Section 5: Exercise Technique and Training Instruction

Chapter 13. Integrated Training and the OPT Model

- Integrated training combines flexibility, cardiorespiratory, core, balance, plyometric, SAQ, and resistance training into one system.
- When an exercise program is progressive and systematic, using a progressive overload approach, the body becomes stronger by adapting to the new demands placed on it.
- Fundamental movement patterns include squatting, hip hinge, pulling, pushing, and pressing.
- Maintaining ideal posture places the client's body in the most optimal state to perform movement patterns safely and effectively.
- Optimal ROM allows joints to move freely.
- Fitness professionals should provide programming that requires movement in all three planes of motion: sagittal, frontal, and transverse.
- The acute variables for training include repetitions, sets, training intensity, repetition tempo, rest interval, training volume, training frequency, training duration, exercise selection, and exercise order.
- An ever-changing integrated training approach provides a systematic and progressive approach to fitness training; its components include flexibility, cardiorespiratory, core, balance, plyometric (reactive), SAQ, and resistance training.
- Benefits of flexibility training include increased joint ROM, possible decrease in muscle soreness, and a potential reduction in injury risk.
- Benefits of cardiorespiratory training include decreased heart rate and blood pressure while increasing stroke volume and cardiac output.
- Benefits of core training include enhanced posture; better bodily function for daily living; increased balance, stabilization and coordination of the kinetic chain; minimized low-back pain; and improved skill-related movements.
- Benefits of balance training include reducing risk of falls and ankle sprains while improving proprioception and agility-based activities.
- Benefits of plyometric (reactive) training include improved bone mineral density and soft tissue strength, expression of power and explosiveness, while also increasing metabolic expenditures required for weight management.
- Benefits of SAQ training include improved top speed, change in direction, and rate of acceleration and deceleration.

- Benefits of resistance training include increased endurance, strength, and power; muscular hypertrophy; and weight management.
- The OPT model is based on the scientific rationale of human movement science and uses the principles of integrated training.
- The OPT model is divided into three different levels of training: stabilization, strength, and power, which are subdivided into five phases.
- Phase 1 Stabilization Endurance Training is designed to teach optimal movement patterns (e.g., pushing, pulling, pressing, squatting, hip hinging), core and joint stability, and helps clients become familiar with various modes of exercise.
- The goal of Phase 2 Strength Endurance Training is to enhance stabilization endurance while increasing prime mover strength.
- Phase 3 Muscular Development Training is designed for individuals who have the goal of maximal muscle growth or altered body composition (i.e., fat loss).
- Phase 4 Maximal Strength Training works toward the goal of maximal prime mover strength by lifting heavy loads.
- The goal of phase 5 Power Training is to increase maximal strength and rate of force production.

Chapter 14. Flexibility Training Concepts

- Flexibility is defined as the normal extensibility of all soft tissues that allows the complete ROM of a joint.
- Flexibility has a major influence on mobility during dynamic motion.
- Poor flexibility can lead to the development of relative flexibility, which is the process in which the HMS seeks the path of least resistance during functional movements.
- The HMS, also known as the kinetic chain, comprises the muscular, skeletal, and nervous systems. The body's kinetic chain can be further classified into two regional chains: upper kinetic chain and lower kinetic chain.
- Muscle imbalance can be caused by postural distortions, repetitive movement, cumulative trauma, emotional duress, poor training technique, poor bodily control, and biased training patterns.
- Muscle imbalance may result in altered reciprocal inhibition, synergistic dominance, and osteo- and arthrokinematics dysfunction.
- Synergistic dominance is a neuromuscular phenomenon that occurs when synergists take over function for a weak or inhibited prime mover (agonist). This leads to altered reciprocal inhibition of the antagonist muscle.
- Osteokinematics describes how the bones and joints are moving through a ROM, and arthrokinematics describes the motion at the joint surfaces. Altered joint motion can be caused by altered muscle length-tension relationships, force-couple relationships, and poor joint surface motion, which results in poor movement efficiency.

- Neuromuscular efficiency is the ability of the nervous system to recruit the correct muscles, produce force, reduce force, and dynamically stabilize the body's structure in all three planes of motion. To allow for optimal neuromuscular efficiency, individuals must have proper flexibility in all three planes of motion.
- The scientific rationale for flexibility training is illustrated through the concept of pattern overload and the cumulative injury cycle.
- Common types of flexibility exercise include self-myofascial techniques and static, active, and dynamic stretching.
- Self-myofascial rolling is thought to produce both local mechanical and neurophysiological effects on the myofascial tissues.
- Static stretching is the process of passively taking a muscle to the point of tension and holding the stretch for a minimum of 30 seconds.
- Active stretching is the process of using agonists and synergists to dynamically move the joint into a ROM, holding for 1 to 2 seconds and repeating for 5 to 10 repetitions.
- Dynamic stretching uses the force production of a muscle and the body's momentum to take a joint through the full available ROM.
- Fitness professionals should have a comprehensive understanding of controversial stretches, medical precautions, and contraindications to program a safe flexibility program for clients of all fitness levels.

Chapter 15. Cardiorespiratory Fitness Training

- Cardiorespiratory fitness reflects the ability of the cardiovascular and respiratory systems to supply oxygen-rich blood to skeletal muscles during sustained physical activity.
- Cardiorespiratory fitness is one of five components to health-related physical fitness; the others include muscular strength, muscular endurance, flexibility, and body composition.
- Research has confirmed that an individual's cardiorespiratory fitness level is a strong predictor of morbidity and mortality.
- Research demonstrates that cardiorespiratory exercise and physical activity provide many benefits that enhance health, longevity, and weight loss.
- Cardiorespiratory exercise must be individually determined and should use the FITTE-VP principle. FITTE-VP stands for frequency, intensity, type, time, enjoyment, volume, and progression.
- Frequency refers to the number of training sessions in a given time period, usually expressed as per week.
- Moderate-intensity exercise (e.g., brisk walking) should be performed at least five times per week, whereas vigorous-intensity exercise (e.g., jogging or running) should be

performed at least three times per week, or a combination of moderate-intensity and vigorous-intensity is also acceptable.

- Intensity refers to the level of demand that a given activity places on the body.
- Some methods for monitoring cardiorespiratory exercise intensity include calculating $\dot{V}O_2$ max, using percentages of maximal heart rate (HR_{max}), heart rate reserve (HRR), metabolic equivalents (METs), ratings of perceived exertion (RPE), and the talk test.
- Time refers to the length of time engaged in an activity or exercise training session and is typically expressed in minutes.
- Adults should accumulate 2 hours and 30 minutes (150 minutes) of moderate-intensity aerobic activity (i.e., brisk walking) every week or 1 hour and 15 minutes (75 minutes) of vigorous-intensity aerobic activity (i.e., jogging or running) every week, or an equivalent mix of moderate- and vigorous-intensity aerobic activity.
- Type refers to the mode of activity selected, such as cycling, running, or swimming.
- Enjoyment refers to the amount of pleasure derived from engaging in a specific exercise or activity.
- Volume of exercise represents the total amount of work performed in each timeframe, typically 1 week.
- Progression refers to how an exercise program advances.
- Each exercise training session should also include a warm-up phase, conditioning phase, and cool-down phase.
- Stage 1 is designed to help improve cardiorespiratory fitness levels in apparently healthy sedentary clients using a target intensity below ventilatory threshold 1 (VT1) and involves steady-state aerobic exercise.
- A stage 2 workout consists of a mix of recovery intervals just below VT1 (moderate intensity) and work intervals performed at an intensity just above VT1 (challenging to hard intensity).
- Once clients become accustomed to stage 2 intervals and have shown positive signs of adapting to the physical demands, they can begin performing moderately intense steady-state cardio exercise just above VT1, if desired.
- A stage 3 workout includes the client moving in and out of training zones 1, 2, and 3.
- A stage 4 workout involves interval training integrating all four training zones.
- Stage 5 focuses on drills that help improve conditioning using linear, multidirectional, and sport-specific activities performed as conditioning and often combines high-intensity interval training with small-sided games and agility drills.
- Common postural deviations that clients may exhibit while engaging in cardiorespiratory training include round shoulders and forward head, an anterior pelvic tilt, or adducted and internally rotated knees and pronated feet.
- Caution should be made to monitor a client's posture during cardiorespiratory exercise.

Chapter 16 Core Training Concepts

- Core training is critical for improving posture, enhancing performance, increasing injury resistance, and accelerating injury rehabilitation.
- The core is defined by the structures that make up the lumbo-pelvic-hip complex (LPHC) and includes the global and local core musculature.
- Local core muscles generally attach on or near the vertebrae. Local muscles provide dynamic control of the spinal segments, limiting excessive compression, shear, and rotational forces between spinal segments.
- Global core muscles are more superficial on the trunk. Global muscles act to move the trunk, transfer loads between the upper and lower extremities, and provide stability of the spine by stabilizing multiple segments together as functional units.
- When designing a core training program, the local and global muscles should both be trained to develop proper core stability and overall movement efficiency.
- Core strength is imperative for maintaining the natural curvatures of the spine, both at rest and during movement.
- Large curvatures of the spine away from midline are considered abnormal and may be considered either structural or functional scoliosis.
- Core training has been demonstrated to improve injury resistance by contributing to more coordinated motion between the trunk and lower extremities during high-energy, sport-specific activities.
- When developing a core training program, emphasize increasing proprioceptive demand initially instead of increasing the external resistance. Additionally, emphasize quality of movement across the LPHC.
- There are many variables that can be manipulated when designing a core training program, including planes of motion, ranges of motion, speed of motion, volume, and exercise modalities. Be cautious not to change too many variables at one time when progressing an exercise program to ensure that the client is able to demonstrate appropriate mastery at each stage.
- Initially, start with core exercises that involve little motion of the spine and target the local core musculature. Example exercises include (but are not limited to) marching, floor/ball bridge, floor/ball cobra, plank, side plank, dead bug, and Palloff press.
- The next-level core exercise progression incorporates more motion at the spine that also targets global core muscles. Example exercises include (but are not limited to) floor/ball crunch, back extension, reverse crunch, knee-up, and cable rotation, lift, and chop.
- The last core exercise progression involves explosive movement through the trunk and extremities. Example exercises include (but are not limited to) medicine ball chest pass, ball medicine ball pullover throw, front medicine ball oblique throw, side medicine ball

oblique throw, medicine ball soccer throw, medicine ball woodchop throw, and medicine ball overhead throw.

Chapter 17 Balance Training Concepts

- Balance training is a critical component of an exercise program to optimize performance, improve injury resistance, and enhance injury rehabilitation.
- Maintaining balance involves the ability of an individual to control the position of the center of gravity over the base of support.
- Types of balance include static (stationary body position), semi-dynamic (the base supporting the body is in movement), and dynamic (ever-changing base of support) and can be manipulated to change the level of difficulty during a balance training program.
- The balance mechanism involves three key senses:
    - Vision, which is typically used to provide information to the central nervous system about the body's location in space
    - The vestibular senses, which are controlled by sensory receptors in the inner ear and provide the brain information about spatial orientation and the movement of the head in space
    - Somatosensation, which is the ability to feel changes in pressure on the skin, muscle length, and joint angles
- Balance training has been shown to improve performance and reduce injury rates in athletes when incorporated into a comprehensive injury prevention program that is carried throughout the course of an athletic season.
- Strong evidence demonstrates that balance training programs can reduce the risk of falls in healthy older adults.
- Fitness professionals should always emphasize safety when designing a progressive balance training program, especially for clients with a history of injuries or a current injury.
- When developing a balance training program, emphasize a safe and progressive increase in proprioceptive demand based on the client's performance.
- Many variables can be manipulated when designing a balance training program, including planes, range, and speed of motion, as well as the proprioceptive environment. Be cautious not to change too many variables at one time when progressing an exercise program to ensure that the client is able to demonstrate appropriate mastery at each stage.

Chapter 18 Plyometric (Reactive) Training Concepts

- Plyometric training, also known as jump or reactive training, is a form of exercise that

uses explosive movements, such as bounding, jumping, or powerful upper body movements, to develop muscular power.

- Employing plyometric training develops efficient control and production of ground reaction forces, which can be used to project the body with a greater velocity or speed of movement.
- Clients must possess adequate core strength, joint stability, and range of motion and must balance efficiently prior to performing explosive plyometric exercises.
- The integrated performance paradigm states that to move with precision, forces must be loaded (eccentrically), stabilized (isometrically), and then unloaded or accelerated (concentrically).
- The three distinct phases of the stretch-shortening cycle involved in a plyometric exercise include the eccentric or loading phase, the amortization phase or transition phase, and the concentric or unloading phase.
- Plyometric exercises increase rate of force production (power) and motor unit recruitment.
- Plyometric exercises should progress from simple to intermediate to advanced movements and from low intensity to moderate intensity to high intensity.
- Intensity should be prescribed by the client's ability to execute the movement and maintain adequate training technique. If technique is lost, the intensity should drop until proper technique is achieved.
- Plyometric intensity describes the amount of effort or stress applied by the muscles, connective tissue, and joints during plyometric drills and by the distance covered (height of a jump).
- Plyometric volume is expressed as the number of foot contacts, throws, or catches. An example would be the completion of three sets of five squat jumps, equating to a volume of 15.
- A general recommendation is to allow at least 1 day between intense plyometric training sessions. At least 48 to 72 hours between sessions are the recommended guidelines when implementing plyometrics for novice individuals.
- Since plyometric training involves jumping, bounding, and other explosive movements, it is essential to teach proper landing and rebounding mechanics.
- As a general rule, recovery times of 60 to 120 seconds between drills should be sufficient for full recovery, but this is dictated by the client's fitness level.
- When introducing plyometric exercises—especially to new or beginner clients—the movements should initially involve small jumps, and clients should hold the landing position for 3–5 seconds and make any adjustments necessary to correct faulty postures before performing the next jump.
- The next progression is to involve jumps with more amplitude and dynamic motion

performed with a repetitive tempo.

- The last progression includes exercises that are performed as fast and as explosively as possible.

Chapter 19 Speed, Agility, and Quickness Training Concepts

- SAQ training is a useful and effective method of fitness training stimulating muscular, neurological, connective tissue, and even cardiovascular fitness adaptations.
- SAQ exercises can promote improvements in physical performance and sustain youthful movement throughout life.
- SAQ training will allow clients to enhance their ability to accelerate, decelerate, and dynamically stabilize their entire body during high-velocity movements in all planes of motion.
- Speed, the product of stride rate and stride length, refers to the velocity of distance covered divided by time.
- Agility necessitates the ability to start (or accelerate), stop (or decelerate and stabilize), and change direction while maintaining postural control.
- Quickness refers to the ability to react to a stimulus and appropriately change the motion of the body in response to that stimulus.
- Stride rate is the number of strides taken in a given amount of time (or distance).
- Stride length is the distance covered in one stride.
- Proper running mechanics will enable the client to maximize force generation through biomechanical efficiency.
- Components of an SAQ program can significantly improve the physical health profile of apparently healthy, sedentary, nonathletic adults and those with medical or health limitations.
- SAQ programs for youth have been found to decrease the likelihood of athletic injury, increase the likelihood of exercise participation later in life, and improve physical fitness.
- SAQ training for older adults may help prevent age-related decreases in bone density, coordinative ability, and muscular power.
- The high-intensity, short bouts of SAQ drills make them a valid choice for interval training protocols with appropriate nonathletic populations, including weight-loss clients.

Chapter 20 Resistance Training Concepts

- The GAS model outlines three stages of response to stress: alarm reaction, resistance development, and exhaustion.

- The alarm reaction stage, the initial reaction to a stressor, can include fatigue, joint stiffness, or delayed onset muscle soreness.
- The resistance development stage involves numerous physiological changes that ultimately lead to training adaptations that promote increases in performance.
- Prolonged or intolerable amounts of stress lead to the exhaustion stage, which is characterized by stress fractures, muscle strains and ligament sprains, joint pain, and emotional fatigue.
- The principle of specificity, often referred to as the SAID principle, describes the body's responses and adaptations to exercise.
- Mechanical specificity refers to the weight and movements placed on the body.
- Neuromuscular specificity refers to the speed of contraction and exercise selection.
- Metabolic specificity refers to the energy demand placed on the body.
- The main adaptations that occur from resistance training include stabilization, muscular endurance, hypertrophy, strength, and power.
- Stabilization is the body's ability to provide optimal dynamic joint support to maintain correct posture during all movements.
- Muscular endurance is the ability to produce and maintain force production for prolonged periods of time.
- Muscular hypertrophy is the enlargement of skeletal muscle fibers.
- Strength is the ability of the neuromuscular system to produce internal tension, specifically in the muscles and connective tissues that pull on the bones, to overcome an external force.
- Power is the ability of the neuromuscular system to produce the greatest possible force in the shortest possible time.
- Acute variables include repetitions, sets, training intensity, repetition tempo, rest intervals, training volume, training frequency, training duration, exercise selection, and exercise order.
- There are numerous training systems that can be used to structure resistance training programs for a variety of effects. Several of the most common training systems include warm-up set, single set, multiple set, pyramid, superset, complex training, drop set, giant set, rest-pause set, circuit training, peripheral heart action, split routine, vertical loading, and horizontal loading.
- Fitness professionals must safeguard their clients from harm. This requires maintaining a safe environment, ensuring proper equipment set up, using appropriate spotting procedures, and monitoring exercise technique using the five kinetic chain checkpoints.
- Resistance exercises should initially focus on optimizing ideal movement patterns. Once a client displays adequate movement competency, resistance exercises should progress

in a systematic fashion using three steps: (1) stabilization-focused exercises, (2) strength-focused exercises, and (3) power-focused exercises.