or awkward situations when you may encounter an emotionally upset client. Being heard can profoundly help a client to relax and heal. After feeling truly heard, a client may relax - breathe deeper, sleep better and feel less tension in his or her body.

One of the most common mistakes in both personal and professional communications is to give unsolicited advice or turn the focus back to yourself when someone expresses a concern and frustration. By jumping in with a solution or inserting your experiences or situation, the person you're talking with will not feel truly heard. In a professional setting, you also risk traversing into territory better handled by a psychotherapist. With training and experience, however, trainers can learn to manage the fine line between being supportive and moving into the territory of a psychotherapist.



think about it

If you were selling health club memberships and an elderly woman wanted to join the club because her doctor said aqua-therapy would be good for her arthritis, would it make much sense to immediately take her to see the club's most popular feature - the basketball gym? Or would you take her to see the pool - the feature of the club that will benefit her?

Don't be a "feature creature" – certain features of having a trainer will not be a benefit to everyone, you must tailor each and every presentation to the client's goals.

Active listening

Active listening involves giving your full attention to the speaker. Often times this means listening for the feelings behind words, facial expressions or gestures. Words convey only part of the message. To completely comprehend what the client is saying, the trainer needs to understand what the message means to the client. This means that we have to understand what's being said from the clients frame of reference. It also requires a willingness to set aside wandering thoughts, and to stay focused on the client's words.

An active listener will raise interest with non-verbal communication, such as open body language and steady eye contact, and avoids distractions such as fiddling with a pen. The active listener also pays close attention to client's verbal and nonverbal communication. The old saying, "walk a mile in my shoes", captures the essence of active listening.

Reflective feedback - linking active listening to your client

Reflective feedback is one of the most effective techniques for enhancing communication. This involves briefly restating the feelings, concerns or content that the client has said. An active listener, or trainer, that uses reflective feedback, first allows the speaker to relate their story without interruption and then responds by asking further questions or rephrasing what was heard. When doing reflective feedback, do not merely parrot back what someone has said. This can be counterproductive. Instead, find the core of the message, and show understanding by how you reflect back to the client in your own words. Use tone and intention to convey what was heard and check to see that what was heard is accurate. For example, a client claims to be experiencing pain in her right shoulder. An active listener might reflect back, following up by saying, "Tell me more about the pain." "How does this pain factor into your daily activities?", or, "What I hear you saying is that the pain..."



Listen to your client closely. Listen until your mind "shuts up", letting the client talk and to make them feel as though they have been "heard".

If you have accurately received your clients words, your paraphrasing will confirm this for them. If, on the other hand, your paraphrasing is incorrect, the client has an opportunity to correct this. Another advantage of reflecting a message back to the client is that it offers them time to reflect on what they said, and an opportunity to delve deeper into themselves.

Try practicing reflective feedback through asking questions, such as, "So what you're saying is that you've been having headaches after you

were rear-ended last week?" Reflecting in the form of a question gives the client an opportunity to tell you if you heard him correctly and to add any information that they may want to convey.

Validate the client's feelings and experiences regardless of what you think about them. Also, refrain from expressing any judgments or personal opinions. This can be more difficult than you may think. Simple agreement or disagreement with the content of the information can be judgmental, or judgment can be more direct as in the following example: a client is very distraught because her teenage son was caught drinking last night, so you must avoid saying things like, "Wow, I hear how upset you are when your son behaves stupidly!"

Reflective feedback requires total presence; people see, hear and feel when you're paying attention to what they say. It also requires that a trainer paraphrase, instead of repeating, what has been heard, word for word. Only reflect back what is most important to the client and for the process related training.

Interacting with Clients

Initial interviews (sometimes called "orientations" for new fitness club members) play a key role in creating lasting, healthy relationships between trainers and their clients. Information is gathered, rapport is built and ideas are shared. Ideally, these communications occur at regular intervals. The most extensive interview is the initial session with your client. It sets the tone for your working relationship and an effective first session can take a full 60 minutes; this will require good communication skills, especially the ability to listen. Any new client meeting isn't simply about obtaining a client's health history. It is an opportunity to explain the benefits of training with you, to clarify current health status, formulate your professional recommendation, and to educate your prospective clients. It is also time to build a climate of trust by listening carefully to client concerns and questions.

Attitude plays a critical role in determining the difference between failure and success. Attitude is how one decides to approach something. Attitude is a choice. Attitude is the "lens" that colors how we view life experiences. All too often when we encounter something new or challenging, we automatically have a negative attitude about it. But if we choose to look at the situation objectively and decide to stay open to learn more about it, our attitude already changes from a negative one to positive one, is willing to adjust to the new circumstances

What do you do for a living?

You are a problem solver. You are hired to solve your client's problem of not being able to reach their health and fitness goals on their own. Again, you are making connections.



Trainers don't simply tell clients what to do. They work hard to communicate with prospective clients to find out WHY they are embarking on a change in their physical fitness

YOUR JOB IS TO GET YOUR CLIENT FROM POINT A TO POINT B.

The information for the trainer to Bridge the Gap is obtained by proper assessments. Point A is obtained by completing a detailed health history and exercise history, as well as thorough physical assessments. The information for Point B (their goals) is obtained by asking detailed questions of the client.

Without proper assessments, a trainer has no idea how to design the best exercise routine for that client; no way of knowing how to "Bridge the Gap". The reason for this review is to point

out how proper assessments are vital to establishing you as a Fitness Professional - NOT just someone who teaches people how to exercise. By properly establishing yourself as a Fitness Professional in your client's eyes (as the problem solver they are searching for) you will find clients asking you for the sale instead of the other way around.

What Separates Successful Trainers from Marginal Trainers?

Education and practical knowledge are important, however knowledge does not ensure success. Many personal trainers have advanced degrees in exercise science and multiple certifications, and yet may never very successful from a business standpoint. On the other hand there are many trainers who only have the foundational certification and have never advanced beyond that, yet many are very successful. What do these trainers have that others with more education do not? It's a proper STATE OF MIND!

A Successful State of Mind - The Traits of Successful Trainers

- **confidence** Successful trainers are confident in their ability to help their client achieve their goals. Would you want to go to a doctor that was not confident in their diagnosis?
- **professionalism** Successful trainers demonstrate professionalism at all times. Successful trainers are more than just "rep counters" They are attentive to their client's needs and considerate of those around them. Remember, unless you are training in a private setting, a potential client might be watching.
- **enthusiasm** Successful trainers are enthusiastic and motivating. Who wants to be trained by a dry and boring trainer?
- **passion:** Successful trainers are passionate for their work and helping others. Showing passion for what you do will motivate both yourself and your client. This type of passion for fitness is contagious and vital

in creating positive lifestyle changes in your client.

- **the golden rule of training:** “Train unto others as you would have others train unto you” - in other words, if you were going to pay for personal training, what type of training would you expect.

The First Workout - Working as a Team

Remember! Getting Your Client to Their Goals is a Team Effort - You and Your Client.

You are NOT equal teammates, you are the fitness professional, and the TEAM CAPTAIN!!! The trainer is the captain of the team and is in charge, teaching the basics from a position of authority.

The 2 W's

Focusing on the “WE’s” and the “WHY’s”	
WE's	When talking to the client, remember the team philosophy. They don't need to go through this alone, you're there for them. “WE'S” should be used frequently in the first workout. It solidifies the mindset of the team with the client and shows you are always going to be there, private training or not, you will always be their trainer.
WHY's	Asking in depth questions, getting them to verbalize (perhaps for the first time aloud), WHY they are there. It is imperative that trainers get detailed information from the client.



The Focus of the First Session

Much of the time, unsuccessful trainers will only cover goals superficially. A new client will sit across during the initial assessment and when asked about their goals will answer superficially, such as stress management skills, the level of intensity tied to their concentration, or even the approach used for setting challenging - but at the same time - realistic goals - these are all psychological characteristics. For most clients, these can be learned and developed. They contribute to the performance and the well-being of the client, thus we have to know more about them and keep them operating in the background of our mind-set or approach if we are to make proper use of their application. It is better to find out the motives behind their goals - what being “toned up” will do to benefit their life. You need to be able to find out detailed goals in order to “paint the picture” of your ability to fulfill their needs.

Ineffective: (most common) Focusing on goals (wants) and features

Effective: Focusing on motives (needs) and connecting them to benefits

People don't buy features, they buy the benefits that those features give to them. This should be the focus of the first session, finding the motives behind the client's goal (what they NEED - this is found by asking detailed questions) and connecting them to the BENEFITS of YOU (telling the client how you will fulfill those needs).

How to Start the First Workout This is the time to WOW them

Background:

Look at the appointment as an INFORMATION GATHERING SESSION. Both trainer and client will receive valuable information vital to achieving results. The main focus of the appointment is to determine their GOALS and the MOTIVES

behind their goals. In other words, WHY they are there.

It might be wise to explain the process to new clients, who tend to arrive with the intention of exercising during the first meeting. This might happen, but only if time permits and if there are no limitations requiring clearance. Still, it is a lot to expect this to happen in the first meeting with a new prospective client.

Step 1: Greeting

WOW the client with your professionalism and enthusiasm
Nail the first impression
Use their full name
Be lively, bright, energetic from the beginning
Have all your “equipment” ready - clipboard, paperwork, assessment equipment
Make proper eye contact and use a firm handshake

Step 2: Agenda

The first session is an information gathering session. Take time to explain to your prospect the flow how the first session will unfold. Explain the process of collecting physical assessments, health history and goals.

Benefit to client The first session gives the trainer the information they need to customize the ideal program for them. You can use statements such as, “this will allow me to develop the ideal program for you, so it is vital that we share communications both openly and honestly. How does that sound?”

Step 3: Health History & Assessments

Asking questions to see if there are any limitations to exercise is standard practice and part of the health history segment. This supports the idea that you care enough about your client to proceed, but only with caution in mind as well as the client’s goals, as these elements are re-

sponsible for forming the basis of your client’s program design. You MUST make this time all about the client.

Benefit to client When the trainer acquires the information needed to design a safe program, you are demonstrating that you are responsible in your approach, while showing that you are goal-oriented and focused. Your client will benefit from your attention to detail as you dig into their health history. Safety also factors in here, too. Hopefully, the client will feel that you are capable of designing an exercise program that does “no further harm” to them or the conditions they are managing.

Take detailed notes. Your client will be giving you rich information about their motives and goals.; it is vital to ‘hear’ your client. Reflect back to the client what you have heard. You may also refer to other clients with similar conditions or goals that you’ve helped in the past.



Be very mindful when doing assessments - your client will know what they want, but your assessments will reveal what they truly need! Once you have identified “needs”, you can design an individualized and personalized for the client.



Step 4: Goals-“The Fun Part”

Re-Emphasize The Importance of the Goal Section

“...The more I am able to understand your unique wants and needs, the better I will be able to design a program for you to achieve your goal.

Integrating the Why's and the We's

WHY'S **ASKING DETAILED QUESTIONS (“THE ROLLING WHY”)

The trainer must show empathy. Open communication is vital. What is the benefit to the trainer? - it increases credibility and professionalism. The trainer is better equipped to create programs. As goals become more detailed, and motives established, the client will be verbalizing sensitive topics that they may not have said before.

Examples

When have you ever been able to achieve what you want?
How does that make you feel?
What drives you to want this?
Why now?
Visualize the “PERFECT YOU” - What do you look like? How do you feel? How does it affect your confidence, self-image, to see yourself, etc?

Refer back to other clients and their success with similar goals. This anecdotal type of reference is useful to the client who may be wondering how you can help them with a specific condition or goal that they are wanting to meet.

WE'S

Remember to use “we” repeatedly throughout goal section

Take copious notes. This is extremely important!

Occasionally repeat back info you've heard them tell you – this shows you're interested, listening and are concerned in helping them succeed!!

Step 5: Painting The Picture The 4 levels of fitness

While we may live the fitness lifestyle, our clients most likely do not - we take a lot for granted. They don't know how or why exercise works. We need to explain to them how their body will adapt and make the changes they want – PAINT THE PICTURE!! Explain that this is an adaptation process that everyone goes through (fit or not) when their body is getting used to the “NEW” demands being placed on it. These new demands could be working out, learning a new sport, a new martial art, dancing, etc.



Use the NESTA pyramid as your template and you can NOT go wrong!. After assessing the client, determine where their current abilities are, and set your sights on your clients vision or goal.

When explaining, use both technical and layman's terms. This skill relies on your ability to communicate properly with your client as well as your understanding of the 4 levels of fitness.

After explaining how their body is going to adapt, paint the picture of how you (THE FITNESS PROFESSIONAL) are going to use these principles to guide them to their goals. - Lay out a general game plan.

Step 6: Make Your Professional Recommendation

This is not “SELLING.” If you’ve been professional and enthusiastic, the sessions should be easy to come by - they will already see the importance of training with you. Remember to connect the MOTIVES which drive the client’s goals to the BENEFITS of having you as their trainer.

“From what you’ve told me about (their goals) I recommend we start with 3 days a week...”

Maintaining Professionalism – YOUR big picture!

The majority of your time as a trainer is in providing client services. Your ability to effectively schedule appointments greatly impacts your success and your stress level, too. Allow yourself sufficient time between clients, while not having large blocks of unproductive time. You may discover that you need to schedule time differently for new clients, whereas some ongoing clients will regularly need additional time. You may need a longer recuperation time after certain clients. Sometimes staying within the allotted session time can be difficult when you don’t have anything else scheduled immediately after the session. While having the flexibility to extend a session might be wanted, it shouldn’t be complimentary. Be careful to respect the time



Continuing education is not only required for trainers, it can also be a lot of fun; meeting other trainers is a great way to network.

boundaries of yourself and your client(s). The longer you are in practice, the more proficient you will become at judging how much time is necessary to spend with each client as well as in between sessions.

Continuing education is also necessary to your career path. You will find ways to broaden your knowledge, particularly in the areas of interpersonal skills, product knowledge, technical skills and business skills. Some ways to do that include reading magazines and books, taking classes, attending seminars, watching videos and networking.

It can be helpful to be assessed periodically. This can be done by your clients and by calling on coworkers or peers; try to encourage every client to provide feedback to you regarding their experience. It is only necessary to go through the process just once or twice per year. Feedback is essential for your professional growth. This concept can seem a bit scary - the idea of evaluation does have some ego risk involved, but how are you going to know which areas to enhance if no one tells you? Remember, knowledge is power. Since most work in this field is very individualized, it's recommended that you obtain as many evaluations as possible to get broader, more objective feedback. Many trainers find evaluations highly beneficial. They are also a good way to get your clients more involved in their health goals.



Don't be afraid to have your contemporaries or peers provide feedback or assessments of your abilities. Think about how many times you have watched another trainer and realized how great it would be to know their ideas for helping clients.

The Top 8 Social Media Platforms for Fitness Professionals (and how to use them)

Simple, proven strategies to expand your social reach and online influence

Introduction

Have you ever heard of the book Social Media is Bull\$#@! by B.J. Mendelson?

If so, you might be familiar with the author's argument that social media can never replace real world business connections, and that social media marketing isn't nearly as powerful as some marketing experts would have you believe. B.J. makes a pretty good point. After all, what's the point of having thousands of Facebook fans if you're not able to convert those fans into dollars signs for your business? However, in considering the following statistics, Mr. Mendelson may just need a new title – and a new perspective – for his book.

- Dell Computers has increased its sales by \$2 million thanks to its @DellOutlet Twitter handle, which offers exclusive deals to Twitter followers.
- A partnership between fashionista Diane von Furstenberg and HauteLook resulted in over \$100,000 in sales in a single day thanks to a well-positioned Facebook ad campaign.
- PETCO has increased its new customer base by 40% by offering exclusive deals and engagement opportunities through its social channels.

Sorry, B.J. – big brands are making big bucks with social media, and individual fitness professionals are following in their footsteps.

Why Your Social Media Strategy Isn't Working (and what to do about it)

It's clear that social media is a powerful tool for growing a fitness business (or any business!) and getting more clients into the gym. But for most fitness pros, social media marketing is the first thing that ends up on the chopping block the second things start to get busy. With clients, classes, and the never-ending demands of running a fitness-based business, it can be hard to stay updated on the constantly changing world of social media, let alone stay consistent with your online efforts and monetize your social media marketing.

If you....

- Are a “fitness person,” NOT a “marketing person”
- Don’t have a dedicated social media expert on your team
- Know how to use social media for personal reasons but not necessarily to drive business
- Aren’t sure which platforms you should be using in the first place
- Aren’t clear on how to convert social leads into paying customers
- Have been trying to use social media for
- business but aren’t seeing the results you want

...then read on to discover exactly what you're missing when it comes to social media, and exactly how to create a powerful strategy that will give you the results you're looking for in just minutes per day.

But first, let's make sure you're not guilty of any of these 7 Deadly Social Media Sins:

1. You Have No Strategy - A lot of fitness professionals know they should be using social media, but have no clue how to begin. So, they create a Facebook page and a Twitter feed and dive in head first, without any way to measure their results.

2. You're Tracking the Wrong Goals - Social media marketing, like other forms of content marketing, can be difficult to measure in terms of effectiveness. If you're trying to track generated revenue based on non-revenue generating activities, you're likely to crash and burn fast.

3. You're Not Flexible - While it's important to have a strategy in place, it's just as important to continually tweak that strategy based on the shifting tides of social media. Social marketing changes constantly, which means your strategy has to change with it.

4. You're Using the Wrong Platform(s) - If your social media strategy is dead in the water, it could be that you're putting all of your energy and effort into the wrong platform. Just because Twitter is the second most popular social platform overall doesn't mean it's the second most popular with your clients.

5. You're Too Salesy - An important part of your strategy is engaging your audience without constantly selling to them. After all, do you go on Facebook to be sold to? I doubt it! People use social media to connect with friends, share funny and awe-inspiring content, get news updates, and be entertained. That means that your strategy has to find ways to connect, inspire, inform, and entertain your audience, first and foremost.

6. You Don't Post/Tweet/Share Enough - While each platform is different in terms of how often you should post, chances are you're not posting enough.

7. You're Selfish - One of the biggest mistakes fitness professionals tend to make in their social media strategy is being selfish. They "post and run" in Facebook groups, never liking or commenting on other people's content, they share content THEY like instead of content their CLIENTS might like, or they treat social media like a megaphone instead of a two-way conversation

Uh-oh...are you guilty of one or more of these social media sins?

Don't worry. In this chapter, you're going to learn exactly how to solve these social media problems and create an effective strategy that wins you more business, clients, and customers.

The Social Media Solution

How to Generate HUGE Social Media Results in Just Minutes Per Day

Social media is all about engagement. Each social platform gives you the opportunity to get to know your future clients, answer their fitness questions, help them achieve their goals, and provide them with as much value as you can. When you create a social media strategy with the client in mind, you're much more likely to secure their training business. Social media allows you to connect with clients and prospective gym members on a personal, social level. The bond you create through fun platforms like Facebook and Twitter breeds loyalty in customers, who'll be more likely to stick with your gym and better yet, bring along their friends. In this way, social media is a powerful lead generator that costs next to nothing!

In this chapter, you'll discover....

- Which social platforms will appeal to your clients and customers
- How to get started on Facebook, Twitter, LinkedIn, Instagram, Periscope, Pinterest, Google Plus, and YouTube
- Best practices for each platform, including do's and don'ts
- Growth strategies for expanding your following and influence
- Advertising + monetization strategies for turning followers into paying customers

Social media isn't an overnight revenue-booster, but it is part of a proven, long-term marketing strategy that expands your reach, endears you to prospective clients, and establishes your unique voice in a sea of competition

#1: Facebook

Why you need it

There are lots of social media platforms that you DON'T need, especially if you're targeting an older (think Baby Boomer) client base. Facebook is not one of them. That is to say, not having a Facebook presence is sort of like not having an online presence. It can even be argued that you can get away with not having a website, but you can't get away with not having a Facebook page.

According to the company website, Facebook has...

- 968 million daily active users
- 844 million mobile daily active users
- 1.49 billion monthly active users
- 1.31 billion mobile monthly active users

If those numbers aren't enough to convince you that your clients are hanging out on Facebook, the International Business Times recently published this statistic:



71% of online adult use Facebook.

Odds are good that your current and prospective clients fall into that 71%!

How to get started

The type of Facebook account you need to create will depend on your fitness business. If you are an entrepreneur and a personal trainer, you'll use Facebook differently than if you're a club employee in a locally based, single-location gym. Luckily, Facebook gives you easy-to-understand options when first setting up your account.

Step One: Create a Personal Facebook Account

I highly recommend you begin with a personal Facebook account if you don't have one already. There are certain functions you can only access with a personal account, such as creating and participating in groups. While you won't only want a personal account, you will want to have access to a personal account because of the flexibility and reach it will give you on Facebook.

Step Two: Create a Facebook Page

Once you have a personal account set up, you will want to create a Facebook page to represent your gym or your personal brand.

Here's what you'll need to create your page:

- 160x160 profile pic or logo
- 851x315 branded header image
- Long description of your gym/brand
- Mission statement for your gym/brand

Be sure to **choose the right category for your page**. For instance, if you are a personal trainer interested in becoming a motivational speaker and best-selling author, you might want to create a Public Figure Facebook page. If you represent a gym that has one location, or run the local

branch of a franchise gym, you'll want to create a Local Business Facebook page. There are lots of options, so choose the option that best represents your personal brand as a business owner or employee. Once you have your Facebook page setup, invite your personal friends to Like your page. These Likes will serve as the foundation from which you build your Facebook following.

Step Three: Create a Facebook Group

Facebook pages are going more and more in the direction of websites. It's still important to have one, but chances are you'll see far more engagement by participating in or starting your own Facebook group. A Facebook group is a more personalized experience for group members that share a common interest. There is a feeling of belonging to a particular club, and an exclusivity that comes from knowing posts are seen by group members only, not everyone on Facebook. People join groups because of a passion or a problem. Because of that, groups are a much better place to engage with prospective clients and show them what you have to offer.

Create a group and invite friends and clients to be members of your group. This group will set the stage for monetization at a later date. Even in a large Facebook group, you'll instantly enjoy a closer bond with members who share the same interests, and be able to draw from this pool when searching for new clients.

- **Add past and current clients to your Facebook group**
- **Add Facebook friends to your Facebook group**
- **Invite email subscribers to your Facebook group**
- **Reach out to the members of other relevant groups and invite them into your tribe**

Facebook fans realize that posts to your newsfeed are public, and that they are targeted toward as many people as possible. They also

realize that content posted in a group is much more targeted, more special, and more directly relevant to them.

Best practices (do's and don'ts)

Post Content Daily

Facebook's algorithm picks and chooses what it thinks are your most valuable posts. That means it's likely less than 10% of your Facebook fans are seeing your posts at any given time. Posting content consistently is the best way to make sure you're staying top-of-mind with fans and followers. A good rule of thumb is to post an engaging question, photo, link, or article at least once per day.

Strive for Engagement Above Numbers

Instead of striving for a bigger number of Facebook fans, strive for better quality connections. A Facebook group with 100 active, interested members will drive more business than a group with 1000 disengaged members.

• Focus on the quality – not the quantity – of your Facebook fans

• Don't buy fan Likes on Fiverr – these are just low quality Likes of people not in your target market

• Use Facebook as a tool to strengthen connections with current clients and meet new prospective clients

Respond to all comments in a timely manner, and acknowledge fans when they Like or share your content. This will help you create an engaged community of fans from which you can draw new clients and valuable market research.

Include a Call to Action

Facebook uses Call to Action (CTA) buttons to help you achieve your business goals. Whether you want to increase email signups, boost fan page Likes, or get prospects to sign up for a free training session, Facebook can help you do it.

Choose from 7 different Facebook CTAs, including “Sign Up” and “Book Now,” and link to any page inside or outside Facebook.

Go easy on the automation

Apps like Hootsuite and SocialOomph can save you hours each week by automatically posting your content while you sleep, and you can now autoschedule posts directly from Facebook itself. The problem with this is that the interaction that follows can't be automated. It's crucial that you or a member of your team are monitoring your Facebook account daily, responding to comments, and encouraging engagement.

- **Respond to all questions, comments, and other forms of Facebook engagement as soon as possible**
- **Mix up automated posts with ‘live’ posts and activity**
- **Follow up with Facebook fans via phone or email and ask how you can help them with their lifestyle and fitness goals**

Growth strategies

Once you've set up a Facebook profile, page, and group, included a Call to Action, and found a way to balance automated posts with authentic interactions, it's time to focus on growth. The #1 way to grow your Facebook community, and thus gain access to more and more prospective clients, is to increase fan engagement on your page.

8 Ways to Increase Engagement on your Facebook Page

1. Post signs throughout the gym asking for Facebook likes and offering a specific incentive for liking your page. For example, you might offer a free kickboxing class to those who like your page, or give exclusive discounts/rewards to Facebook fans only.

2. Observe the 80/20 rule - A good rule of thumb is to share other people's content 80% of the time, and your own content 20% of the time.

This keeps fans interested and prevents them from feeling “sold to” every time you post.

3. Post at the right time - You're likely to get the most interaction right when you post, so choosing the best time is crucial. Generally speaking, the most people will see a post on your Facebook page between 6-8am or 2-5pm between Monday and Friday - but always test what works best for your audience.

4. Never buy Facebook likes - If a prospective client sees 5,000 likes on your Facebook page but hardly any shares or comments on your content, they'll know you're pulling a fast one! Instead, court real, authentic fans who are truly interested in you and your brand. When it comes to engagement, it's far better to have 50 active, involved followers than 500 people who never respond.

5. Ask authentic questions - Ask questions of your fans when you truly want to know the answer. The authenticity will shine through and you'll start a real conversation that could lead to real clients! For instance, if you're having trouble choosing which movie to see, looking for a new hairdresser, or debating where to hold your next conference, ask your fans! People love to share their two cents, especially on social media.

6. Create timed offers, freebies, and discounts – Provide value in the form of a coupon, contest, discounted service or fun freebie. Teach your fans that your Facebook page is the only place to score these goods, and watch as engagement and likes soar.

7. Get personal - Great personal posts to your Facebook page might involve travel (share a few vacation photos!), checking in at a great restaurant (“Has anyone else been here?”), or doing a fun activity with your kids. Remember that these posts don't necessarily have to be directly related to your business; their purpose is to connect with fans on a human level.

Advertising + Monetization

In addition to helping you build a platform of engaged fans and followers (all of whom will become your prospective clients), Facebook provides opportunities to monetize those relationships outside of the gym. These include selling products on Facebook, creating Facebook video campaigns, and creating Facebook advertising campaigns.

1. Sell directly on Facebook

Did you know that Facebook is one of the fastest growing eCommerce sites in the world? There's no reason to spend money driving traffic from Facebook to your website when you can simply sell directly from Facebook itself. After all, everyone is already on Facebook anyway! Thanks to storefront solutions like Payment and 8thBridge, more and more solopreneurs and microbusinesses are selling their wares via social. Throw in Facebook video advertising and you have a multitude of powerful ways to increase awareness, engagement, and revenue.

2. Create a Facebook Video Campaign

A recent survey of over 100 industry leaders found that 87% percent of them have Facebook video marketing campaigns in the works (source: Global Newswire). There are two important lessons to take away from this: first, Facebook is a video marketing force to be reckoned with – consider using video for any Facebook ad campaigns you may be running in the future. Second, a huge majority (80%++!!) of thought leaders and successful businesses are using video marketing to increase brand awareness. These companies have millions to spend on marketing research each year, so why not follow in their footsteps and embrace their strategy for your own business and brand?

3. Create a Facebook Ad Campaign

Facebook has made it easier than ever to connect with your ideal clients by creating a targeted Facebook ad campaign. Unlike more impersonal pay-per-click advertising, Facebook ads are designed to be intimate, engaging, and hyper-personal. Whether they appear as a post in someone's newsfeed or as a graphic advertisement sandwiched between their page Likes and friend's list, Facebook ads are presented in

a seamless way that results in high conversions.

Set Specific Goals - You can create a Facebook ad campaign to increase page Likes, promote a specific post, send traffic to your website, or increase conversions on a particular website or landing page.

Choose Ad Images - Choose eye-catching, shareable images that don't contain too much text, as Facebook bans any graphics more than 20% text-heavy. You also want to make sure each image is a minimum of 600px wide, however ideal image specs are 1200 wide by 627 pixels high.

Create Ad Copy - Your Facebook ad campaign has a lot of rules about the length of your ad copy, so be sure to follow them to a tee:

- Your headline cannot exceed 25 characters
- Your ad body text cannot exceed 90 characters
- Your link description cannot exceed 90 characters

Remember that Facebook is its own search engine, and including trending keywords will help your target market find you.

Choose Your Target Market - Choose the audience your ad will target based on age, interests, geographic location, and their connection to you on Facebook. For instance, if you're creating an ad to get more Likes for your Facebook page, you don't want to target people who already like your page. Facebook makes it easy to exclude your fans and target their friends instead.

Set Your Budget - If you're running a campaign to promote a post, drive traffic to a website, or increase conversions, you'll be charged on a pay-per-click basis: every time someone clicks your ad, you'll be charged a pre-agreed upon fee. If you're running a Facebook ad campaign to get more page Likes, you'll be charged every time someone views your ad, regardless of whether or not they like your page.

During campaign set up, you'll be asked if you'd like to "bid for clicks" or "bid for impressions." The most effective way to ensure maximum en-

gagement is to select “bid for clicks” and to set your budget higher than the amount Facebook recommends. Remember, you won’t necessarily spend your maximize bid every day. If you set a budget of \$5/day, for example, you may only spend \$2-\$3 per day instead. But upping the maximum increases your chances of more clicks, and therefore more conversions.

Monitor Your Ad - Monitor your ad every day, or at least every few days, to see what’s working and what’s not. Export data from your campaign so you can get an accurate picture of how things are playing out, how many clicks/conversions you’re getting each day, and how much you’re spending each day.

Optimize Your Campaign - If a particular photo or headline is getting better results than others, you can ‘turn off’ all other options and only use the content that’s getting the best results. If you notice a particular demographic is responding to your campaign more than others, you may want to redo your targeting and only target people from that demographic.

While Facebook is growing and changing every single day, it’s clear that this social network is here to stay. By building an engaged tribe of Facebook fans, you’ll have a pool of prospective clients to target in order to grow your fitness business.

#2: Twitter

Why you need it

If you think only Millennials use Twitter, think again. With over 500 million tweets sent every day and 316+ million monthly users, Twitter is a force to be reckoned with. It’s also a completely different animal from Facebook, allowing you to target an entirely different audience of prospective clients and customers for your gym.

Twitter is a fast-paced, real time social network that lets users to connect through microblog-



ging, or “tweeting” 140-characters at a time. Twitter is immensely powerful in that it lets you connect with thought leaders in the fitness industry by following them and mentioning them in your tweets. Unlike Facebook, it is relatively easy to grow a large following on Twitter simply by following others with similar interests to you. And since 80% of Twitter users engage with the platform via mobile devices, those who use Twitter most are active, on-the-go types who make ideal fitness clients.

How to get started

It’s easy to get started on Twitter in just a few minutes, but you’ll need to do some brand-related prep work before your account goes live.

1. Choose your Twitter handle

Your Twitter “handle” is the username you’ll use on Twitter and how other users will connect with and follow you. Be sure to choose a name that represents your brand as a fitness trainer or fitness club. Fitness entrepreneurs should choose their full name if possible, while clubs can tweet under @NameOfClub.

2. Upload your materials

For your Twitter profile, you will need:

400x400 profile pic

If you are a fitness entrepreneur or personal trainer, make sure your profile pic is a picture of you. If you own/run a gym, you may want to use the gym’s logo as your profile picture.

1500x500 branded header

The header is a great place to post an image of you during a training session or otherwise showing what you do. You can also create a custom Twitter background that uses the same colors and textures as your logo or marketing materials.

140-character profile description

Use the 140-character profile description like it’s SEO copy. Include keywords and hashtags

people are likely to search for if they're looking for a trainer or coach. Do hashtag research on RiteTag.com to find out what fitness searches are trending on Twitter, and don't forget to include the URL to your website as well.

3. Follow relevant people and brands

The third way to get started on Twitter is to follow fitness-related people and brands. This can include other fitness trainers, gyms, authors, and entrepreneurs in the health and wellness field. Just be sure to take it slow when first starting out. If you follow too many people at one time, Twitter will think you're a spammer or a bot and lock your account. Just like on Facebook, choose quality over quantity and only follow those who you're truly interested in connecting with.

Best practices (do's and don't)

1. Tweet Early, Tweet Often

A single tweet is seen by less than 2% of your followers. That means sending 3 tweets per day is only enough to reach 6% of your audience! Marketing psychologists now say it takes 12 impressions for people to remember a brand. Tweet less than that each week and you're sure to get lost in the shuffle! It's not unreasonable to tweet every 10 minutes, as long as the content is valuable and interesting to your followers. Use automated services like Hootsuite to pre-schedule tweets throughout the day and make your presence known.

2. Share Great Content (with pictures)

Just like on other social networks, it's a great idea to share other people's content on Twitter. This means frequently retweeting relevant content your followers will love. Use an app like Twibble to curate content from other fitness professionals. Each time they post something new, your Twitter account will automatically tweet a link to their content. Followers will keep following you because you're a reliable source for fresh, interesting content and because you're not constantly 'selling' them your own content.

It's also a great idea to tweet content from popular sites (think HuffPo or The NY Times). Look

for articles or blog posts that a) are relevant to your followers, and b) already have several thousand retweets and shares. Since the content has proven itself to be popular, you're much more likely to get lots of retweets and interaction on Twitter.

3. Automate Your Tweets (but not your interactions)

Live tweeting is fantastic when and if you have time, but it's also crucial to be tweeting consistently throughout the day. In order to do that, make sure you're using an app like Hootsuite or SocialOomph to automate your tweets. A good Twitter strategy is to create and schedule all of your content for the week on Sunday or Monday, then focus your Twitter time on engagement throughout the rest of the week.

4. Use Social plugins to cross-promote on other platforms

Give your followers an opportunity to promote your content on Twitter no matter where they happen to be online. Include social sharing icons in your emails and on your blog posts, and be sure to link your Twitter account with your Facebook and other social accounts.

5. Reward your followers

Do you thank each and every new follower you get? You should. Sending out a "thank you Tweet" to every new person who follows you makes Twitter a more personal place to interact online. It also drastically reduces the chances of your new follower unfollowing you in the near future. Feel free to batch your "new follower tweets" by using up to 5 Twitter handles at a time, and composing a tweet like this: "Awesome new followers: @soandso, @fitnessfreak, @coach2stars...." Etc.

By giving each of your new followers a "shout out," you're promoting them to the rest of your followers and giving them some exposure. Be sure to follow them back as well, especially if they are a potential client, competitor, or colleague.

6. Be consistent

Your Twitter strategy will only work if you are consistent. That means consistently using Twitter in the following ways:

- **Consistently posting fresh content using an automation app (Step 3) and content curation app (Step 2)**
- **Consistently engaging your followers with retweets, replies, favorites, and “shout-out’s” at least 15 minutes every day (ideally more!)**
- **Consistently tweeting to share your content, services, and brand**

Remember that sending out one tweet is akin to connecting with 1% of your followers. Twitter moves quickly, and chances are that 99% of those who follow you will miss your tweet! Don't be afraid to tweet multiple times per hour. Most Twitter feeds are so chockfull of tweets that users won't even notice how often you're tweeting. Finally, remember that tweets aren't precious – follow best practices by keeping it short and sweet, and using relevant hashtags whenever possible. But don't labor for hours over a single tweet (unless, of course, you're already a huge celebrity with followers hanging onto your every tweet. In that case, leave your Twitter strategy in the hands of an expensive PR team and go enjoy a massage or something!).

Growth strategies

Keep It Clean (clean up your followers)

Are you following or being followed by a bunch of spammers? You know the type – the people constantly hitting you up with tweets like “Get 24k followers for \$24!!!” Clean up your list and make sure those you follow, and those who follow you, are made up of (real) targeted tweeters. A targeted tweeter is someone who falls into your target market and could be a potential client or customer someday. That, or they have the potential to become a brand advocate or partner and refer friends and family to you and your brand.

When clients, prospects, event bookers and TV producers look at your Twitter account, they're

not simply looking at your number of followers. They're looking for authentic engagement with real people who are passionate about what you do.

Give Frequent Shout-out's

Acknowledge each and every new follower you receive with an individual, personalized tweet. Yes, this takes time, but it can easily be outsourced to a VA and the benefits are awesome – you'll have hardly any unfollows which means your list is always growing, and your followers will return the ‘shout out’ favor by retweeting your content.

Acknowledge everything!

If someone takes the time to mention, favorite, or retweet something you've posted on Twitter, acknowledge it with a mention, favorite, or retweet. This is a fantastic Twitter hack because it's so simple and not enough people do it. When you reward your followers for “good behavior,” they're far more likely to continue engaging with you and sharing your content. This in turn leads to more followers, more engagement, and the creation of a loyal Twitter tribe.

Use TweetAdder

TweetAdder keeps you tweeting day and night, even while you sleep. This app lets you pre-schedule tweets in bulk so your content is constantly being pumped out. This tool is particularly useful for increasing podcast downloads and getting found through hashtags. Remember that Twitter is its own search engine, so tag your tweets appropriately to increase their chances of being found!

Work Your Followers (Case study)

Twitter is not just about growing your following, but engaging the followers you already have. Fitness trainer Ben recently hit the 60,000 follower mark on Twitter, and he did it by working his followers. In addition to the “shout out’s” mentioned above, Ben chooses 5 followers per day to focus on. He mentions them in his tweets, retweets their content, and otherwise engages them. The next day, he moves onto the next 5 people on his list.

Yes, it takes time to get to everyone on his list, but the personalized attention makes people stick with him. And clearly this technique is working - 60,000 followers is nothing to sneeze at, especially for your average fitness coach!

The best Twitter hacks combine awesome apps and technology with a personalized touch. Remember that a lot of these Twitter to-do's can be outsourced to an assistant or freelancer, but be sure to spend at least 15 minutes per day giving your followers the personal touch only you can give. Having a loyal, engaged following on Twitter is one of the fastest ways to grow your brand, build a tribe, and convert followers into paying clients!

Advertising + Monetization

Your long-term Twitter monetization strategy is the same as it is on Facebook: by expanding your reach and connecting with prospective clients, you will position yourself as an expert within the fitness industry and remain top-of-mind when clients are ready to hire a trainer or join a gym. You can enhance and speed that experience with paid advertising on Twitter, which allows you to promote your account, individual tweets, and specific trends.

Begin on the Twitter for Business website (Business.Twitter.com). Before you create an ad campaign, you'll be asked to choose between three different campaign types:

Promoted Accounts – promote your Twitter handle under the “Who to follow” stream in order to increase targeted followers.

Promoted Tweets – promote a specific tweet that you want to make a big splash, such as info on an open house at your gym, or a link to your upcoming webinar.

Promoted Trends – promote topics and hashtags you want people to see. For instance, if you're attending or hosting a fitness conference, you can promote a trend related to that conference, encouraging targeted followers to

view all tweets and updates related to that conference.

From there, you can create a pay-per-click advertising campaign that targets users based on location. Twitter's targeting is not as specific as Facebook's, but that may change soon. After the campaign runs, use Twitter's Analytics tool to view the number of impressions your campaign generated, as well as the traffic it drove to your website.

Twitter is a powerful tool for fitness professionals because it allows you to connect with followers in real time and build a substantial following quickly. Remember to tweet frequently and consistently, share valuable content with links and images, and consider investing in paid advertising to boost your reach even further.

#3: LinkedIn

Why you need it

Okay, let's admit it - LinkedIn just isn't as sexy as Facebook, Twitter, and all the other “fun” social media platforms that are used for both work and play. But forget about LinkedIn's clean-cut, professional exterior. The fact is that your LinkedIn profile may be able to do more to grow your business this year than all other social platforms combined.



That's because there are over 100 million active LinkedIn users in the United States, and nearly 380 million users worldwide. 40% of LinkedIn users use the application every day, and in 2014 alone LinkedIn user profiles were viewed 28 billion (with a b!) times. (*source: Digital Marketing Stats*).

When it first started, LinkedIn served as a sort of online resume posting site for job seekers and recruiters. Today, it's an important way for all business professionals to assert their expertise and status within their chosen industry. Whether you're a personal trainer or a club employee, having both a personal and business profile on

LinkedIn is essential for:

- Increasing reach
- Growing sales
- Attracting new clients
- Generating leads
- Creating a tribe
- Staying top of mind

How to get started

Just like Facebook and Twitter, you will need some basic marketing materials to get started on LinkedIn. If you are a personal trainer or independent fitness entrepreneur, you'll be creating a profile page. If you own or work at a gym or fitness company, you will want to create a profile page *and* a company page.

Create Your Profile

On LinkedIn, it's important to differentiate between personal and business profiles. Don't write your company LinkedIn profile as if you're a single person (even if you are), and don't write your personal LinkedIn profile as if you are a company (even if you are!). A personal LinkedIn profile should talk about you, your background, and what you do to help your clients succeed. Let's say you're the CEO of a company called Fearless Fitness. Your personal profile should talk about your role within the company, how you've helped it to grow, your personal history with the company, and how you work to help your customers and clients. The company page can then give a broader overview of your business and the services it provides.

Keep in mind that both your personal and company profiles should be focused on the end user and how you can help solve their most pressing problems.

Profile Page

- Your profile picture appears as 200x200 pixels. There is no maximum file size so the bigger, the better! If you choose to get a premium (paid)

LinkedIn account, a profile picture that is 240x240 is recommended.

- Choose a background image that is 1400x425 pixels.
- Consider using the same profile picture and background image you are using on Facebook and Twitter so it's easy to recognize you across multiple platforms.

Company Page

- Include a standard logo that is 100x60 pixels. This is what users will see when they land on your company page.
- Include a square 50x50 logo. This smaller version of your logo will be used throughout other areas of LinkedIn and will be visible in your newsfeed, so make sure it's the right size.
- Upload a banner image that is 646x220 pixels for a standard company page, and 947x330pixels for a company showcase (paid) page.

Once you have your images uploaded, it's time to write your LinkedIn profile. Both personal and company profiles will benefit from the inclusion of keyword-rich SEO copy. Make it easy for others to find you by including terms such as "personal trainer," "[Your City] fitness center," etc. Be sure to include these keywords in the title and subheading of your profile or company page.

In your personal profile, you'll be asked to list and describe jobs you've held in the past. Feel free to eliminate jobs that are not relevant to your current fitness business. Focus on the Skills section of LinkedIn and incorporate all of your fitness-related skills into your profile. When crafting your summary, which is a short bio that introduces you to the LinkedIn community, consider writing in the first person to make it more personal ("I've been a personal trainer for the past 13 years and I'm passionate about my job!").

In your company profile, it's time to create a page that represents your business as an entity that reaches beyond you as an individual.

Here, use third person when writing your profile (“XYZ Fitness was established in 2009 and has become the most popular fitness center in Atlanta”). Includes specialties (personal training, yoga, aerobics, etc), details on products and services you provide, your number of employees, and the year your company was founded.

Keep in mind that LinkedIn hides most of your profile to make room for your most recent status updates, so viewers can only see the first few sentences when they land on your page. For this reason, make sure those first few sentences are enticing and induce curiosity to make the reader click “read more.”

Be sure to include a specific Call To Action in your profile on both your personal and company pages. Invite viewers to visit your website, opt in to your email list, schedule a free consultation, or connect with you on Facebook.

Make Connections

LinkedIn will help you make connections by showing you who you already know on the platform. This is done by giving the application access to your email address book. You can also reach out to personal connections from Facebook, Twitter, and other social platforms and ask to connect with them on LinkedIn as well. The more connections you have on LinkedIn, the larger your network will be and the easier it will be to find qualified leads, promote your fitness business, and establish a professional reputation online.

Start sharing updates

Just like Facebook and Twitter, LinkedIn allows you to share status updates with your network. Choose relevant content, include an eye-catching image, and post consistently. Consider the professional nature of LinkedIn before selecting what you want to share – this is not necessarily the platform for sharing personal pictures. Keep it focused on career and business updates and content your audience will love.

Best practices (do's and don'ts)

1. Further optimize your use of keywords

Your LinkedIn profile provides lots of different opportunities to insert relevant keywords, making it easier for prospective clients and customers to find you. But having keywords in your headline and summary alone just doesn’t cut it. Make sure to do your keyword research within LinkedIn itself (as opposed to on Google or by using another SEO tool). Use LinkedIn’s search bar and see what pops up, or go to the profiles of colleagues and competitors to get keyword ideas.

From there, make sure to use keywords in all of the following areas of your profile:

- **Headline**
- **Job description**
- **Summary**
- **Specialties**
- **Publications**

Remember that when it comes to keyword optimization, your goal is to make it easy for others to find you. Be willing to sacrifice a bit of eloquence and creative copywriting in favor of the perfect keywords.

2. Highlight the right parts of your profile

Did you know that you can change the order of the different sections that appear on your LinkedIn profile? If you’re an employee seeking a full-time job, you’ll want to highlight different sections than you would as an entrepreneur, author, or coach. For example, if you’re a personal trainer who’s also an author or speaker, you’ll want to highlight the Publications section so your published works and articles are among the first things potential clients see when they view your profile.

Here is how to change the order of your profile:

1. In the top nav bar within your LinkedIn profile, select Profile à Edit Profile
2. Mouse over the section you’d like to move

3. Drag the section to its new position.

Consider what your ideal customer is looking for when they view your profile. Highlight the areas you'd want them to see first, leaving the least important sections at the bottom of your profile.

3. Separate your Summary from your Skills/Specialties

If possible, keep your Summary section separate from your Specialties section. Keeping these two areas separate gives you more space in the Summary section to pitch yourself and incorporate relevant keywords. If you combine the two, you'll have far less space to work with and won't be able to accurately represent yourself in either area.

If you have already combined Summary with Specialties, don't worry! You can create a "mock" Specialties section in your Summary by first typing in "Specialties," and then choosing from a drop down list of relevant keywords.

4. Endorse others

LinkedIn gives you the opportunity to endorse your connections for certain skillsets and areas of expertise. The more people you endorse, the more people are likely to endorse you in return. Be selective, however – when you recommend a colleague to another colleague, it's your reputation on the line!

Growth strategies

Get others to share your content - The best way to get your social content shared is to first get to know your LinkedIn connections as intimately as possible.

- Research their LinkedIn accounts and see what kind of content they share the most
- Stay clean, positive, and "office cooler-friendly" with your content
- Experiment with different content lengths, images, and descriptions
- Create helpful content that is user-focused and that makes their lives better in some way

Post Once per Day – consistently sharing high quality content is the fastest way to build a fitness-based following on LinkedIn.

Engage, Engage, Engage – if you want others to share and comment on your updates, be sure to share and comment on theirs. On LinkedIn, you get what you give, so spend at least a few minutes every day acknowledging other people's status updates and news.

Ask for connections – LinkedIn suggests connections for you from right within your profile. If you'd like to connect with someone in the fitness industry, or someone who could be a potential client, simply click "connect." With a paid account, you can send connection requests to people you don't yet know but would like to.

Join groups - Just like on Facebook, participating in groups on LinkedIn amplifies your ability to make connections. There is a group search function on LinkedIn where you can search specifically by group topic, select relevant fitness-related groups, and ask to join.

Use a Call to Action (CTA) - As a fitness professional, your LinkedIn profile is going to be slightly different than that of a typical employee. Because you're not necessarily looking for a new job (at least not in the traditional sense), it's important to include a strong Call to Action (CTA) in your LinkedIn profile. In the summary section, give the viewer specific instructions for how to get in touch with you or what to do next.

You might...

- Invite them to connect with you on LinkedIn
- Reveal how they can get a free gift on your website
- Ask to connect on other social networks (y'know, the sexy ones)

Whatever you do, don't leave your prospect hanging! By telling them what to do next with a strong CTA, you'll greatly improve the chances of them contacting you in the future.

Promote outside LinkedIn – Include a link to your LinkedIn profile in your personal email as well as

any email campaigns you send to your list. Ask Facebook fans to connect with you on LinkedIn and tweet your LinkedIn profile to Twitter followers. Include a link to your LinkedIn profile on your website. Consider using sharing plugins to make it easy for your audience to share your content to LinkedIn, as well as follow you on LinkedIn.

Advertising + Monetization

Monetizing your LinkedIn profile is easy with LinkedIn's built-in ad campaigns. The way you advertise on LinkedIn is similar to Facebook in terms of targeting power, but lacks the flexibility to promote your LinkedIn profile. Instead, the pay-per-click setup only allows you to promote a third party link, like a link to your website or landing page.

Let's say you're launching a new Pilates class at your gym. LinkedIn advertising will allow you to create a targeted ad campaign by gender, age, and industry, but also by hyper-specific qualities like job title, city, company size, or LinkedIn group membership. Choose exactly who you want to sign up for your new class, then create a campaign with a set pay-per-click daily budget.

For each ad, LinkedIn requires

- **25-character text headline**
- **75-character description**
- **Your name or company name**
- **A 50x50 image**
- **The URL you want people to visit**

While there is not yet an option to promote your LinkedIn profile like there is on Facebook and Twitter, LinkedIn's targeting options make advertising a great way to monetize your account and attract targeted traffic likely to purchase your fitness-related services.

Don't underestimate the power of LinkedIn to attract new clients and customers. It's also perhaps the best social network out there for net-

working with industry colleagues and securing career-boosting opportunities like speaking engagements and joint ventures.

#4: Instagram

Why you need it

If a picture speaks a thousand words, then Instagram just can't shut up! This youthful social media platform is fiercely popular with Millennials and younger audiences, with 90% of users under the age of 35. It's also being used by more and more brands, companies, and celebrities to build big followings and make connections using exciting images.



Instagram has...

- **75 million daily active users**
- **300 million monthly active users**
- **A reach that includes 34% of the entire U.S. population**

Instagram lets you post pictures and videos instantly, allowing you to share the most exciting moments of your day with your followers. With cool filtering options, your photos can look artsy and interesting even if you have no experience as a photographer. This platform is 100% mobile based and works with Android and iOS.

Unlike Facebook, whose algorithm decides what you do and don't see in your newsfeed, Instagram shows you every image of those you follow. This means that your followers are seeing your images too, and that you can have a much bigger, more consistent impact each time you post. Videos posted to Instagram automatically play in the feed, making it easy to share exercise videos, fitness tips, and training sessions with your followers. The totally mobile nature of Instagram makes it a great platform for fitness professionals who are always in the gym and can't always access a laptop or desktop computer.

How to get started

Download the Instagram app for your smartphone or tablet from within the app store or by visiting Instagram.com.

You will need:

- A 161x161 pro
- file picture – use the same profile pic you’re using on Facebook, Twitter, and LinkedIn.
- A username that represents you or your company
- A 150-word bio that is SEO-friendly and includes keywords and hashtags
- Your website URL included in your bio

Images are meant to be uploaded to your Instagram account from your mobile device in real time and will be displayed in your feed at 510x510 pixels. Your most recent uploads will also be displayed on your profile.

Best practices (do's and don'ts)

Instagram is not Facebook! – Instagram is NOT the place to share photos of you going out to dinner with your favorite aunt. Instagram is artsy, and at its core is about great photography and exciting, inspiring snapshots. When you post an image, you’re competing with other pictures of exotic destinations and awe-inspiring happenings. A simple snapshot of you lounging around the gym just isn’t going to cut it, so be selective with what you choose to share with your followers. Is your photo beautiful, interesting, or helpful in some way? If not, don’t post it and wait til you have one that is.

Don't blast your followers – “Blasting” is a big faux pas on Instagram, so make sure you’re not guilty of this common sin! While it’s kosher to post Instagram pics throughout the day, your followers do not want to see 10 similar pictures posted within a few seconds of each other. Why? Because Instagram is all about what’s fresh, interesting, and different. Sharing a pic of the same plank hold from 16 different angles is sure to make your followers yawn.

Encourage Client Sharing - Instagram is a great social tool for gym owners and personal trainers because it’s so easy to get your clients involved. Encourage members to post pictures of their accomplishments or favorite workouts using a hashtag specific to your gym. Whenever they share a photo on Instagram, all of their Instagram followers will see that photo and be exposed to your brand, which in turn will drive more traffic to your website.

Maintain your brand identity – Getting more training clients is easy when you have a strong understanding of who your clients are: what makes them tick, what they’re afraid of, and what they value most. If your Instagram photos don’t resonate with that identity, your content won’t get shared. Make sure you have a deep understanding of your clients and other social connections. If in doubt, look at what they tend to post and share on Facebook and Twitter. What values can you assume from analyzing their content? If most of your fans are sharing inspirational quotes with each other, rest assured that inspirational photos on Instagram will be a shoe-in for sharing.

Growth strategies

Use hashtags – Hashtags are not only a great way to help potential clients find you on Instagram; they can also be strategically used to increase your number of followers. In addition to hashtags like #fitnessaddict and #fitnessmotivation, use hashtags like #I4I (like for like), #tagforlikes and #instafollow to attract new followers and build your network.

Hold a contest – Post a photo announcing your fitness-related contest on Instagram. Ask people to follow you and/or like the photo in order to enter the contest. Be sure to offer a fitness-themed prize to the contest winner and include related Calls to Action, such as subscribing to your email list to find out who won the contest.

Like other pictures – Engage with others on Instagram by liking their photos and following them. Search fitness-related hashtags to find users who are interested in fitness and likely to

be members of your target market. Then engage with them by following their Instagram feed and liking their pictures. You're sure to get a fair amount of people liking and following you back!

Promote your account – Sync your Instagram account with Facebook, include an Instagram icon on your website, and ask for Instagram follows on Twitter and other social networks. Cross promotion is the best way to bring the followers you already have over to Instagram.

Share helpful images – Travel bloggers can get away with sharing beautiful locales on Instagram all day long. You, on the other hand, are most likely working from the same location and can't rely on beauty alone to grow your Instagram following. If you can't be awe-inspiring, be helpful, engaging, and beneficial. Share photos and videos that show your followers how to make a tangible change in their lives through fitness. Doing so will not only build brand trust between you and prospective clients; it will dramatically increase the shareability of your Instagram photos and grow your following.

Stay focused on the client - Feel free to share photos you're passionate about, but remember that the content isn't for you – it's for your clients and prospective clients, and should therefore be presented with their needs, wants, and problems in mind.

Stay focused on goals - People share content when it's in alignment with their life's goals. Because of this, it's crucial to know what kinds of goals your clients have and help them reach those goals through the photos you share on Instagram. Identify specific goals that many of your clients have. If weight loss is a common goal, for instance, your photos should not only reflect that goal, but show people exactly how to reach that goal through targeted action steps.

Use the “Get Followers” app – Designed for iPhone and iPad, this app helps you find Instagrammers in your target market and promote your profile to them. While you're still responsible for posting interesting images, the app does work to

help you connect with people interested in fitness and health.

Advertising + Monetization

Since Facebook owns Instagram, the way to advertise on Instagram is through Facebook. Specifically, you need to use the Facebook Power Editor or the Facebook Ads API in order to create an ad campaign for Instagram. At the time of writing, Facebook promises to have Instagram functionality from within its more user-friendly “ad creation” application by late 2015.

If you have already created an ad campaign on Facebook, you can use that same advertising account to create ads on Instagram. Since Instagram users are shown all posts from every account they follow, the likelihood of them seeing your Instagram ad is much higher than if you were to use Facebook's algorithm alone.

Your Instagram ad will appear exactly as a normal post would appear – as a square or landscape image with a text description underneath. The only difference is that users will see a blue “Sponsored” icon in the upper right hand corner of your image. Be sure to include relevant keywords, hashtags, and a strong Call to Action.

This year Instagram has begun allowing advertisers to use clickable URLs within their ads. This is done with a “learn more” button placed within a carousel ad (several photos that are viewed in sequence by swiping within the application). On the last photo in the series, users can click to learn more and be sent to your website. Note that they will view the site from within Instagram, so it's crucial to have a compelling reason for them to stay on your site and complete an action instead of continuing to scroll their Instagram feed.

Instagram is fresh and edgier than many of the other social networks out there. Its visual nature makes it perfect for providing exercise instruction, sharing healthy recipes, and demonstrating proper form.

#5: Periscope

Why you need it

As a coach, personal trainer, or solopreneur, video lets you engage your audience on a whole new level. By connecting with your face and voice, clients and prospective customers can get a sense of what it'd be like to work with you while vetting your expertise. Now take all of those benefits and amplify them tenfold with the growing popularity of live video streaming, and you've got a recipe for marketing success.

Real-time video applications like Periscope are giving social users and brands the ability to connect in real-time.

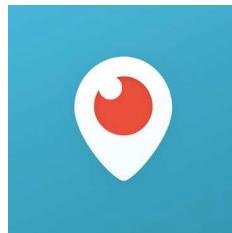
- Personal trainers and fitness experts can live-stream their training sessions with current clients
- Coaches can livestream talks, podcast recordings, and interviews
- Wellness experts can livestream Q&A sessions with clients and give new customers a no-risk way to ‘try on’ their brand for free (and in real time)

Are people really looking for live-streamed videos? Wouldn't it be better to spend time and money creating a more polished, pre-recorded video for your brand?

The data says no.

Since its Twitter launch in late March 2015, Periscope has seen some 50,000 tweets per day that include live video streams. (source: Marketing Land). If video marketing is powerful, then live video marketing is positively almighty. Periscope already has 10 million users, 2 million daily active users, and streams over 40 years (not hours, not days, but years) of video every single day.

Periscope allows users to see the world through other people's eyes by watching video through their smartphone, sort of like FaceTiming with strangers. The live, real-time nature of Periscope encourages its users to “pop in” and view video



feeds from all over the world. Users can comment on the stream in real time, and the person filming can respond in real time. When users find a stream that's interesting to them, they will follow the person or company that created that stream and “tune in” the next time they stream on Periscope.

Businesses and entrepreneurs are using Periscope to do all sorts of exciting things. Using the app, you can live stream product launches, exercise classes, or simply let people join you on your commute to work. The implications for fitness trainers are particularly exciting because with Periscope, you can invite prospective clients to experience your training sessions, classes, and workshops with you as a way of building your brand and reputation. People get a chance to “try before they buy” and get to trust you, which will make closing a sale and winning a new client that much easier.

Periscope also records each live stream and stores it for viewing for up to 24 hours. With the right storage apps, you can download and store each Periscope you create. This means that every time you stream, you are creating content that can then be repurposed and used on your website or other marketing channels.

How to get started

To get started using Periscope, you need an iPhone or Android mobile device and a Twitter account. Download the Periscope app and follow the instructions for logging in to Twitter. Your Periscope account will automatically be connected to your Twitter account, and you'll see a list of people you follow on Twitter who have recently streamed on Periscope.

Watch a few videos to get a sense of what Periscope is all about. You can either watch streams of those you're following, or select the “View Global List” option and watch livestreams from users you're not connected with yet. You can also view recent broadcasts that are no longer live but recently finished streaming.

Create a live broadcast. Don't worry about the content right now, simply dive in and see what happens. Periscope is all about spontaneity, and scripted videos perform poorly compared to spontaneous ones. Let users join you for part of your day, whether you're headed to the gym, working on your blog, or getting ready to speak at a conference.

Make sure you...

- Turn on location sharing so your audience can see where your broadcast is taking place. Many Periscopers may tune in to your feed because they are curious about where you are in the world.
- Create a compelling title that accurately reflects what viewers are going to see/experience with you.
- Select Twitter Post On so a link to your stream will be shared with your Twitter followers.
- Create a Private Broadcast if you only want to share your stream with a few select followers (like your training clients, for instance).

Add new followers. Periscope will show you two lists from which you can build a bigger audience. The first list shows you people who use Periscope that you are already following on Twitter. Follow whoever you like and get notified any time they begin a broadcast. The second list is Periscope's "Most Loved" list that reveals the most popular broadcasters from around the world. Follow your fellow fitness colleagues to announce your presence on Periscope and get the ball rolling.

Best practices (do's and don'ts)

Get the right equipment – besides your iPhone or tablet, you may want to invest in a tripod to avoid shaky handheld streaming during your broadcast. (Try a tripod with a smartphone mount for an inexpensive way to look uber-professional). This will also let you talk to the camera hands-free, and frees you up to demonstrate exercises or work with a training client. Make sure your mobile device is fully charged and you have a strong WiFi or data-based connection.

Get strategic with your title – it's important to create a streaming title that is compelling, but also one that's accurate. Include a specific Call to Action in the title so your viewers know what to expect and can prepare comments or questions for you, i.e. "Your weight loss questions answered" or "Ask me anything about cross training".

Brand your broadcast so followers know what to expect from your livestream. Include fitness-related hashtags and titles each time you stream, even if you're streaming from Starbucks. This will help your followers get to know you as a fitness professional first and foremost.

Choose vertical or horizontal filming – Periscope has recently added landscape filming capabilities to its app, allowing you to stream video vertically or horizontally. As viewers leave comments, those comments will appear in the lower half of the video screen, so make sure the most important elements in your video can be viewed towards the top of the screen.

Engage your audience – Periscope is meant to be a conversation between the streamer and the viewers. Be sure to acknowledge all comments, respond to questions, and show your appreciation for any hearts (likes) you receive.

Answer questions in real time. When you respond to comments and questions as they are asked, viewers get the thrill of knowing your feed is, in fact, live.

Growth strategies

Share your broadcast across your other social networks. Always make sure the "Twitter post" option is selected before you start broadcasting, which allows the application to tweet a link to your broadcast. After Periscope tweets the link to your broadcast on Twitter, copy and paste that link and share it on Facebook and other social networks. You can also include it in an email blast or include it with a screenshot on Instagram.

Share broadcast replays. As you can imagine, a lot of your followers won't be able to view your feed in real time because they're busy working or doing other things. Periscope automatically saves each broadcast you create, making it available to your followers. You can also share recorded broadcasts on Facebook and other social networks to further increase your reach and followers. On iOS, go to Settings, then log in to Facebook from within the Settings app. Next, open Periscope and select the "Share to Facebook" option. Copy and paste the link and share it on LinkedIn, Instagram, or the social platform of your choice.

Boost positive feedback by asking viewers to tap the heart icon to answer yes/no questions. If they tap once for yes and twice for no, you're increasing the number of hearts your feed receives, and in turn your overall visibility.

Follow other people in the same way you would on Twitter or any other social network, making sure they fall somewhere within your target market. You want to build a substantial following, sure, but you also want to target users who could become clients or customers someday. The more targeted people you follow, the more people likely to follow you back.

Go private with an exclusive broadcast that can only be seen by invited guests. This is a great way to build exclusivity and buzz around your brand.

Analyze your results by looking at how many people watched your livestream, how long they watched, when they stopped watching, and how many hearts you received. Feel free to survey your Twitter and Periscope audiences to ask them what they most want to see from you in a livestream video, then give the people what they want!

Advertising + Monetization

Periscope's advertising and monetization options are as innovative as the application itself. Instead of traditional ad campaigns or promoted Periscope videos, the creators of Periscope are

taking a more organic approach, working with big brands and social media stars to promote products via video.

So if you can't (yet) buy advertising on Periscope, how can you monetize the app? By using it as a lead magnet for your fitness business. Use Periscope as your "free initial consultation" with prospective fitness clients. Commit to streaming live once per day and offering viewers valuable training tips, weight loss secrets, or strength-building insights. At the end of each broadcast, be sure to invite your viewers to complete a Call to Action that will help you build your business and turn a profit fast: sign up for an in-person training session in your gym, download a coupon for a free aerobics class, subscribe to your email list, or join your Facebook community.

Periscope video only remains on the platform for 24 hours, so it's crucial to move quickly to make the most of your broadcast. Consider using a video storage app like Gbox to store your Periscope videos for long-term use in your marketing.

#6: Pinterest

Why you need it



If you're not using Pinterest marketing, you're missing out on one of the most powerful social media tools for coaches and trainers – especially those who work in the health and wellness industry. Health, fitness, exercise, and personal growth pins are consistently rated among the most popular on Pinterest. That means they're shared the most among Pinterest users and result in the most click-through's to the pinner's website. Pinterest is also unique because it lets you reach a wider audience than just your followers. When you pin an interesting image, graphic, photo, or meme, your followers can see it in their feed, by everyone else on Pinterest can see it too by searching for your topic.

Pinterest at a glance

- **100 million users**
- **42% of U.S. women use Pinterest**
- **500,000+ business accounts**
- **93% of Pinterest users regularly shop online**
- **67% of all pinned content comes from a business's website**
- **33% of new Pinterest signups are from men**

Pinterest users love connecting with and sharing the businesses, brands, and companies they love. With only 5% of small businesses taking advantage of this growing platform, why not strike while the iron is hot?

How to get started

Just as you differentiated between personal and business pages on Facebook and LinkedIn, you'll have to choose if you want to create a personal or business Pinterest account. The same rules apply: if you are branding yourself as a personal trainer or independent fitness professional, your name and face are what your clients want to connect with. If you represent a gym or other fitness business, a Pinterest business account will be more your speed. However, keep in mind that only Pinterest business accounts have access to Promoted Pins, Pinterest's advertising platform. Also, it is possible to create a business account and brand it with your personal profile picture instead of a business logo.

Create your profile

To create your profile, you will need:

- Your **business or personal name**
- A **profile picture** or logo (upload a square image at least 600x600 – Pinterest will resize this to be 165x165)
- A **branded username** that will be your Pinterest URL (pinterest.com/yourname)

- An “About you” **bio statement** shorter than 160 characters
- Your location
- Your website URL

Follow other pinners

Pinterest is filled with pins, which are organized into themed “boards.” These boards are created by users who are known as “pinners.”

To get started, search for and follow some fitness-related boards. If you find a board you really like, you can also follow the pinner who created that board. As always, following others is a great way to get more followers for yourself. Remember that you are likely to find and connect with potential clients not only by discovering pinners, but by tapping into the audience of those pinners. In this way, each pinner you follow has the potential to bring an entirely new audience to you.

Create some boards

You can like pins and follow pinners without creating your own boards, but in order to gain a following on Twitter you need to create your own boards as well. Boards will allow you to collect the pins you like best and organize them in an appealing way. When people view one of your boards and like what they see, they're more likely to check out your other boards and follow you.

Best practices (do's and don'ts)

In order to engage an audience on Pinterest and convert pinners into paying customers, it's important to abide by the rules of the road: Pinterest is not Facebook (or Twitter, or Google+), and has its own set of criteria to follow in order to achieve success.

Be specific with board content and board names so pinners know what to expect. A board titled “Fitness” won’t make as big an impact as a board titled “Lower Body Workouts to Do at Home.”

Pin actionable images. Here is where health and fitness entrepreneurs have an edge over everyone else on Pinterest: the industry is, by nature, action-oriented. Because of this, savvy pinners are sharing how-to content that gives step-by-step, graphic instructions for everything from sit-up series to preparing healthy meals. Pins that show the user how to complete specific exercises are extremely popular, as are before-and-after pins and pins that inspire the user to take action. If you give the pinner something to do, not just something to see, you're sure to gain new followers (and new clients!).

Choose Visually Appealing Content. Pinterest is a highly visual medium, which means that 99% of a given pins' shareability is based on how it looks. When pinning exercise series, recipes, or quotes, take care to share the most visually stunning material possible. For instance, exercise pins that feature good-looking models that have been photographed professionally tend to do much better than quick snapshots of amateur exercisers taken with a smartphone. Again, Pinterest is not Facebook. Users don't want to look at a regular Joe or Jane; they want to pin that which is extraordinary, special, rare, and inspiring.

Optimize pin descriptions with hashtags and keywords. Since Pinterest is so visual in nature, the most important part of your pin is always the image, photo, or infographic. However, the description area of each pin is powerful because it helps people find your pins in the first place. In addition to describing what your pin is all about, you want to include a relevant link to your website, keywords, and/or hashtags that will help pinners find your content. Including the full URL to your website or blog post is crucial. When you do, pinners will be able to click on your pin and view your link without leaving the Pinterest application. This creates a seamless user experience while allowing users to engage with your brand beyond the pin.

Pin other's content. Remember that while you can upload your own pins, the fun part about Pinterest is discovering, sharing, and collecting other people's pins. If you choose to upload your own,

remember that Pinterest is not Facebook – no one else is interested in pinning photos of you and your dog! However, they may be interested in pinning an image of you demonstrating a helpful exercise or fitness tip. Always keep your audience in mind when choosing what to pin. Remain faceless. Pins without faces are statistically shown to convert better (source: Sprout Social). This is very important for fitness pros!! How can you showcase exercises/proper form without including a face?

Growth strategies

Participate in Group Boards. Like all social media, Pinterest is highly interactive and is based on engagement. You can't simply "pin and run" if you hope to create connections with prospective clients and grow a strong following. By becoming a member of a group board, you will make connections with other fitness professionals and get access to their audiences on Pinterest. Consider starting your own group board and inviting popular pinners to contribute to it.

Optimize your pin descriptions. Once you have begun pinning with relevant keywords, hashtags, and links, you can take it a step further. For instance, the words "recipe," "cup," and "DIY" are included the most above all other keywords on Pinterest (source: Sprout Social). How can you incorporate these popular words into your pin descriptions? Don't be afraid to get creative with a "recipe for fitness" or "DIY home workouts."

Be consistent with your pinning, especially on your group boards. The more you participate on Pinterest, the faster your following will grow. Since Pinterest is different from Facebook and Twitter in that not all of your followers will see every single thing you pin, you can feel free to pin a bunch of content at one time, as well as pin every day.

Comment and like other's pins, and respond to all comments and likes on your pins. Follow those who interact with your pins and boards the most, and don't be afraid to ask them to subscribe to your email list or complete some other CTA.

Cross promote your pins on Facebook, Twitter, LinkedIn, and other social platforms. Integrate the “pin it” button onto your website and into your email campaigns. Add the Pinterest app to your Facebook page and tweet cool pins whenever possible.

Experts at Pinterest marketing are constantly

- **Pinning other's content as well as their own**
- **Creating collaborative group boards that allow them to share and showcase health and fitness related pins**
- **Liking and commenting on other's pins**
- **Alternating promotional content with “just for fun” pins (i.e. other people's pins or pins that do not include links to their website)**

Promoted pins have been statistically shown to be just as popular as organic pins. They show up in regular searches and look just like regular pins, except for a small “Promoted” icon at the bottom of the pin. If you have room in your budget, promoted pins are a powerful marketing weapon to add to your social media arsenal.

Thanks to its visual nature, shareability, action-based content, and opportunity for engagement, more and more fitness professionals are using Pinterest to grow their followings both on and offline. If you're new to Pinterest marketing, get started by creating a few fitness-related boards, pinning other's content, and becoming a member of relevant group boards. From there, you can begin creating and pinning your own content. Finally, don't forget to connect with current friends, clients, and prospects by following them on Pinterest. This will lay the foundation for Pinterest domination in the very near future!

Advertising + Monetization

Use Promoted Pins

If you have a Pinterest business account, you can get access to promoted pins. Promoted pins will allow you to start getting your content in front of more and more targeted pinners using the Pinterest marketing advertising model. Promoted pins are a Pinterest marketing opportunity similar to Facebook ads or sponsored tweets.

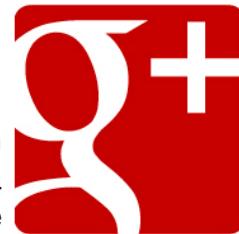
Once you've chosen action-based, visually appealing content, you'll have the opportunity to promote that content to the pinners most likely to fall within your target market.

- Choose from an **engagement campaign** to increase engagement on Pinterest, or a **traffic campaign** to drive pinners to your website or landing page.
- Set a goal and budget for your campaign – you only pay when people click on your pin.
- Choose a target audience to promote your pin to.
- Analyze your results with Pinterest's analytics.

#7: Google Plus

Why you need it

Google+ has a bad reputation when it comes to social media platforms, but it's actually one of the most powerful tools you can use to improve your search ranking with Google. With somewhere between 300 and 540 million users (Google's a bit hush-hush about the exact numbers), G+ doesn't have as much activity as Facebook and Twitter – but it doesn't matter. The true power of G+ lies in how Google includes its content in search engine results.



Your Google+ profile and content will...

- **Increase your Google search visibility**
- **Improve your SEO/page rank**
- **Help your content rank when your website does not**
- **Show up in “local carousel” results**
- **Allow you to easily connect with anyone who uses Gmail**
- **Show up in searches in G+ Publisher**

How to get started

G+ is similar to Facebook and other social platforms in that it allows you to make connections with other users, post and like content, join groups, and create business pages. The jargon is just a bit different.

Instead of friending or following someone on G+, you add them to circles. You can create each circle to be as niched as you want, i.e. "Work friends," "Workout contacts," "Clients," etc. Circles help you organize your contacts and target specific people with your content.

Instead of "liking" a post, you +1 it. The more +1's a post has, the more visible it becomes on G+ and the more likely it is to pop up in a Google search. You can also share a post on G+, which will publish it on your G+ feed for those in your circles to see.

Instead of groups, G+ has communities. They work similarly to Facebook groups.

Just like most other social platforms, G+ has profiles for individuals and pages for businesses. Consider creating a business page branded with your company information or your individual information and image.

Here's how to get started using Google+:

1. Create your profile – even if you're more interested in creating a G+ page for your business, you'll need to begin with a Google profile to start. Once you have a Google profile you'll have access to all sorts of applications and tools, including YouTube, so it's a good idea to have one. Keep in mind that you can create a Google account using an email address other than a Gmail address if you so choose.

2. Upload a profile picture – your picture will display at 250x250, but it's best to upload a larger-sized image which will look better when viewed at the smaller dimensions. Consider using the same profile picture you're using on all other social platforms for brand consistency.

3. Create a tagline and introduction – in addition to a tagline and brief intro, G+ combines Facebook and LinkedIn profile information by asking for the places you've lived, jobs you've held, skills you're proud of, and demographic information. Share whatever you like, but keep it on-brand and fitness-oriented.

4. Choose a cover photo – G+ recommends a cover photo that is 1080x608. The application will accept other sizes, but nothing smaller than 480 x 270 and nothing larger than 2120 x 1192.

5. Create a Google+ page – Once logged into your G+ profile, look for the big blue + circle icon and click it. You'll be sent to a page where you can fill in your page name, website URL, and the type of page you want to create (product or brand, entertainment, community, etc.). The dimensions for your profile and cover photo are the same, but consider using a logo instead of a profile pic if promoting your gym or brick-and-mortar business. You may also want to use a cover photo template to ensure a responsive design that looks great across all devices.

Best practices (do's and don'ts)

Post images and graphics whenever possible. G+ is very visual and users like to +1 visually appealing content.

Circle other pages and profiles. This will help you create segmented target audiences, which in turn will help with sharing/promoting your content and monetizing each audience. Once you circle, you can then share appealing content with each circled group, increasing the likelihood they will +1 and share your content. Also, every time you circle or follow others, they are more likely to follow/circle you back.

Use hashtags and keywords that are automatically populated on your G+ post. When you post content on G+, you have the opportunity to fill out a description. Include relevant keywords and see which hashtags G+ suggests by typing in the '#' sign followed by a hashtag.

For instance, when you type in "#fit" you will

see a list of Google's suggestions, including #fitness, #fitnessmotivation, #fitnessaddict, and more. Including these hashtags will help people find your content and make them more likely to circle you and share your stuff.

Hashtags also help people find your G+ content in organic Google searches. For instance, if you post content and use the hashtag #healthyliving, Google may include your post in a search for "healthy living tips" or "healthy living recipes." In fact, it can be much easier to rank on page 1 of Google through your G+ content than through your website or blog!

Include links in the post description – but not all the time! If you only post links on G+, your followers won't stay around for long. Include links to your website, blog, and landing pages, but also post engaging content without a URL, such as photos, questions, quizzes, and infographics. Also, make sure to include your main URL on your profile and page so it's linked with your G+ account.

Share, +1, and comment on other people's content. This is the best way to connect with others and grow your circles on G+.

Ask for **client reviews** on your G+ page. The more reviews you have, the better your G+ page will rank in local Google searches. This option only applies to businesses/companies, not to individuals.

Growth strategies

Sync your page with your profile – if you have both a profile and a page on G+, you can grow your following by sharing page content from your profile. It's much easier to circle contacts from your individual profile, so chances are good you'll have access to a bigger audience. For this reason, sharing your page content from your profile will expand your reach and encourage more people to follow your page.

Get on the Hot and Recommended list – Google+ promotes trending hashtags, communities, and posts through its What's Hot and

Recommended stream, which is featured on the main Explore page of the site. In order to get on this list, you may want to deviate from fitness-related content and share a photo, meme, or GIF you're sure will go viral. How to do that? Check out what's trending on G+ and time your post to coincide with a specific niche topic, such as #throwbackthursday. When you get enough shares and +1's to trip Google's algorithm, your post will appear in the Hot feed, and you will greatly increase your followers.

Be active in communities – Share, +1, and post awesome content to get noticed in fitness-related communities on G+. Be sure to follow the community guidelines for what is and isn't ok to share. Some communities frown on sharing blog posts, for instance, because they see it as spammy self-promotion. Find other ways to add value to the group and build relationships. The more consistent and beneficial you are, the more circles you'll get.

Ask for what you want – it never hurts to ask for more followers if you do it the right way. In each description, include a follow request along with a benefit, such as "Circle us to get more 2-minute fitness tips!"

Sync with other social accounts – Ask for G+ connections on Twitter and Facebook, and add a G+ follow badge to your website, blog, and email marketing campaigns.

Attend Google Hangouts – Google Hangouts and other G+ events will let you meet people face to face via video. You can connect and chat in real time and solidify the connections you've made on Google+. The new followers you gain from these events will be much more likely to +1 and share your content since they know you "personally."

Advertising + Monetization

Google+ offers +Post ads as a way to monetize your G+ account. These ads are incredibly powerful because they are not just promoted on G+, but throughout the Internet. According to Sprout Social, +Post ads have the potential to be seen

on 2 million external websites that are linked to Google's Display Network.

Not everyone can use +Post ads, however. In order to promote a post on G+, your page must have a minimum of 1,000 followers. The content you choose to promote should be fitness related and family friendly since Google will review it before making the ad live.

+Post ads can be created using your Google AdWords account or from within your G+ page. Once logged into G+, simply choose a post you want to promote and select the arrow in the upper right hand corner. Then select "Promote this post." The pay-per-click options and budgeting work in the same way they do if creating a traditional Google AdWords campaign.

While Google+ may not have the numbers or obvious engagement of more popular social platforms, it offers many tangible benefits that can't be found on Facebook or Twitter – namely, the chance to have your content seen across the entire Internet, not just a single social platform.

#8: YouTube

Why you need it

As a personal trainer or fitness professional, having your own YouTube channel is an essential component of your marketing strategy.

Not only is YouTube the perfect platform for creating web-based personal training services and an online fitness brand; it's also one of the biggest forces to be reckoned with on the internet.



- Over 1 billion people regularly use YouTube
- YouTubers watch hundreds of millions of hours of video every single day
- YouTube's reach is far greater than any U.S. television cable network
- YouTube's audience is 80% outside the United States, making it possible to "go global" with your brand

- Nearly 75% of B2C marketers create video content on YouTube (source: TrackMaven.com)

More and more people want to exercise from the comfort of their homes, but still need the instruction, motivation, and expertise of a fitness professional or personal trainer. Video lends itself well to fitness and training because it's the perfect way to hold tutorials, demonstrate proper form, showcase classes, and increase your status as a trainer or fitness brand.

There is a huge market for people searching for exercise videos on YouTube. By shooting simple videos, like the best way to perform a bicep curl, you can grow a huge following, attract more offline clients, and increase your revenue.

How to get started

Remember that Google account you created when you were getting started on Google+? Good, because it's the same account you're going to use for YouTube. From within that YouTube account, you can create multiple YouTube channels where you can upload videos. For instance, you could create one channel that's focused on how-to training videos, and another channel where you share workout videos from your gym. Be sure to name your channel with your brand in mind, and make it clear what kind of videos viewers can expect to see.

Like every other platform we've discussed thus far, YouTube gives you the opportunity to showcase a profile picture and a cover photo, which in YouTube-land is called "channel art."

- Your profile picture will automatically be pulled from your Google profile.
- Your channel art should be 2560x1440 pixels. Consider using the same cover photo you use on other platforms.
- Include a keyword-rich description of your channel.
- Include a link to your website
- Include links to your other social media accounts, including Facebook, Twitter, and Google+

Best practices (do's and don'ts)

Create LOTS of content – Uploading one video to YouTube once in awhile just isn’t going to cut it if you want to get noticed. According to Track-Maven.com, the top 25 brands using YouTube to market their products publish upwards of 75 videos every single month. Your videos do not need to be professionally produced, but they do need to be valuable and published consistently.

Create multiple channels – Another secret of big YouTube players is that they upload video content to multiple YouTube channels. Doing this will allow you to brand each individual channel with targeted content to attract particular types of viewers. You’ll also be able to track which channels perform best and create videos that have been proven to resonate with your audience.

Keep it short and sweet – The most popular videos on YouTube are no more than two minutes long, and no shorter than 16 seconds.

Optimize video descriptions – Each video you upload can be optimized with keyword-rich descriptions, an SEO-friendly title, and lots of “tags.” Tags are simply YouTube’s word for “keywords,” and are automatically populated when you begin typing into your video description. Don’t get creative with tags – select what YouTube suggests because the tags that pop up will be the most searched for on the platform.

Post at the right times – Although viewers can watch your YouTube videos at any time, the moment you upload or share your video has the potential to make the biggest impact. That’s why it’s important to promote at the perfect time. According to marketing research, the most popular viewing time on YouTube is on Thursdays and Fridays between 12pm and 3pm Eastern.

Make videos mobile-friendly – Everything you upload – just like everything you create for your website or other social platforms – should be mobile optimized and look great on a smartphone or tablet.

Growth strategies

All of the best practices we’ve covered so far also apply to growing your YouTube channel: cross-promoting across other social platforms, engaging other users by commenting and sharing their content, subscribing to other YouTube channels, and so on. But because YouTube is such a dynamite social space for fitness professionals in particular, it’s important to dig even deeper and take advantage of YouTube’s ability to produce viral videos.

The #1 best way to grow your YouTube channel, expand your reach, and score new clients through the videos you share, is to consistently create viral videos on YouTube. Viral videos take the Internet by storm, get shared millions of times, and launch their creator into the online spotlight. Viral content gives you the opportunity to shine in front of the entire online world, making it easier than ever for your tribe (and prospective clients) to find you. Viral content can also lead to a huge surge of email opt-in’s, website views, and new customer inquiries. It’s a surefire way to get attention, so how come everyone’s not creating videos that goes viral? Because viral videos must contain these key 7 ingredients. Without the right mix, your content will fall into YouTube oblivion as soon as it’s posted. Here are 7 powerful ingredients to include in each and every video you upload:

1. Universal appeal

Videos that go viral have universal mass appeal. That’s not to say that your content can’t be industry-specific or geared toward a certain target market. But it must contain universally felt emotions or situations that can be related to by millions of people.

Example: A huge majority of viral content features the antics of babies or animals. Why? Because almost all human beings, regardless of age, ethnicity, or culture, are inherently drawn to cute little creatures doing cute things. Find a way to incorporate this type of “viral seed” into your workout videos and you’re sure to expand your reach way beyond your intended market.

2. Shareability

Just because content is universal doesn't mean it's shareable. Viral content becomes viral by user-generated sharing. It's not enough to get a bunch of likes or views – you also want people to share your content with friends with a comment that reads "You have to see this."

Example: Sorrow is a universal feeling. It's something everyone understands. But it's not something everyone wants to share with their friends or display publically. This is why content that invokes joy or laughter is much more likely to go viral than content that evokes sorrow or pain. When in doubt, make sure your content is "water cooler"-friendly. If people wouldn't talk about it around the water cooler, they probably won't share it online either. How can you make a video demonstrating proper sit-up form more shareable?

3. A positive spin

Positive content goes viral much more often than negative content. Sure, there is plenty of negativity online and people are quick to indulge in Twitter wars and nasty Facebook exchanges. But viral content tends to be most popular when it has an uplifting message, is funny, or gives people practical tips on how to live a better life.

Example: In a study conducted by the NY Times, emotionally positive messages went viral far more frequently than negative messages. An article about people falling in love with New York City fared far better than an article about a baby polar bear's caretaker dying. Sadness is especially toxic when trying to create viral content.

Let's say you're shooting a video featuring a client of yours who's had lots of health challenges. Instead of focusing on their hardship, use your video to show how they've overcome those hardships by working with you. The uplifting message of triumph over adversity is not only positive, but universal as well.

4. Emotional arousal

If your content is universal, shareable, and positive, but lacks deep emotional appeal, it still won't go viral. The most effective content appeals to deeply felt human emotions like love,

joy, hope, anger, and fear. Keep in mind that you can still stay positive while incorporating fear and anger into your content.

Example: The content created and shared during Charlie Sheen's 2011 breakdown was some of the most viral of all time. Sheen's story had emotional appeal because it was all about anger – an emotion everyone understands and can either empathize with or despise. This emotional connection is what caused a single tweet of Sheen's to receive over 7,000 retweets in a single day when he sought to hire an intern during the height of the scandal.

So what does this mean for a personal training video? In addition to giving practical fitness tips, demonstrating exercises, and showcasing client success stories, there must be a strong emotional pull present in your videos. Think about the reasons people want to get and stay fit: to live longer, to have more energy for their kids, to feel like themselves again, to gain confidence. All of these reasons contain deep emotions that can be brought out in your videos in order to arouse an emotional response from your viewers.

5. Actionable insights

In addition to emotional resonance, viral videos often becomes so because they have "news you can use," i.e. they provide people with practical tips to make their lives better. This includes lists, how-to content, life hacks, and unique prescriptions for better living. The key to creating actionable viral content is to give the end user a way to engage with the content and make it work for them.

Example: The most viral content on Pinterest includes pins that people can do or learn, i.e. "How to compost," "7 things every new mom should know," and "The best foods to grow indoors." This is great news for fitness professionals because the very nature of what we do every day is actionable! When demonstrating a new exercise or sharing fitness tips, be sure to include a clear, specific video title so your viewers know they're about to get hit with massive value.

6. Fear and anxiety

Steer clear of sadness but don't be afraid to create video content that invokes fear, anxiety, and even anger. These emotions are just as powerful as more 'positive' emotions like hope and love, and are even more effective if positioned in a positive context.

Example: When Willie Nelson partnered with Chipotle to create an animated music video about factory farming, the content instantly went viral. The emotional appeal started with the fear and anxiety of a world dominated by factory farms, but ended with hope for the future of farming. The juxtaposition of both emotions in one video was the perfect recipe for viral content. A lot of people have fear and anxiety around their weight and their health. You can address this directly in your videos as long as you also provide a solution for how to overcome such emotions – training with you, of course!

7. Presence

Great viral video content is always focused on the present moment. That's not to say that it can't deal with the past or future – in fact, some of the most popular content online comments on things we've done in the past or what we think the future might be like. The key is to showcase past and future as it relates to our current times and contemporary lives.

Example: "Throwback Thursdays" are popular on Facebook because they make us remember how far we've come since 'back in the day.' They remind us where we are now and give us a sense of connection with the world around us. A great way to play on past and future in fitness videos is to do a "before and after" segment featuring one of your clients. You can film their first training session, then follow them as they progress through your training program. Once they've made substantial progress, film another training session and edit it together with their first session, allowing the viewer to experience remarkable transformation in a single moment.

Advertising + Monetization

YouTube has a great built-in program for monetizing your various channels. Because YouTube is connected to your Google account, the You-

Tube Partner Program is connected directly to your AdSense account. All you have to do to begin monetizing your YouTube videos is go to the monetize tab within your account and select Enable My Account. Follow the prompts and you'll soon be making money every time someone watches one of your videos.

YouTube videos are monetized through advertisements that appear before or during your videos. You can choose what types of ads you want to appear depending on what you think will annoy your viewers least (because let's be honest – no one likes ads during videos!). For example, TrueView in-stream ads appear at the very beginning of your video and allow the viewer to skip to your content after a few seconds. YouTube also offers display ads, which appear to the right or bottom of your video, and overlay ads, which appear on the lower portion of your video as it's playing.

In addition to monetizing your video content, you can also purchase advertising on YouTube in various formats, all of which are charged on a cost per view basis (as opposed to Cost Per Click). In the spring of 2015, YouTube announced a new TrueView advertising feature called "Cards." Cards allow advertisers to add a Call to Action (CTA) to video advertisements in the form of a small text card that appears on the right side of the video screen (or below the screen on mobile devices). Cards create much more opportunity for engagement thanks to their positioning, the CTA language used, and the new payment structure that's been rolled out by YouTube. Instead of getting charged whenever someone decides not to skip an ad, advertisers now get charged whenever someone clicks a card. This means more visibility for you, the advertiser, which in turns leads to better monetization of your videos on YouTube.

YouTube continues to dominate video marketing and afford individual content creators the opportunity to build a following, connect with their audience, and monetize their videos quickly and easily. For fitness professionals, this social platform offers the perfect way to show prospective clients what you and your brand have to offer.

CONCLUSION

How to Succeed on Social

Social media success is a combination of reach, engagement, lead generation, and monetization. In order to make social media work for you across Facebook, Twitter, LinkedIn, Instagram, Pinterest, Periscope, Google+, and YouTube, adopt the following 7 failproof success strategies:

1. Build awareness

If only you could hop onto Facebook and instantly start creating a steady cash flow. If that were possible, everyone would be doing it! Huge companies like Petco, Hautelook, and Dell succeed in monetizing their social media because they have a certain level of brand awareness – a level you need to strive for if you also want to monetize your social media marketing. That's not to say you have to be an international celebrity trainer to start making money with Twitter. You do, however, have to consistently solidify your social presence by sharing great content, interacting with your followers, and positioning yourself and your brand as a leader in your particular market – even if (no, especially if) that market is hyper-local.

2. Enhance engagement

Social media marketing is just like any other type of marketing: engagement with the prospect is the key to success. Social media being what it is, your chances for direct engagement with the end user are better than ever. Focusing on engagement with your followers will not only clue you in as to what they need and want from you as a fitness professional; it will increase your chances of a sale when the time comes to present a paid offer.

3. Offer special promotions

Reward your social followers the same way you might reward your email subscribers – with exclusive offers just for them. If you make it clear that your Twitter followers or Facebook fans will receive special discounts, coupon codes, or promotional offers at certain times of the day or week, new prospects will be much more likely

to follow you (especially if you've done a great job with awareness and engagement in steps 1 and 2 above).

Make the promotional offer clear, consistent, and relevant to your target market. If you're a personal trainer, for instance, you could offer a coupon code for a free training session, and a series of free sessions to the person who shares your offer the most (that's free viral marketing!).

4. Hold contests

Nothing screams 'social media success' like a well-executed contest. Contests are fun, they don't feel 'salesy,' and they're an excellent way to increase engagement with your brand. A popular contest also reveals tons about what your prospects like and want from a personal brand like yours. Try combining a paid Facebook campaign with a contest. Offer followers discounts toward classes or training sessions by sharing the contest with their friends. In this way you'll get "facetime" with your followers and their friends, expanding your reach exponentially.

5. Choose paid advertising

Almost every social media platform now offers paid promotions, where you can advertise to a select group of targeted followers or other social demographic. Unlike traditional Pay-per-Click ads, which don't try and disguise the fact that they are advertisements, social ads allow you to choose sponsored posts and other highly targeted campaigns that make your message feel more like an offering from a friend than an ad from a company. You also have more power than ever when it comes to targeting. You can choose exactly who sees your ad and make sure you're only spending money on people in your target market who are most likely to buy.

6. Integrate with Apps

More and more companies are monetizing their social media marketing by combining their social presence with mobile applications. 50% of all smartphone users use their phones to download or access apps (source: Pew Research Center). That's a huge market share just waiting to interact with your brand. Social-based apps

are the most popular and the most likely to drive sales. Apps can be paid or free, but their use should always lead to opportunities for the user to make a purchase.

The most successful individuals and brands use social media marketing not only to gain new customers, but to retain the loyal customer base they already have. Be sure to reward loyal social followers with deals and discounts, feature products and services that people will want to share with their friends, and remember that social media is, above all else, an ongoing, two-way conversation between you and your target market