

FITNESS FOR HILLWALKING, HIKING AND BACKPACKING

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# HILLFIT



BY CHRIS HIGHCOCK

**Version 2.0**

**STRENGTH!**

THE MISSING ELEMENT IN YOUR TRAINING

# **Fitness for Hillwalking, Hiking and Backpacking**

## **STRENGTH!**

**The missing element in your training**

**Version 2.0: April 2013**

*By  
Chris Highcock*

[www.hillfit.com](http://www.hillfit.com)

## ABOUT THE AUTHOR

Chris Highcock has had a regular fitness column in the leading UK hillwalking and backpacking magazine, [TGO \(The Great Outdoors\)](#). Obsessed by fitness since he started training with weights as a teenager he later gained BAWLA (British Amateur Weightlifting Association) qualifications in weight training. Now he operates a popular blog at [Conditioning Research](#) that highlights current developments in exercise and fitness science. Conditioning Research was chosen as one of [Outside Online Magazine's 'Top 10 Fitness Blogs for 2011'](#).



While his fascination is with fitness, Chris's passion is for the mountains. He spends as much time as he can in the hills around his Scottish home, gradually ticking off Munros and smaller hills. In recent years he has walked in the mountains of Andalusia and the Austrian Alps. Photographs and accounts of walks are posted on the blog "[Cairn in the Mist](#)".

Chris believes that fitness is not an end in itself; training is about maintaining capability. Ultimately it is about facilitating enjoyment! Strength makes everything easier, and when it is easier it all becomes more fun. Being fit lets you get out into the hills more often and lets you enjoy it more when you are there. It also sets you up for a healthy and active life into old age.

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The information provided in this book is for educational purposes only. The author is not a doctor and the material is not meant to be taken as medical advice. The information is based upon the author's experience as well as his interpretation of the current research available. Any advice given is meant for healthy adults only. Readers should consult their doctor to ensure that this advice is appropriate for their individual circumstances, particularly if they have any health issues or pre-existing conditions.

This book is for informational purposes only and the author does not accept any responsibility for any liabilities or damages, real or perceived, resulting from the application of this information.

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## FOREWORD: WHY HILLFIT v2.0?

The first version of this book was released in January 2012 and it has proved to be a popular with hillwalkers and backpackers in the UK and elsewhere around the world. Simplicity was an aim for that first edition: I wanted to get one key theme across to the readers, to enthuse them about a basic but very valuable concept. This is no “hidden secret wisdom” but a profound truth that can transform your performance as a hiker: getting stronger helps and getting stronger is not complicated. Version 1.0 was not a heavily referenced textbook, although there were resources listed at the end for those that wanted to dig more deeply. Rather it aimed to convince the reader of the value of getting a little stronger and then to explain how to do it. I kept the language simple and the approach straightforward.

As the book began to sell I started to receive feedback on the ideas and method it outlined. There were questions seeking clarification of some points and comments on how things were explained. Through my own reading and study, my basic position continued to evolve. Re-reading the booklet I also identified areas where I could improve what had been presented, making my message more useful. The key theme remains the same, but as I came to revisit the text I found that there were things that could be expressed more clearly.

I was also aware of other ideas that I wanted to include that would add to the value of the book. However I knew that I was not the best person to write about all of these areas. As a result, this version includes some contributions from a few other writers who have offered short sections on topics such as developing balance, improving walking gait and maintaining mobility.

I hope to go on learning and sharing that knowledge. Hillfit will continue to develop. I learn from my own training, from the wisdom of others and from the comments of those that have read this book and started to apply its ideas. There is a [Facebook group](#) where some of these ideas are discussed and if you ever want to ask any questions about anything in these pages, either use that forum or simply email me at [chris@hillfit.com](mailto:chris@hillfit.com)

**Chris Highcock**

Edinburgh, Scotland April 2013

## INTRODUCTION: SUNRISE

Under my feet the earth crunches with each step, crisp frozen soil noisy beneath my shoes. It was dark when I left the car at the bottom of the hill, but light is coming intermittently now as the moon reveals herself from behind swift moving clouds and then hides again. I follow a familiar route past trees and through a gate and then up steeper ground to meet a path that slopes down from the ridge above. Each pace takes me higher and I become aware of the light starting to creep into the sky from behind me to the east. There is no sun yet but its arrival is certain, heralded by radiance that gilds the bottom of the cloud with a warm golden flame.

Emerging onto the ridge I scare a couple of grouse who in return startle me as they cry *go-back, go-back* and flap off untidily in search of another hiding place. The view is now open and I can see the ridge before me pulling my eyes to the west, another line of hills to my left, lined up diagonally to the southwest, peak after peak. My destination ahead is caked in frost, perhaps it is light snow? The crescent moon unmasked now sits above the summit while the sky around it turns violet then pink somehow taking colour from a rising sun that is still below the horizon. As I make towards that peak, the frost I walk on loses its cold grey palour and begins to glow orange. It surprises me every time and always takes my breath away.



I turn to my left, and the sliver of sun tiny at first but moving surprisingly fast seeps from the hills of East Lothian and launches itself on a new day. In this moment I am refreshed. Things are placed in perspective. Up here I am literally above my problems and worries. That is why I come to the mountains and spend time outdoors.

## ***DISTRACTION***

Now my breath is taken away by the experience: the views and the wildlife....the wind and the beauty. But it was not always so. There was a time when I did not enjoy those things so much because my breath had been taken away by the effort of the climb, burning muscles and sweat dripping into my eyes absorbed my attention. When each step is a battle the joy of the hills is limited. You are distracted by the effort, the difficulty of the journey.

## ***HILLFIT – EASIER, SAFER AND MORE FUN***

This is not your average fitness book. I am not pulling this together so that you can fit into your new dress, lose the pounds you put on at Christmas or “look good naked”. That might happen as a result, but I have more subtle aim: I want you to *enjoy* yourself more in the outdoors! I want to remove some distractions – your breathlessness and your wobbly legs.

## ***THE HILLFIT MANIFESTO***

The aim is to get more fun from your time in the outdoors; you enjoy it more when it feels easier. Getting stronger is the most important thing you can do for your fitness as a hillwalker (I will from here on it use this British term for a hiker or backpacker). It will keep you safer, make each step more fun and transform your experience in the wilderness. Being Hillfit removes the distractions.

Hillfit explains why strength is so fundamental then shows you how to get stronger with a set of exercises that are simple and safe.

- **Simple** – There is no need for a gym or any equipment. The exercises are easy to learn, gross body movements.
- **Safe** – movements are selected to minimise risk. The last thing you want is for your training to injure you.

Hillfit is focused on letting you *enjoy* the outdoors not preoccupied with your effort of it all. Maybe you are now where I have been. You love the space, the views and the fresh air but, to be honest, climbing those hills is a struggle sometimes. You



watch your companions easily pull up the steepest slopes barely breathing hard while you are panting and your muscles burning. You start to ask how it could feel easier?

## ***FITNESS – THE MOST IMPORTANT PIECE OF GEAR***

Of course the marketing tempts you: maybe you need new boots or a lighter jacket. Perhaps a new rucksack will make all the difference. So often we are told that the solution to our problems is to buy something. There is a huge industry out there offering all sorts of gear each item holding out the promise of an improved experience in the outdoors. Better clothing and lighter gear will help, of course but I get tired of the way that “kit” dominates the outdoor magazines and blogs, as if what you really need is another tent or pair of trousers to transform your time outside. So often the “secret” is presented as something material – buy this gear and you will have a better time in the mountains!

Maybe it is not outdoor gear you need but better skills? Could it be that you need to improve your navigation skills or map reading? Perhaps you need to learn better techniques for lightweight camping.

Better skills and good gear can help, indeed they may both save your life in certain circumstances. But deep down you know that it is simpler .... and cheaper! If it is ever going to *feel* easier, if you are going to be distracted by the views and not by your struggle to keep going then you need to get better at walking: stronger, fitter and more skilled at putting one foot in front of the other. You need to get Hillfit!

Fitness is something that every walker, hiker and backpacker needs. It weighs nothing but will make your pack lighter. Equipped with it, your trips to the hills will be safer; each walk will be easier and more fun. It is more valuable and versatile than the latest waterproof shell and a lot more satisfying to possess. This is the dirty little secret.....dropping £200 on a new jacket will not make the climb any easier. A week's skill training will not stop your thighs from burning as your heart and lungs fight to get fuel to your muscles.

It might not be “sexy” or fashionable. There is not an industry of marketing men selling this. All I am offering is a way to improve your fitness for the hills. More than that: I am passionate about the neglected element of hill-fitness: **strength**.

## **HILLFIT: STRENGTH**

Again, I want you to have fun. When you are stronger walking will not take as much energy: you can get further and go for longer without your legs getting tired. Because each step will take less effort you will not get out of breath so soon, so you can chat with your pals as you walk. You will feel fresh hours into the walk. Being Hillfit makes walking fun again! It is safer too, you will be more resilient, less likely to stumble and will have the energy to deal with any problems if they arise. Your lack of fitness will no longer be a distraction from the beauty of the wilderness. Thankfully, useful strength is not hard to develop: it takes application and effort, but week by week you will improve.

## **OUTLINE OF THE BOOK**

The book is split into four parts.

**Part 1: Why Get Stronger?** - explores why as a hillwalker you should spend time getting stronger. I will look at how strength will improve your experience as a walker, making each step easier, more efficient, less draining and safer. Beyond that we will consider some of the many health benefits that flow from strength training.

**Part 2: How to get stronger** – is the meat of the book. It explains something of the processes that cause muscles to get stronger and presents a way of applying those principles to a simple set of exercises. The exercises are simple to learn, don not require great skills to perform and are focused on safety. We pay great attention to how the moves are to be performed with progression as you get stronger. The basic routine is designed to be performed at home with no special equipment, but there are options to apply if you have a cheap set of adjustable dumbbells or access to a gym with some basic machines.

**Part 3: How to apply that strength as a walker** – getting stronger is one thing, but you also need to apply that strength to the skill of walking. This section looks at how to walk. It sounds like something fundamental, but with a little attention your gait can become more efficient so that each step is easier and takes less energy. When each step is easier you can go for further. Walking more often will itself make you a

more skilled walker, but how you walk is also important. We will think also about balance and how the brain maps your body in space to move efficiently.

**Part 4: Beyond strength** – fitness in terms of your capability for walking is not just about your muscles or your heart and lungs. You need to pay attention to other considerations such as sleep and maintaining a suitable range of motion in your joints, not through stretching but general mobility work. We are all getting older too and need to think about the skills that will keep us walking and functioning into old age.

**Part 5: Putting it all together** – pulls these various threads together and presents a way of weaving these ideas into your daily life: sleep, mobility, regular walking, balance work and strength training.

## **THE SCIENCE AND REFERENCES**

I am not an exercise scientist, but I do try to keep up with the research and maintain a layman's understanding of the physiology of what is going on in the body as we exercise. This book is not sprinkled with references throughout the text. Firstly, that can interrupt the flow of the argument and above all I want to keep this readable. But that approach can also be misleading: lots of references might look authoritative but can just be posturing by the author. Most of what I write here can be found in any basic exercise science textbook, or on wikipedia. I have listed some references where I cite particular quotes and at the end I have provided links to a few books where you might want to look further. **My first job is to enthuse you, then to point you to where you can educate yourself further.**

## **NO GURU, NO METHOD, NO TEACHER**

Van Morrison has a song *No Guru, No Method, No Teacher*. So often we are looking for a guru who will bring us some secret knowledge. This is true in lots of areas of life but especially in health and fitness. We want the special new method that will give us great strength, chiselled abs and superhuman endurance. So we buy the new book, follow the fad diet or do the special exercise.

I am not here to be your guru. If there is one secret that I offer it is consistency. The approach presented here is simple and straightforward and will work. However it

requires application, consistency and patience. In January each year the gyms become full of new members, the slimming clubs booked full of recruits and the pavements throng with runners. Those who succeed in their goals of weight loss or fitness are not the ones with the best genetics, the greatest talent or the newest gear. The ones who will get to their targets are those who are still in the gym, still running, still at class six months from now or 12 months from now.

Achieving improved strength and fitness is not going to come from a magical new scientific training method – although evidence will guide us to better ways of training – success will come from persistence. Make the ideas in this book a habit and be patient.

## ***WHO IS THIS FOR?***

As we turn from these introductory remarks to the Part 1, I want to think for a moment of you the reader.

## ***A PROGRAMME FOR EVERYONE***

This is not a training programme for the elite hill-runner or those looking to get their marathon time under 3 hours, although all athletes will benefit from strength training. Such athletes, due to their genetic makeup as much as their training, are already far beyond the average. We are those who inhabit the middle of the bell curve, not the far edge! The focus of this book is on getting the typical man or woman more prepared for their days in the hills, within the constraints of limited spare time and competing priorities. If you enjoy time walking in the outdoors and want to enjoy it more, tackling those days with less pain and effort to distract you from the views, then the programme I outline is for you.

## ***A FOCUS ON ENJOYMENT***

The aim is to make your time in the hills more fun. It is more fun when it feels easier; it is easier when you are able to walk with less effort; it is less effort when you are stronger. Strength means that the climbs do not leave you as breathless or with muscles burning with excess lactic acid. Properly designed and executed exercise is the method we will use to achieve that cascade of effects. This will also

bring broader health benefits, but the focus is to make it easier for you to enjoy time in the outdoors. Look on the health benefits as free bonus gifts!

## **MINIMAL AND LIGHTWEIGHT**

The programme is time-efficient and requires no special equipment. You can complete this routine at home and reap great benefits for your health and fitness. The only investment you need to make is a little time.

Like the best modern backpacking equipment, my approach is basic, functional and “lightweight”. It is minimal, not because that is fashionable in this time of ultra-light backpacking, but because effective exercise is simple and does not need much time or complexity. We apply the best technology to get the maximum effect from the minimum effort. Training is to prepare us for our walking, it is not an end in itself. So, our concern is to ***train as much as necessary, not as much as possible***: we want to be rested and ready for the hills at the weekend!

### **CHAPTER SUMMARY**

*Hillfit is focused on letting you enjoy the outdoors not distracted by the effort of it all. This comes not from gear or skill but from fitness and fitness is built on strength.*

### **HIKING: ADVENTURE FOR YOUR BODY AND MIND**

By Tim Anderson

*When is the last time you went hiking? When is the last time you took a stroll in the countryside, or even the "urban" side? I'm not talking about taking a walk here. I am talking about hiking - navigating terrain that has awkward, uneven steps, terrain that challenges the brain as it tries to determine where to place the next step, terrain that requires the body to use strength, grace, coordination and prediction. Yes, prediction. The brain sometimes has to "guess" where you should move and place your next step on the fly, where you should place your hands for more stability, whether or not you should step, skip, or leap to that next rock.*

Hiking is so much more than a mindless walk. It is brain and body candy. It feeds the

mind and body at the same time. It gets you outside, it gets you engaged, it gets you moving and it opens the door for some "adventure."

You were made to hike. You were made to climb mountains and descend valleys. From the time you were an infant, your body started growing and developing through the movement patterns that would strengthen you and prepare you to be able to take long, joyful, challenging hikes across any breath-taking landscape. Through exploring your world as a child, you tied your body together through cross-lateral movements like rolling, crawling, skipping, climbing, walking and running. You became amazingly strong and resilient through the playful exploration of movement.

For many of us as adults, we have gotten away from exploring our world through movement. Instead of spending most of our days engaging in the cross-lateral movements that built us up so well, we spend most of our days stationary as static objects. As a result, we are, in a sense, allowing ourselves to unravel. We have fallen too far away from our intended design and as a consequence, we have become weak, frail, and injury prone.

**We need to regain our strength and rebuild the bodies we were meant to have.** All we have to do is pay attention to how children approach life, and then do what they do. Children do two things extremely well as they are growing and developing: they engage in cross-lateral movement patterns frequently every single day, and they play, in some fashion, every single day. We need to follow their example because the very same patterns and movements that once tied us together as a child can still work to tie us together as adults. Through learning how to play again and engaging in our foundational movement patterns and reflexes, we can "tie" ourselves back together again. In other words, we can effectively press the "reset button" on our bodies and regain the strength we once had. All we have to do is become like a child, again.

Perhaps one of the best resets, or cross-lateral patterns, you can engage in when setting out to become strong again is the **simple baby crawl**. The baby crawl is the foundation for our gait pattern, or our "hiking pattern". Crawling like a child offers tremendous benefits. It can help restore your posture, it gets your shoulders and hips working together, and it rebuilds and encourages reflexive strength throughout the entire body. Crawling literally ties the body together and lays a solid foundation for strength. Not only that, but crawling, because it is a cross-lateral pattern, stimulates new neural connections between the left and right hemispheres of the

brain, thus improving communication between the two hemispheres. The better your brain communicates, the better you move!

Spending just a few minutes practicing the baby crawl each day can help rebuild a strong, resilient body capable of climbing any hillside. **When you practice crawling, keep your head up so you can see where you are going, keep a big chest, and make sure your opposite limbs are moving together.** That is all you have to do. This may seem like a silly idea at first, but try it for month or so and see for yourself if you do not feel stronger and more capable when you go hiking, or when you perform any everyday task.

The other thing that children do so well to build really strong, healthy bodies is play. They engage in play almost every single day. Children are masters at intuitively knowing how to play. For a child, every act of exploration is an act of play. They explore their environment and master new movements through joyful curiosity. They delight in conquering new challenges, and expanding into new territories while they earn new strength through learning how to move. To a child, play, exploration, movement, and strength go hand in hand. To an adult, playing can be a great "reset" that not only combines exploration, movement and strength, but playing can also relieve stress and soothe the soul.

**This is where hiking comes in! Hiking can be a wonderful form of play for the adult. It allows us to use and move our bodies while we are discovering beautiful landscapes and conquering challenging terrains. In other words, hiking is a great recreational activity that engages both the body and the mind. Hiking is a doorway to adventure.**

And that is what play is; play is adventure - something we need more of in our lives. We simply need to play more. The joy it brings keeps us young and healthy on the inside, and the strength it builds keeps us young and healthy on the outside.

Again, the very things a child does to build amazing strength can also work for us as adults. We, too, should deliberately engage in cross-lateral patterns like crawling, or even walking, every day and we should learn how to play and explore our world as we once did when we were children. If we would just do these two things, we could regain our health, our strength, and our resiliency. There would be no countryside that we could not conquer.

*Tim Anderson is the co-author of [Becoming Bulletproof](#): An Uncommon Approach to Building a Resilient Body and the author of **Pressing Reset** and **Fitness Habits Made***

***Easy.** He's been a personal trainer for 14 years and can be found via his **Live is Movement** website at [tasfitness.blogspot.com](http://tasfitness.blogspot.com) Tim's lecture on crawling can be found at [Movement Lectures](#)*



## PART 1 WHY GET STRONGER



### ***WHY THE HILLWALKER NEEDS STRENGTH***

So fitness is more important than gear or skills, releasing you to enjoy the hills more. What comes to mind when you picture a fit, well-conditioned hill walker? You might think of agility, flexibility or maybe stamina. “Strength” is probably not on your list. People associate strength with weightlifters or bodybuilders, but not with those who perform well in the mountains.

Consequently, folk too often shy away from strength training, thinking that it means “bodybuilding” sessions in a gym. When they decide to train and get fit for a hill-walking holiday, a jog round the block is the usual solution or worse still maybe boring hours on a treadmill or stationary bike. For years we have been told about the benefits of “cardio” training, developing endurance through enduring hours of exercise. Thankfully there is another way that can deliver what we need, which is strength and the benefits that will come with it. And, as we will see, strength training will also bring endurance with it. Indeed some scientists even doubt whether there is such a thing as “cardio”.

So why is strength so important? I am going to answer that question in two parts. Firstly we will look at how getting stronger will make you a better walker. Then we will discuss the range of health benefits that proper strength training can produce.

## GETTING STRONGER WILL MAKE YOU A BETTER WALKER

Remember, I want you to enjoy your time in the outdoors. Getting stronger will make you a better walker and will enhance your fun in a number of ways.

### THE GLASS

The strength coach, Dan John, uses a nice example: your absolute strength is like a drinking glass. Whatever you want to achieve in terms of physical performance, endurance, flexibility, resilience, has to fit into your glass. If you have a small glass, i.e. little absolute strength, you will not fit much in there. If you have a big glass, you will be able to fit a lot more inside. No matter what your fitness goal, being stronger will help you get there faster. As Dan John says in his DVD [Intervention](#):

*“...if I can get you stronger, it’s going to be easier long term... not only to get your goals, but to maintain your goals over a long time. The bigger we can make your glass, the easier it is for you to attain and maintain your goals... the bigger your glass, the easier it is going to be.”*

That sounds like nice rhetoric, but what does it really mean? Why is strength so important, not only for walking in the hills, but for everyday life?

## STRONGER MUSCLES PROTECT YOU FROM INJURY

This may sound like a strange place to start, but I do not want to start with how strength training makes you perform better. When you are injured, performance goes out of the window. With strains, breaks, sprains, tears or ruptures your hillwalking will stop! As I have got older my focus more and more has been to avoid injury because when I am injured activity is over. My biggest concern is to avoid hurting myself!

This has an application to the sort of exercises that we will look at later, they need to be as risk free as possible, but is also a major motivation for strength training: **stronger muscles, bones and connective tissues are more resilient and therefore less prone to injury.** Many of these benefits flow from the general health benefits of strength training that we will look at later, but include:

- This strengthened structure, particularly the muscles, acts as the body's major shock-absorber to protect you from the trauma of impact, whether as a result of a fall, or the repeated minor insults of every step that you take when you are in the mountains.
- Strong muscles also enable you to maintain good posture, as we will see below, which itself prevents injury by directing the force of your movements through the most appropriate structures and tissues. This avoids excess wear-and-tear on your bones, tendons and ligaments. Colin Gordon of [Edinburgh Deep Tissue Massage](#) said in a [blog post](#) : *"Lack of strength is a major contributing factor to the problems I see in many clients. Lack of strength makes it difficult to maintain good posture, you tire more quickly, resulting in compensatory movements that put strain on other areas and increase the likelihood of injury; a stronger athlete is more injury-resistant."*
- Strength training will help you correct structural imbalances that increase injury risk and lead to improper motor patterns. For example, the non-dominant side of the body is often weaker, which will throw your stride off. Strengthening all the muscles can address this problem. Many walking injuries, especially knee and hip-related issues, are the result of such muscle imbalances or weaknesses. Strength training improves structural balance and can help prevent injury and chronic pain.
- As we discuss below, resistance training is beneficial for increasing bone strength, and muscular strength also appears to be positively related to bone mineral content and bone strength. As lower-body strength levels increase, the incidence of stress fracture is reduced.
- A reduction in muscle strength as we age not only results in a loss of functional ability, but also increases the risk for falls and fractures. Maintaining strength as you age will not only keep you walking, but will make that walking safer.
- **Strength training teaches you how to move well.** It teaches you how your body works mechanically and how it moves. Thinking about the ways you move in an exercise will teach you how to move more efficiently and safely in other activities, including walking. Certain exercises that I do in the gym have made me think about how my legs, hips and back work together when I am walking for climbing a steep slope, so that I use better and safer positioning.

Building muscle and strength is one of the best ways that you can make yourself more resilient and injury resistant as a hillwalker. With a more robust frame, balance muscles and correct posture you will be less prone to inappropriate wear and tear and less likely to fall. When you do fall strength training will give you muscle to absorb the impact and stronger bones that are less prone to break. Injuries will always happen – I have broken a toe on the mountain by accidentally kicking a rock – but a proper strength training approach should make injury less likely and less severe.

### ***STRONGER MUSCLES ARE MORE EFFICIENT – EACH STEP TAKES LESS ENERGY, LESS FUEL***

But of course there are performance benefits that you will get as a walker from strength training. At a very basic level, it is easier for stronger muscles to do the same tasks. Greater strength means less effort will be required to do anything, from lifting a weight to walking up a hill.

Simplifying things, imagine that you have 20 “units of strength” per muscle fibre, while your weaker friend only has 10 units. If it takes 2,000 units to climb a hill, your cardiovascular system will only have to support the work of 100 fibres (2000 divided by 20) to get you to the top, whereas your pal will need to recruit and fuel 200 fibres (2000 divided by 10). You get to the top feeling fine but he is out of breath because his cardiovascular system had to provide oxygen to power twice as many muscle fibres. When you are stronger, your heart and lungs do not need to toil as hard to support the same amount of muscle-work. *Stronger muscles make everything easier. This is what making your glass bigger means:* everything gets easier and you can go further. What does this mean in specifics though? How does strength translate to efficiency?

### ***STRONGER MUSCLES IMPROVE POSTURE.***

Strengthening the muscles will help to improve and maintain your posture as you walk. An efficient walking gait will translate into greater walking efficiency. Each step will take less effort. Weaker muscles are simply not as efficient at moving the body through space and several studies have found muscle *weakness* to be a key factor in making walking require more energy.

The human body is not just a stack of bones, it is a complex structure held in position by various muscles in balance keeping tension on the structure to hold it in position. Like the pole on a tent being held in position by taut guy ropes, your posture relies on “*tensegrity*” – the interrelation of a while web of muscles from your head to your toes, maintaining tension and keeping you upright. Weaker muscles simply can’t maintain this appropriate tension and the posture collapses, you slump forward and suddenly stress, wear and tear is directed where it was never designed to go.

### ***STRONGER MUSCLES HAVE MORE ENDURANCE.***

We may think of strength as being independent of endurance, but endurance is built on strength. Endurance is important in the mountains – you want to be able to keep going for hour after hour, mile after mile. When you are stronger you can keep going for longer. Strength training helps your body deal with the stresses of walking. Your muscles will be able to perform for longer before getting fatigued, which will help you maintain a good posture and gait that will itself help to prevent injury. Improving the strength of the muscles that are needed for walking will increase your endurance.

### ***STRONGER MUSCLES MEAN BETTER BALANCE***

Balance is a fascinating topic and an under-appreciated sense. To keep your centre of gravity balanced over your base of support, your brain brings together information from three different systems:

- The **visual** system – you see the position of your body in relation to your surroundings;
- The **vestibular** system – your inner ear detects movement in different planes; and
- The **proprioceptive** system – sensors in your muscles and ligaments (“proprioceptors”) plot the position of your body in space.

If the brain senses that you are overbalancing, corrective action is taken: muscles unconsciously contract or relax until balance is restored. Often balance deteriorates with age, resulting in falls and injury, partly due to weakness in the muscles. If the

muscles are too weak to maintain the appropriate position of the body then balance will always be poor.

Balance is vital to walking in the outdoors where you will be on uneven and unstable terrain. We will look later at how your brain maps your position and how that can be developed. There are specific and simple exercises that you can do to strengthen the proprioceptive system: the most basic of these is simply to spend time each day stood on one leg; e.g. I recommend that everyone brushes their teeth while balanced on one leg and to build this simple habit into your daily routine. More fundamental though is the truth that **strengthening the muscles to allow them to maintain your balance and keep you upright is the real key.**

## ***STRONGER MUSCLES PUT LESS STRAIN ON YOUR CARDIOVASCULAR SYSTEM SO YOU WON'T GET OUT OF BREATH SO FAST***

We can talk about balance, posture or endurance but for most of us, being “hillfit” is more basic: we want to walk uphill without getting “out of breath”. How about a bit of context: what is happening when you get out of breath?

Metabolism, the various chemical reactions that keep your body alive and moving, is very complicated. It might help to think of a hybrid car that can run on different fuels, electricity or petrol, depending on what is available and how hard the engine is working. Similarly, we have alternative fuel systems for our cells: fat or a form of sugar called glycogen. Both go through a series of reactions to produce “ATP” molecules – the body’s ultimate energy source.

Fat stores are in effect unlimited; there are enough molecules of fat, even in the leanest athlete, to keep them going for hundreds of miles. However burning fat is a slow process that needs lots of oxygen: this is the aerobic fuel system. Burning sugar uses a different process. It is an immediate fuel and is processed quickly but stores are limited. It burns without oxygen, so is called anaerobic. However it also burns “dirty” and produces lactic acid in the muscles, making them sore and less efficient.

When you get out of breath you are working too hard for the aerobic system to cope: it requires more oxygen to keep burning fat than you're able to supply, so you switch to the anaerobic sugar-burning system. Unfortunately that fuel will soon run out and in any event produces lactic acid. We want to train so that we can work harder without our metabolism running out of oxygen and being forced to swap from burning fat to sugar. That is where strength comes in. Strength training causes changes in muscles, metabolism, the heart and the blood vessels that make you more efficient at using fuel and oxygen.

The cardiovascular system consists of the heart, lungs and blood vessels. Its primary function is to transport those fuels to the muscles and to remove the waste products that are produced. The system works 24 hours a day, (otherwise you are dead!), performs harder when you are jogging or walking up hill and functions *intensely* with strength training. When each muscle is stronger you will need fewer fibres for any given task. Since you will need to fuel fewer fibres, the heart and blood vessels have to do less work to get those fuels to the muscles. When you are stronger you will be able to keep using your aerobic system even at higher intensities and speeds. You will be able to go harder before you run out of breath.

Strength training also has effects within each muscle cell, causing new and better "mitochondria" to develop in the cell. These are the "power plants" of the muscle where the fuel is burned. The more of these that you have in your cells, the more oxygen you can take in to burn fat. The more oxygen you can process like this, the less out of breath you will get.

Of course, this is something of a simplification – your body has different ways of burning fuel for energy and you will never be exclusively burning fat or sugar, as is presented in the next section. The principle is clear though, weaker muscles take your breath away faster!

### ***BUT DON'T I NEED "CARDIO" TRAINING?***

All this talk of strength training? What about the more usual jogging or cycling for 45 minutes. All your mates are doing "cardio"! I asked James Steele II, an exercise scientist from Southampton Solent University. He told me that there is no such thing as "cardio"!



## THERE'S NO SUCH THING AS CARDIO

By [James Steele II](#)

There's no such thing as 'Cardio.' You heard it right, **'Cardio' doesn't exist**. Well, let me explain and clarify that statement more specifically. When people think of exercise as being 'Cardio' they generally think of exercise that will improve their aerobic or cardiovascular fitness. To exercise physiologists cardiovascular fitness can be measured in many ways; the maximum amount of oxygen that the body can uptake, transport and utilise during exercise (VO<sub>2</sub> Max), the amount oxygen or energy required to perform a particular exercise at a given absolute workload (Economy of Movement) with a lower oxygen or energy requirement being more economical, or the threshold ability of the body to remove metabolic by-products such as lactate during exercise through various mechanisms (TLac). Therefore it's appropriate to think of exercise as being 'Cardio' if it improves any of these things being that they represent cardiovascular fitness.

### WHAT DO WE MEAN BY CARDIO?

For most people however 'Cardio' has been repeatedly espoused as being of a particular style (long, slow, distance exercise) and of particular modalities (running, cycling, rowing etc.). There is an apparent dichotomy presented by the fitness industry regarding strength or resistance training (RT) and what is colloquially termed 'Cardio.' However, if instead we step back and think of what we are trying to achieve with 'Cardio' (improving our cardiovascular fitness) the dichotomy begins to fall apart. What I intend to explain is that 'Cardio' isn't the only thing that can improve cardiovascular fitness. That fact kind of makes the term redundant; hence there's no such thing as 'Cardio.'

A number of studies in recent years have begun to question one side of the 'Cardio' dogma; that it needs to be long, slow and of great distance. These studies have begun to show that performing high intensity interval exercise that takes a fraction of the time but uses a very high intensity of workload, thus requiring a very high intensity of effort, produces similar adaptations to exercise that uses a lower intensity of workload for a longer period of time. These findings are what led me to question the other side of the dogma; whether modality was important in and of itself.



RT can also be manipulated to affect the relative degree of intensity required during training. Importantly however, as long as repetitions are performed to the point of momentary muscular failure (MMF; i.e. when despite your greatest effort, and without deviation from proper technique, you can no longer move or resist the load being used) effort is maximal regardless of the load used, whether a barbell, dumbbell, resistance machine, or your bodyweight. In the past there have been scientific reviews published on whether RT can improve cardiovascular fitness, but none of them considered this potentially important factor. A further look at the scientific studies, isolating the ones that had their participants train to MMF and thus a maximal intensity of effort, shows that the variables such as VO<sub>2</sub> max and economy of movement, that represent cardiovascular fitness, are consistently and significantly improved. A small number of studies comparing RT performed to MMF with traditional 'Cardio' exercise also show that the two do not produce significantly different results. This occurs whether the participants rushed between exercises in a circuit style fashion with little rest, or whether a more traditional RT programme involving short rests between exercises was used.

### **RESISTANCE TRAINING IMPROVES CARDIOVASCULAR FITNESS**

An important factor to be taken from this is that properly conducted RT utilising a high intensity of effort can clearly produce significant improvement in cardiovascular fitness. The apparent dichotomy between RT and 'Cardio' thus appears to be false. This is a liberating finding for many as RT could be considered a far more efficient method of training requiring less time to perform, being generally safer, and providing a host of other benefits not the least being improved strength. Performing the exercises outlined in *Hillfit* by Chris in the style suggested will give you exactly what you need to improve your cardiovascular fitness in preparation for getting out into nature and doing the walking that you love. It's important though to realise also that although RT can improve your cardiovascular fitness, further benefit to the specific activity you participate in regularly comes from doing exactly that....walking.

Now many people at this point venture the question of exactly 'how' on earth RT can possibly improve cardiovascular fitness. This is something that I've attempted to look into also and so I'll offer a summary here of some of the acute things that happen physiologically when you perform RT to MMF and what chronic physiological adaptations happen to actually translate into improved cardiovascular fitness.

A high oxygen cost during exercise is thought important for producing cardiovascular adaptations. Most previous studies have suggested that RT results in very low oxygen costs, but again they have not been controlled properly for intensity of effort. In general the oxygen cost during exercise depends on the size and how well trained the active musculature are. As we'll see however the adaptations at the specific musculature are potentially more important and so oxygen cost relative to whole body  $\text{VO}_2$  max is not very useful for determining the effectiveness of an exercise, RT or otherwise. What is seen however is that as intensity of effort increases throughout the exercise the oxygen cost increases. Also the oxygen cost of RT to MMF is higher than if you stop short of failure.

### **STRENGTH TRAINING STIMULATES THE ANAEROBIC AND AEROBIC METABOLIC PATHWAYS**

Metabolically there is a reason for why this is the case. In a similar vein to how there is a false dichotomy with reference to RT and 'Cardio' there is a similar one in the differentiation between aerobic and anaerobic metabolism. The two are not distinct but are intrinsically linked such that although the relative production of energy from the two linked pathways change in proportion as exercise workload and effort increases, the two cycle maximally when exercise is performed with a max intensity of effort. The end product of anaerobic glycolysis is something called pyruvate. This is transported into the mitochondria by an enzyme called pyruvate dehydrogenase to be used for energy production in the presence of oxygen called aerobic glycolysis. The enzyme however is what physiologists call 'rate-limiting' meaning that its maximal rate of action is limited in normal circumstances. As this maximal rate is neared pyruvate begins to build up outside the mitochondria of the cell as its production through anaerobic glycolysis exceeds its utilisation and needs to be removed. Another enzyme called lactate dehydrogenase acts to convert pyruvate and hydrogen to lactate for either use or removal. Studies have shown that oxygen use by the active muscle during maximal effort RT is maximal and likely determined by the rate-limiting nature of pyruvate dehydrogenase. Lactate also significantly increases from RT to MMF. Thus both anaerobic and aerobic metabolic pathways are stimulated significantly potentially explaining why improvements in cardiovascular fitness are seen.

Molecular signalling pathways that are activated during RT to MMF may also be responsible for the improvements in cardiovascular fitness that occur. Again there is typically a dichotomy presented between the pathways that are thought to improve cardiovascular fitness (adenosine monophosphate protein kinase; AMPK) and the pathways thought to increase strength and hypertrophy (mammalian target of rapamycin; mTOR). This is because the two appear to be mutually exclusive; in fact AMPK inhibits mTOR activation. However, further research has shown that both pathways are in fact activated through RT that involves a very high intensity of effort, yet at different times. AMPK responds to changes in cellular energy status and so immediately after RT to MMF when energy has decreased it is activated. However, after a while this activation drops, no longer inhibits mTOR, and allows it to transiently activate. Thus these two pathways thought to predominantly control both cardiovascular and strength adaptations are both activated as a result of RT to MMF and may be responsible for improved cardiovascular fitness.

### **STRENGTH TRAINING WORKS THE CARDIOVASCULAR SYSTEM**

Finally there are acute responses that occur in the heart (myocardium) and the circulatory system (vasculature) during RT to MMF. Adaptation in the myocardium is thought to occur from exercise and be part of the explanation in improved cardiovascular fitness. However, the actual stress that the heart undergoes during RT to MMF appears insignificant. It is true that peripheral blood pressure rises significantly during RT, but this pressure is partly explained by increases in intrathoracic pressure. The heart itself does not experience much change in pressure and in fact studies show that its function improves during RT and this is thought partly to be due to enhanced return of blood from the peripheral musculature to the heart. The improved venous return of blood occurs due to the active muscular contraction 'pumping' the blood more efficiently back to the heart, which improves coronary blood flow, perfusion and myocardial function. Although there may not be much stimulus to the heart directly there can be adaptation in the local blood supply to the active muscles. There is currently lack of research offering strong evidence for what might result in local vascular adaptations to increase local blood supply and oxygen delivery. However, as RT intensity of effort increases so too does bloodflow which increases the stress the vasculature experiences. This increase may have some effect on production of nitric oxide, which is a potent vasodilator allowing improved oxygen delivery.

All of these acute effects that occur during RT to MMF may go some way to explaining why we see improvements in cardiovascular fitness measures as a result of performing a training program of RT to MMF. Certainly much happens that could stimulate the improvement. But the cardiovascular fitness measures are really sort of surrogate markers that provide information about the complex concerted physiology that contributes towards cardiovascular fitness. What is really interesting is to know what physiological adaptations and changes are happening as a chronic result of performing RT to MMF.

### **STRENGTH TRAINING BUILDS BETTER MITOCHONDRIA**

The mitochondria are the oxygen using powerhouses of our cells. They produce energy through the utilisation of oxygen and thus improvements in their ability to do so and increases in their number would be a likely culprit for explaining improved cardiovascular fitness. In fact there are a plethora of studies showing exactly this result from RT performed to a high intensity of effort. In fact one study has shown greater increases in both mitochondrial enzyme activity and mitochondrial number as a result of RT compared to traditional 'Cardio.' The improvements in mitochondria may be a result of RT actually causing changes in muscle fibre type. Muscle fibres can be very broadly categorised into slow (type I) which are predominantly oxidative and very fatigue resistance, fast oxidative (type IIa) which are also oxidative and fatigue resistance, and fast fatiguing (type IIx) which as the name suggests fatigue quickly. As the intensity of effort involved in an exercise increases so too does the activation of these muscle fibres in a sequential fashion. When MMF is reached all available fibres should have been activated with the last ones being the type IIx fibres. What studies have shown is that the number of type IIx fibres decreases and type IIa fibres increases (and in one study type I fibres also) after a period of RT to MMF. Gene expression of the two follow suit also. This appears to in part be due to the activation of AMPK from RT to MMF. Type IIx fibres have the greatest activation of AMPK probably because of their fatigability. This activation stimulates mitochondrial biogenesis, which increases mitochondria and their enzymes. This seems to cause type IIx fibres to actually change into more fatigue resistance type IIa fibres thus improving cardiovascular fitness.

## STRENGTH TRAINING BUILDS MORE BLOOD VESSELS

Again, coming back finally to the chronic adaptations seen in the myocardium and vasculature, there is very little research supporting an actual change in heart dimensions. This is perhaps not surprising given that the heart itself is not significantly stressed during high effort RT (it should perhaps be noted however that there is evidence to suggest that regular 'Cardio' performed too often may produce unfavourable adaptations in the heart which could be indicative of a damage). However, the vasculature does undergo adaptations, which serve to enhance the supply of oxygen to the local active musculature. Capillarization, which is an increase in the capillaries supplying a muscle with blood, happens again as a result of RT to MMF. The number of capillaries contacting muscle fibres increases as does capillary to fibre ratio. This increases blood and thus oxygen supply to the working muscle as well as enhancing removal of other products of muscular contractions.

Hopefully the summary of the science there wasn't too overwhelming for most readers. Although for those who want further information I suggest reading the peer reviewed scientific paper my colleagues and I have written on the topic. ***The take home message however is this; there's no such thing as 'Cardio,' meaning that no one exercise improves cardiovascular fitness.*** High intensity of effort is the key in producing cardiovascular fitness improvements and that can be attained safely, efficiently and effectively through the type of RT suggested in ***Hillfit***. It will also confer benefits over and above traditional 'Cardio' such as improved strength, hypertrophy (muscle growth) and increased injury resistance.

*James graduated from Southampton Solent University with a BSc in Applied Sport Science in 2010 and is currently completing a PhD in exercise physiology/biomechanics, specifically looking at isolated lumbar extension resistance exercise in the treatment of chronic low back pain and it's associated physical symptoms. He has published a number of peer reviewed articles including "Resistance Training to Momentary Muscular Failure Improves Cardiovascular Fitness in Humans: A Review of Acute Physiological Responses and Chronic Physiological Adaptations" and "Evidence Based Resistance Training Recommendations"*

*His blog is [The Life and Times of James Steele II](#)*

## **GETTING STRONGER WILL MAKE YOU HEALTHIER**

Your concern should never just be on your performance as an athlete, and every hillwalker is an athlete. Health and the quality of your life over the whole of your lifespan is much more important. Fitness is different from health, even though the two words are so often bracketed together, and health is always the priority.

## **FITNESS AND HEALTH**

Fitness is specific: it describes your capability to do a particular task, whether that is picking up 100 lbs or climbing a mountain. Health can be defined in a variety of ways, but is concerned with the overall operation of all your body's systems (e.g. heart, lungs, brain, nerves, hormones) and to ensure they are working optimally. You can be fit for a specific task yet still be unhealthy overall. Ultimately your long-term health and how you can preserve it should be your primary concern.

People accept that exercise has a role in health. The media and government often put out messages that it can reduce the risk of cancer, heart disease, diabetes or dementia. When hearing this people assume that they need to do aerobic or "cardio" (cardiovascular) exercise, such as jogging, cycling or going to fitness classes. Strength training and its amazing effects on overall health are so often neglected. Strength training can do so much more for your health as we will now see, with benefits far greater than you would get from "cardio" activities.

The sort of strength training that Hillfit outlines to improve your hillwalking performance will also deliver much more important effects for your overall health, now and as you age.

## **STRONGER MUSCLES FIGHT THE LOSS OF FUNCTION THAT CAN COME WITH AGE, AND SLOW COGNITIVE DECLINE**

Being able to function into old age requires strength. Muscle loss (also called sarcopenia, from the Greek meaning "poverty of flesh"), is the degenerative loss of skeletal muscle mass and strength associated with ageing. Researchers are now

realising that fighting the gradual loss of muscle is the most effective tactic to slow down the general physical effects of getting older. Starting in your 30s, you lose 1-2% of your muscle mass each year; strength training can slow this decline. In this respect, developing strength and maintaining muscle mass reverses the effects of getting older.

As we have seen, being stronger makes everyday tasks – like picking up your shopping bags or standing up from a chair – easier. The stronger you are as you age, the more function and independence you will retain, both essential to health.

Studies have also shown that strength training can slow cognitive decline. This is probably due to improved glucose control and insulin sensitivity, something that we will look at next. Alzheimers' Disease is sometimes referred to as Type 3 Diabetes due to a suggested link between metabolic dysfunction and cognitive decline.

## ***STRENGTH TRAINING IMPROVES GLUCOSE METABOLISM AND INSULIN SENSITIVITY***

An important health-benefit of intense exercise is that it increases insulin sensitivity in your muscles. Insulin is a storage hormone: it removes glucose (sugar) from your blood and puts it into storage as glycogen in the muscles, where it can be easily burned for fuel, or in fat cells for storage for longer-term energy requirements. But, if you never do any hard muscular work, the glycogen in your muscles will never get burned up because that fuel will not be needed.

If that happens, the muscles remain full of glucose; glucose in the blood can't get into the "full" muscle cells so it starts to build up. Your body does not want high levels of circulating glucose, as that causes all sorts of problems. So, it will always try to get the sugar stored away somewhere, by producing more insulin, which acts by giving the sugar access into cells. If the muscle cells are always full of sugar already they may become "resistant" to insulin and they don't let the new sugar in. That means more sugar and more insulin floating round in the blood. When it can't get into the muscles the sugar is taken to the liver, where the high insulin levels act as a signal to attach it to fatty acids for storage in fat cells. These tend to remain sensitive to insulin and will let the sugar in for storage as fat. Thus, if your muscles are not burning sugar then the only place for excess sugar to go is to get stored as fat.



Thankfully, this process can be reversed with intense exercise. Through hard training the muscles will burn the stored glycogen in the muscle fibres. This frees up space in the muscles for more sugar from the blood; sugar that was backing-up in the blood can now be moved into the muscle, instead of being stored as fat. The muscles become more sensitive to insulin, so less insulin is required. With less insulin you will not be storing as much fat.

So, to summarise, exercise in any form has been shown again and again to improve insulin sensitivity by altering the cells' ability to respond to insulin and to metabolise glucose, but strength training, in addition to the benefits of the actual physical activity it provides, also works by increasing the body's total fat free mass, thereby bolstering the body's glycogen storage 'tank'. More muscle gives your body somewhere safe to put glycogen, so it doesn't end up running wild in your bloodstream.

Additionally, a recent study in the journal *Nature* reported in early 2012 showed how any time you perform muscle contractions the body produces a hormone called irisin that will improve insulin health. With strength training, you intensely and repeatedly contract the muscles, producing even more irisin, which in turn greatly promotes insulin sensitivity. (*Reynolds, Gretchen. Exercise Hormone May Fight Obesity and Diabetes. The New York Times. 11 January 2012.*)

## **STRENGTH TRAINING CAN REDUCE YOUR BODY FAT, EVEN IF YOU DON'T LOSE WEIGHT**

Proper strength training makes it easier to lose body fat. There are several elements to this:

- As said above, when muscles are emptied of glycogen, sugar can be moved from the blood to the muscle, insulin levels will fall and any excess sugar is less likely to be stored as fat.
- A higher muscle mass leads to a higher resting metabolic rate. In other words you will "tick over" at a higher level, burning more calories whatever you are doing and even when doing nothing.
- You will burn calories while doing strength training, but also after the workout as your body restores its energy stores and rebuilds its damaged tissues.



These elements will also make it easier for fat to be released from fat cells, to be burned as fuel. The process is mediated by an enzyme called hormone-sensitive lipase, which is inhibited by high levels of insulin in your blood. Increased insulin sensitivity through strength training will reduce insulin levels and so hormone-sensitive lipase will be better able to release fat from storage to be used as fuel.

## **STRENGTH TRAINING IMPROVES LEPTIN SENSITIVITY**

Leptin is another hormone which is important for health and, especially, for body composition. This is one of the “satiety” hormones, which signals when you have had enough to eat. Leptin *resistance* means you are less good at detecting that signal to stop eating; *you become deaf to it*. Many obese people seem to be resistant to leptin and don’t sense the body’s signal to stop eating.

Intense exercise has been shown to make people more sensitive to leptin, so an uncontrolled appetite and its effects, should be less of a problem. Exercise can help you get a healthy appetite balanced with a sense of fullness when you have had enough to eat. Listening to signals like that will help to stop you eating more than you need and assist in losing excess bodyfat.

## **LOSING WEIGHT MAKES YOU A BETTER WALKER**

If you lose bodyfat it is likely that you will reduce your overall bodyweight (of course you may build some muscle weight to compensate!) That in itself will make your walking more efficient. Each step will require less energy if the body that is moving weighs less.

People obsess about shaving grams off their gear blind to the obvious that they are carrying extra kilos of fat on their guts. Losing a few pounds of fat will not only deliver health benefits, but do more to make your walking easier than dropping a few hundred pounds (£’s) to reduce the weight of you gear by a kilo or two.

## **MORE MUSCLE IMPROVES METABOLIC RATE**

Maintaining and building muscle mass has other important effects. Muscle is the body's primary site for burning fuel, both fat and blood sugar. The more muscle you have, the more calories are burned while resting and the better you will be at metabolising your food, reducing the risk of obesity, diabetes and other modern "diseases of civilisation."

Simply doing the sort of strength training that Hillfit prescribes can increase your Resting Metabolic Rate (RMR). This is the amount of energy your body burns at rest, doing nothing. Muscle mass burns more energy at rest than fat does, so having a bit more muscle and a bit less fat will automatically raise your metabolic rate, even if you overall stay the same weight.

One consequence of this is that you can eat more food and maintain your weight. A more significant benefit is that by eating more food, you can provide your body with more nutrients. In an effort to lose weight people sometimes embark on very restrictive diets, severely limiting their intake of food. As a consequence they can miss out on some essential nutrients – vitamins, minerals, protein and more. Allowing yourself to eat well is important. Being well nourished is vital to health. As Amber of [www.gokaleo.com](http://www.gokaleo.com) says, ***Eat the Food!***

## **STRENGTH TRAINING MAINTAINS STRONG BONES**

Strength training also plays a key role in maintaining strong bones. The popular belief that weight-bearing activity leads to stronger bones is partially true: muscles provide one aspect of the stimulus that causes bones to get stronger and denser. Strong muscles maintain tension on the bone, causing it to grow thicker and stronger. Weaker muscles do not pull on the bones in the same way, resulting in thinner, less dense and more fragile bone. Dense bones, additional muscles to cushion any impacts and stronger muscles to maintain function and prevent falls, are all huge benefits to health, especially as we get older, when a fall can have devastating consequences.

This is especially important for women where hormonal changes – a reduction in oestrogen as a result of menopause increases bone “re-absorption”, and decrease the deposition of new bone that normally takes place in weight-bearing bones. As a result, hip fracture is a leading indirect cause of death in older women, and weakened bones are far more likely to fracture in a fall. Strength training, by stressing the bones, and developing the muscles that maintain the tension on them, can significantly slow or even prevent the process of bone deterioration and its dangers.

## **STRENGTH TRAINING CAN IMPROVE RANGE OF MOTION/FLEXIBILITY**

When we think of flexibility we tend to picture people doing various static stretches, often hamstring or calf muscles. However, scientific research indicates that such stretches can actually make performance worse, increasing the potential for injury and doing nothing to reduce muscle soreness.

Often, the problem is not a lack of flexibility but of functional strength; the muscles are too weak safely to control movement around the joints. Recent research has found that, even in the absence of stretches, strength training can markedly improve the safe range of motion at joints, as those muscles become better able to manage movement. We will look at mobility again later in the book.

### **CHAPTER SUMMARY**

*Getting stronger will make hillwalking easier. Each step will be less effort, you will be better balanced, go harder without getting out of breath and be more resistant to injury. Your overall health will also benefit as you build and use muscle an organ that does some very important things in your body. All this frees you up to have more enjoyment in the hills.*

## PART 2: HOW TO GET STRONGER



### **BEATING A DEAD HORSE: GETTING STRONGER HELPS**

After that last chapter, it now feels like I am beating a dead horse, but as a foundation for this chapter I want to lay down one proposition: **getting stronger is a good idea for you as a hillwalker.** All things being equal, it will make walking feel easier, delay the point at which you get out of breath, make you more resilient and resistant to injury, assist you in losing body fat and benefit your general health in range of ways.

OK, you are convinced....but now the big question: **What and how?** What do we get stronger and how do we do it?

### **WHAT ARE WE GOING TO STRENGTHEN? EVERYTHING!**

*The head bone connected to the neck bone,  
 The neck bone connected to the backbone,  
 The backbone connected to the thighbone,  
 The thighbone connected to the knee bone,  
 The knee bone connected to the leg bone,  
 The leg bone connected to the foot bone,  
 The foot bone connected to the heel bone,  
 The heel bone connected to the toe bone,  
 Oh, hear the word of the Lord!  
 "Dem Bones" – Traditional Song*

The body is not a collection of bones, stacked up together with muscles acting as pulleys to move the limbs. That is a simple way to analyse it, but it misses out some important truths. The whole thing is connected together. Muscles work in concert with each other to move the body through space, keeping the entire structure of the body under the correct tension. Walking requires hundreds of muscles to work in a complex choreography to move us in a wonderful process of destroying and recreating balance.

Being a stronger walker requires us to strengthen the walking muscles....but what we rarely recognise is that they are **ALL** walking muscles. It might be obvious that you walk with the legs and hips, but the muscles of the chest, shoulders, arms and back are also involved – supporting your posture, maintaining balance and catching you when you fall.

Strengthening *all* of the major muscles groups of the body is essential to create a stronger walker. Building all of the muscle you can all over also lets you capitalize on the health benefits of muscle that we have listed.

## **GETTING STRONGER....HOW?**

This is not a book on exercise physiology. I want you to get stronger, so you will have more fun in the hills. However, I am not going to look in detail about all the processes that go into getting muscles to get stronger - the way that mechanical tension, minor tissue damage and various chemicals produced by exercise send signals to the muscle to grow and get stronger. That stuff is all fascinating and the research around it and understanding of it is always developing. There are good books out there and excellent websites if you want to research more and some are suggested in the resources at the end of the book.

In order to get stronger we do not need to understand the metabolic processes that are at play. There are however some principles that flow from those processes that we can apply and work with. One key idea is that of sending signals. We are trying to send a message to our bodies that there is a need for the muscles and associated systems to get stronger.

## ADAPTATION AND OVERLOAD

There is an illustration that is often used, the legend of Milo of Croton, a wrestler at the ancient Olympics. Allegedly he got strong enough to lift an adult bull by starting in childhood and lifting and carrying a newborn calf, repeating this feat daily as the beast grew to maturity. As the calf got bigger Milo got stronger. He adapted to the increasing load by growing stronger. Modern day strength-training simply mimics Milo's approach: by challenging muscles with increasing loads they adapt, getting stronger so they can cope with such loads in future.

This is the principle in biology called hormesis: a stressor that has a beneficial effect. The body reacts to the stress imposed on it to become stronger and better able to cope with any future repeat of that stress. Think of a suntan: sunlight is a stressor, but the skin reacts with a tan to protect it from damage. This is **adaptation**: like skin reacting to sunlight, muscles react to training loads imposed on them, by increasing their ability to cope with them.

However, Milo did not just lift the same weight each day. The calf was growing, the weight was increasing. The load got bigger day by day and his muscles had to respond by getting stronger each day too. This is **overload**. If you don't increase the load, bit by bit, beyond what you can currently cope with there will be no need for adaptation. Always pushing a little bit more keeps sending the signal that you need to grow and get stronger.

## SUPERCOMPENSATION

Another way of looking at this is the idea of *supercompensation*. Muscle growth is stimulated by the overload and stress of training. Exercise takes energy and "tears down" muscles fibres. As you recover from a workout, the body does not just return to its preworkout state, but also prepares itself better to withstand the next workout by becoming bigger and stronger. You do not just rebuild to where you were but you add on a little more. When you work hard, the body reacts by building more strength and more muscle, just in case you call on it to do that sort of thing again.

There is a fascinating area of study around muscle growth and strengthening, but we are just looking for some simple principles to guide us. Thinking about how we adapt to progressive overload is important. We will be trying to send signals to our bodies to supercompensate. This is where we get to exercise!

## EXERCISE vs HILLWALKING

So, getting an adaptive response is the aim of exercise. It is not about fun or fresh air! The true purpose of exercise is to apply a stimulus to recruit all of the muscle fibres to set off a cascade of health benefits, not least of which is the strengthening of the muscle as it adapts to the stimulus. We want to control the stimulus so as to get the benefits, without the risk of injury through inappropriate motions or too much wear-and-tear. Exercise is focused on delivering these benefits safely and efficiently.

Ken Hutchins of [Renaissance Exercise](#) points out that *exercise* is not about fun but rather delivering those benefits:

*"...We exercise not to enjoy the exercise, but so that we can apply our improved bodies gained from the exercise to enjoy all the other activities (or inactivity) in our lives."*<sup>5</sup>

Activity, or recreation, is something different and encompasses all sports and recreation, e.g. hillwalking, climbing, football. These have specific skill-sets to which you can apply your strength. Each of these activities can have exercise benefits, but they may not be the safest or most efficient ways of obtaining those benefits. The first thing to do is to develop strength through exercise routines, then learn and practice the skill-set specific to the preferred sport or activity, applying that strength to become safer, more capable and tougher. ***My hillwalking is not "exercise". Exercise is what I do to make my hillwalking more enjoyable.***

### HILLWALKING IS NOT EXERCISE!

*By Skyler Tanner*

Hillwalking is not exercise! If you've walked any strenuous hills in your life, your immediate response to my above statement is likely to be "piss off." Bear with me on this.

Walking in and of itself is not exercise. It certainly provides some of the external feedback/effects of exercise: windedness, burning in the legs, sweating. However, the purpose of hill walking is not to exercise; it's to walk the hill and enjoy one's self. It is recreation.

Exercise is not something you do; it is something you are attempting to enact upon the body. You are attempting to exercise your physiology at a sufficient intensity to create health benefits through overcompensation during recovery. It must be quantified and improved over time to continue to tax our physiology toward greater improvements in fitness. That's the outcome of exercise: improved fitness. This can and often allows you to perform a task with less effort, thereby reducing the exercise effect this task or activity may provide.

I can simplify the above as this: when you get better at recreation, it gets easier; when you get better at exercise, it gets harder.

*Sklyer Tanner is a strength coach from Austin Texas, currently working toward a graduate degree in Exercise Science. He is a practitioner of evidence-based, no-bullshit training and nutrition coaching. He can be contacted through <http://skylertanner.com/about/>*

Exercise will get us stronger. We then need to learn to apply that strength efficiently to our walking, which is what will be discussed in part 3. For now though, we turn to the Hillfit Exercise Routine and we are going to look at how to choose some different movements to use as exercise, how to do them and how to put them together as a weekly routine.

## **THE HILLFIT ROUTINE**

The basic movements that are going to be described are exercises that you can do at home with no special equipment. I will give options for each move, a substitute that you could use if you have a set of cheap adjustable dumbbells or if you choose to train in a gym where they have exercise machines. The focus is always on the effect of the exercise, not on the tool that you are using. Your muscles do not know whether the load that they are feeling – the stimulus we are applying – is coming from your own bodyweight, a dumbbell or a machine. The same signal is being sent, the same cascade of metabolic processes. Bodyweight, dumbbell or machine exercises can all be done safely or dangerously. In each case we want to minimise risk.



## EXERCISE SELECTION – PICKING THE MOVEMENTS

As we start to select which movements to use for our exercise there are a few principles to deal with. Remember, the aim is exercise, not recreation. So we are not looking for moves that are fun or skilful but those that allow us to stimulate the muscles safely and under control.

## THE FUNCTIONAL MYTH

You do not need to mimic the motions of hillwalking as an exercise. The key is safely to strengthen the muscles and then apply this strength to your skill area, be it walking or throwing a discus. You sometimes see people, walking with weights attached to their ankles and wrists. That might add load to the muscles but there are safer ways to stress those muscles and joints. In any case, walking with weighted hands or feet *is a different skill* from normal walking. The idea is to build strength with sensible and safe training, then to apply that to your skill: hill-walking.

## SAFETY FIRST

We will pick moves that track natural muscle and joint function so as not to put either in a vulnerable position which might lead to an injury. Hillwalking itself might carry some injury risk, but the exercises we choose to gain fitness for walking should be safe in themselves. The hills are dodgy enough and you do not want to injure yourself in the gym and then end up being kept out of the mountains. The old Latin adage must apply: ***Primum non nocere*** – first do no harm!

Safety always comes first - strengthening muscles without over-stressing the joints and using exercises specifically to strengthen the areas most often injured, to minimise the chance or severity of an injury.

## **CONGRUENT**

Ideally, exercise should also use movements that have the muscle at its strongest when the leverage is weakest. In terms of biomechanics, we need to match maximum muscle torque with the point of the maximum moment arm. This is what Bill DeSimone calls congruent exercise (see Resources section), and I have mainly chosen exercises that take this into account.

### **CONGRUENT EXERCISE: JOINT-FRIENDLY WEIGHT TRAINING**

**By Bill DeSimone**

Many of us weight training types fall into the same trap. We start with the basics, see some progress, and then what we should do is settle in to a manageable, sustainable routine, and get on with our lives.

Instead, because we're enthused about this new passion, we go on the hunt for the next best thing. If curls are good, then concentration curls must be even better. If using more weight than I did two weeks ago is good, then training to failure and beyond will be better. If a pulley station is good, then a machine with gears and weight stack and rods and cams must be better. If moving a weight this far is good, then moving the weight even farther must be better.

Except...that it's not. For all the material that's available in print and online about exercise, much of it ignores some simple truth: that there are only so many ways to load a joint safely, and if you insist on doing otherwise, you're going to end up with either a chronic condition or acute injury...and without any magic benefits to show for them.

I've ruptured my own biceps and triceps training. Not when I was new and inexperienced, but after 25 years of training, multiple certifications, and a heavy dose of High Intensity/Nautilus influence. I then put aside all the muscle media and went to anatomy and biomechanics textbooks to figure out where I went wrong.

What I found was disturbing. Much of the exercise material I had referred to directly contradicted safe muscle and joint function, at least according to my interpretation of the anatomy and biomechanics. I realized that I had done a number of things in the name of exercise that wore my shoulder joint over time. Excessive ranges of motion in chest presses, dips, flyes, rows, chins, curls; joint impingements with upright rows, side raises, overhead presses, and certain machines; too much instability and load shifting in order to squeeze out an additional rep.

Now, a ruptured biceps and triceps are annoying. They don't look as good, and since there are two less muscles running through my shoulder, that shoulder is more unstable, very susceptible to chronic inflammation. Not a big deal, but this is: the same contradictions between safe muscle/joint function and common exercise practices exist for the spine and the knee. In our zeal for the next best training technique, while we convince ourselves that we're doing something to get stronger, more muscular, more resistant to injury, in reality, we may only be bringing on more wear and tear. And if that wear and tear shows up in the spine and the knee, not just a ruptured biceps, it can seriously affect the overall quality of your physical life.

Now, I'm not saying to avoid strength training, because there are numerous benefits. And I'm also not suggesting that you avoid a brand name of machine or program or training technique. My suggestion is to know what the biomechanics issues are, so you can make an intelligent decision about your participation and modify things appropriately. To be thorough, you really should review each joint and compare them to your available exercises, but here are some general tips for joint-safe weight training.

**Maintain your posture during weight training exercises**, especially the curves in the spine. When your overall spine is in its normal curves, the pressure on the discs is even. The safest strategy is to maintain the normal curves under load; especially if the exercise encourages you not to. Reduce the weight so that you can maintain the safe spine posture.

**Don't let the weight push you into a stretch.** Articulating a joint for mobility should be separate from weight training for strength. Stretching the joint with a weight generally takes the muscle away from the optimal length for muscle force, and puts the joint in a vulnerable position.

**Keep your hands in your peripheral vision.** For upper body exercises, if you can't see your hands with your head in neutral, you may be overstretching the shoulder. You have some margin for error, but it's a useful marker.

**Keep some air between your calf and hamstring.** With variations of the squat, stop your descent before the angle at your knee becomes too acute. To minimize wear and tear, you'd like the muscular force from the quads to go towards straightening the knee, not pulling the patella into the knee.

**Don't put a barbell over your face, neck, or spine without structural barriers...or at all.** Finally, the safest way to use a barbell is to keep it off you. If your goal isn't Olympic competition or power lifting, you have a choice between the much-touted benefits of barbell work and the obvious safety concerns. Sure, many use barbells without incident, but the incidents that are reported are crushed spines, jaws, and knees. And exercises with a barbell can challenge the nuances of safe joint function, whether maintaining the lumbar spine curves in squats, deadlifts, and rows, or mismatching the carrying angle of the elbow in curls.

***You'll get most of the possible benefits from weight training from basic routines that you can do regularly and safely, like those Chris recommends in Hillfit. And while individual differences apply, so does the basic model for muscle and joint function.***

Know how muscles and joints are supposed to work, compare that to any changes you're considering to your basic routine, and you'll save yourself time, effort, aches, and pains.

Bill DeSimone 1/14/2013

Amazon link: <http://tinyurl.com/CEAmazon>

<http://congruentexercise.blogspot.com/>

<http://www.facebook.com/CongruentExercise>

## **LOW SKILL**

I like to choose movements that are relatively easy for the average person to learn. The idea is to perform an exercise, to load the muscles, not to learn a complex motor skill. Low skill moves focus on the *muscles* that are being stressed; simple gross motor movements do not require great co-ordination or skill. It is a waste of time if you need to spend weeks learning how to perform a particular exercise. Keep it simple. The aim is not to become skilled at exercise but skilled at hillwalking. We want the simplest moves possible.

## **CONVENIENCE**

There are many ways to apply an appropriate exercise stimulus to your muscles. Weights (barbells and dumbbells, backpacks), bodyweight exercises (like pushups) or gym machines. Your muscles experience the tension, the fibres work and are exhausted whether you are lifting a dumb-bell or your own bodyweight.

Convenience is a massive determinant of how well people stick to training programmes. People are more likely to stick to their programme if it is something that they can do at home without needing to go to a gym: 68% of home based exercisers were still training after 2 years while only 36% of gym based trainees kept at it.

The **Hillfit Strength Routine** can be done at home with minimal equipment. It is convenient and should be easy to do during your week. A cheap set of dumb-bells opens up a range of options for your training, but they are not needed as you can do a lot with just bodyweight in your own home.



## **A MINIMALIST'S ROUTINE**

Using these principles it is possible to design a simple routine, using very basic movements to work and strengthen all of the body's major muscle groups. This will be a minimalist routine but will be efficient with a big impact on the body's strength and resilience.

Think about lightweight backpacking: you only take what you need so that your journey is easier and more efficient. Equipment is basic and functional, often having multiple uses. You are not weighed down with excess baggage. I want to approach training in the same way, so that you do what you need to do and no more, with technology and techniques that will have multiple effects. Do not be deceived into thinking that you need a complex routine of difficult exercises.

## **NATURAL MOVEMENT PATTERNS**

Your body does not deal in exercises – it moves! You push things and pull things; you lift things; you stand up; you walk. These are natural movement patterns that the biomechanics of your body is designed to perform. These are the simple moves that we will use to strengthen the body in the Hillfit Routine.

## **PERFORMANCE PRINCIPLES**

The principles above then are the filter through which we choose our exercises, our movements. They decide what is in our exercise toolbox. How do we wield those tools? What are the guidelines to apply as we think about how we actually perform each exercise.

## **ONE SET**

A set is made up of a number of repetitions. If you do an exercise 8 times – up and down - then that is 8 repetitions in one “set”. You only *need* to perform one set of each exercise. Once you have exhausted the muscle fibres there is no particular benefit to going at it all over again. You need to rest and recover, letting the muscles adapt and grow stronger, which will take a few days.

There is controversy here, with some research indicating that multiple sets could have some benefits, particularly if you aim is muscle growth, but if you can get *most* of the basic benefits with one set, why do more? There is more to life than training.

## ***SLOW DOWN***

Perform your repetitions slowly and deliberately taking special care to go smoothly at the turnarounds – the top and bottom of the motion where you change direction. Remember that we want the benefits of exercise while avoiding unnecessary wear and tear. Bill DeSimone in his book *Congruent Exercise* says to think “**lift-pause-resist**” rather than “heave-swing-drop”. Moving slowly and deliberately will help minimise that risks. There are several reasons why such slow motion is useful.

- **Safety** – moving slowly reduces the force from acceleration that is applied and limits the risk of injury that comes from jerking or heaving;
- **Posture** – moving slowly allows you to maintain correct body position so you can focus on the target muscles;
- **Constant tension** – moving slowly limits momentum, which would remove tension from the muscles. Mechanical tension on the muscle is a key factor, along with microscopic damage to the fibres and general metabolic stress, in promoting muscle growth and strengthening (the process called hypertrophy).
- **Concentration** – moving slowly and deliberately lets you focus on the movement, which helps develop your ability to control your movement, your “motor skills”.

It is impossible to give a precise duration for each repetition as each exercise will be covering a different distance, but the focus should be to move without momentum either up or down.

## **EFFORT NOT WEIGHT**

Keep going in an exercise until you can't move anymore and you reach a point of "momentary muscular failure". You get to a place when all of the muscle fibres you are working are exhausted and not able to "fire" anymore. This is a powerful signal to your body that you need to rebuild and get stronger. Don't try to prolong a set by "cheating" – keep your form solid and your repetition speed constant. Stop when you cannot perform another rep in good form.

**You do need to work hard!** Remember we are trying to drive adaptation. Always try to get one more rep, to last 5 seconds longer, to add another pound to the dumbbells.

## **PROGRESSION**

Remember the principle of overload: if you want to keep adapting you need to keep challenging your muscles a little more in each workout. You can do this by increasing the weight you are lifting, spending more "time under tension", or by changing the mechanics of the exercise so that it gets harder. The **Hillfit Strength Routine** will explain how to progress by using each of these approaches in the different exercises that it includes.

Your set should take you somewhere between 30 and 90 seconds. If it takes longer than 90 seconds it is time to make the exercise harder: add weight or move to a more difficult position. Then start to progress again until you are strong enough to need to add more weight. Keep simple notes so that you can see how you are progressing – if you managed 45 seconds for an exercise last week and this week you achieve 60 seconds with the same form, then you are progressing. You might prefer to count seconds or repetitions, just keep the style constant and your records clear.

With a repetition count you might progress by making the exercise harder (e.g. adding weight) when you managed to get 12 reps. The added weight might mean you can now only get 6 reps. Each week try for one more so that eventually you get 12 again....then add more weight! If there is any magic secret to training, this is it – patience and progression.



## **BREATHE**

Your breathing should be natural and relaxed:

- Do not hold your breath
- Do not exhale forcefully
- Do not grunt or scream.

As things get harder, keep breathing, with your mouth open and jaw relaxed, perhaps “panting” a little to get the oxygen in as necessary. Try not to hold your breath as this only raises blood pressure unnecessarily and takes some of the benefit from the muscles.

## **“PACK” THE NECK**

Keep your head aligned properly. Look straight ahead with the chin slightly down, as if you are trying to make a double chin. Do not move your head or neck or look around. That can increase the chance of straining a neck muscle.

## **WORKOUT FREQUENCY**

You need to give yourself time to recover from each training session and to supercompensate – to get stronger. You need time not just to return to normal but also to get better and to go beyond normal. The key idea is not to fix some rigid routine of X workouts a week. Rather we are looking for progress. As long as you are getting stronger you are training enough. If in doubt, train less often. Put the emphasis on recovery rather than training yourself into the ground.

The optimal frequency of training will vary between individuals, but as a general rule you think about training once or twice a week. Always allow yourself to recover before the next session.

If you are not progressing after a few workouts in a row, other recovery factors may need to be checked: ***are you eating enough quality food? Are you sleeping enough? Are you limiting stress in your life?*** If the answer is “no”, you may require additional rest days and need to take an extra day or two off. Don’t worry if you are only working out once a week. If you are also doing tough walks in the hills you will need the extra time to recover. The key is progress: if you are getting stronger then your training is fine.

## ***IT IS EXERCISE SCIENCE NOT ROCKET SCIENCE***

Getting stronger should not be complicated. The aim is clear: we are using exercise to stress the muscles so that they respond by getting stronger. We want to pick safe moves that are simple to learn. We want to perform them so that we keep the stress on the muscles, work hard and then rest so that we are a little bit stronger next time. Safety is at the heart of it – the last thing we want is to hurt ourselves while training – exercise prepares us to have fun in the hills.

There are many approaches to strength training and huge areas of research about the optimal approach for certain athletes and other populations. But that complexity is not really relevant for most people. The bulk of us just need something simple, safe and straightforward. Pick safe exercises, work them hard, recover and go again. It is not rocket science! Work hard on some basic exercises. Keep adding weight to the bar (or using harder exercise variations) as and when you can.

## ***THE HILLFIT STRENGTH ROUTINE***

With all that background we can now get to the exercise itself: the **Hillfit** Strength Routine. This is a set of moves that are safe, simple to learn and which offer the chance to progress. For each movement there are three options: bodyweight, dumbbell and machine. The bodyweight option uses exercises that you can do at home with no special equipment as long as you have a wall and a floor. A backpack will let you add some resistance and make the exercises harder.

Adjustable dumbbells are fairly cheap, do not take up much room and offer the potential for other exercises and simple progression: as you get stronger add another half kilo to the dumbbell.

You might also choose to go to a gym. Many workplaces now have gyms with simple exercise machines and these can be used to train the moves as well. The instructor will usually be able to explain how to use the machine properly and will often have to give you some induction before they let you loose.



Each of these options has its advantages. Choose whatever is convenient for you. Personally I tend to train at home with a set of dumbbells as it gives me an option for a variety of exercises and freedom as to when and how I train.

## **THE MOVES**

The routine involves five movements. These are basic gross motor movements, simple to learn and safe to perform. They are a lower body push, an upper body push, an upper body pull, a lift or “hip hinge” and a plank. *That is all that is required for a basic strengthening routine.* The rest of this section will describe how to do each move, with options for dumbbells and the gym, and how to progress, making it harder so you keep getting stronger.

### **A LOWER BODY PUSH**

#### **BODYWEIGHT OPTION: THE WALL SIT**

The wall sit is a simple, low-skill movement that is easy to learn and good for strengthening the big muscles of the thighs and hips. The wall sit is less complex than a squat, but using it can quickly and safely produce similar results.

- Stand with your back against a wall. Your feet should be shoulder width apart and toes pointing straight forwards. Keep your hands flat against the wall (see picture).
- Take a step forward so that your feet are approximately the length of your thighs away from the wall.
- Bend your knees and slide your back down the wall. Ultimately you want to get achieve a position where your ankles, knees and hips are all at 90 degrees (the 90/90/90 position).
- Push your heels through the floor and keep all your muscles tight.
- Hold that position for up to 90 seconds.
- Return to the starting position.



## WALL SIT PROGRESSION:

When you first try this exercise, you might not be able to do it. Holding that position for 90 seconds is hard. Your muscles will be working hard to hold you in that position. You may need to start with an easier version and then, as you get stronger week by week, move to progressively more challenging variations.

1. **Partial wall sit.** Go through the steps above, but instead of lowering your body so your knees are at right angles, stop when you are only half way down. Hold this position for as long as you can. Focus on the idea of pushing through the floor with your heels. Keep breathing and try to relax your face. Once you can hold this for 90 seconds, at the next workout move on to progression 2.



2. **Wall sit with support.** This time descend so that your ankles, knees and hips are all at 90 degrees (the 90/90/90 position). Put your hands on your knees so your arms form struts to support some of your weight. Again hold this position for as long as you can, pushing through your heels. Once you can hold this for 90 seconds, at the next workout move on to progression 3.



3. **Full wall sit.** As in the previous progression, get in the wall sit position, but this time hold your hands by your sides so all of the work is being done by your legs and hips. Again, the aim is to maintain this position for at least 90 seconds; when you can do this move on to progression 4.



4. **Weighted wall sit.** Once you can hold 90 seconds in the 90/90/90 position, we need to start adding some resistance. Improvise a weight, e.g. bottles of water in your rucksack worn on the front of your body and start the progression all over again. If you have dumbbells you can hold a dumbbell in each hand, although with dumbbells there are other options that we will look at next.



## A STATIC HOLD UNDER LOAD

Holding that position at the bottom of the wall sit is where the exercise is most effective. This is the “congruent” position - the muscles are applying maximum torque while the moment arm (the lever) is at its largest. As you hold that position, you are forcing more muscle fibres to be recruited: first the slow-twitch, then the intermediate- and finally the fast-twitch fibres. Each set of fibres will work to exhaustion before recruiting the next set. Aiming for a 90 seconds time under load (TUL) should ensure that the exercise is neither too easy nor too hard so you work through all of the muscles fibre types. In the wall sit progression we are not dealing with adding weights initially, but different leverage positions.



## DUMBBELL OPTION: THE SPLIT SQUAT

Again, the focus is the big muscles of the thighs and hips. This movement is a favourite of Bill DeSimone and complies with the principles that he lays out in the box on page, as a safe exercise. The staggered stance allows the deep muscles around the hip to stabilise each leg independently, which might help with walking. You will need one dumbbell, although initially you might not even need to add weight.

Rather than photos, for this one I recommend that you look at the You tube video that Bill has done to describe the exercise: <http://youtu.be/x0gZMAEpk70>

- Standing erect and balanced, take a step forward so that your toe is about a shin length from the heel of the other foot. Your rear heel will come off the floor.
- Keep your torso vertical and descend so that you reach a position shown in the video. Your front leg should be at right angles. Your shoulders and hips should be parallel, with the weight mainly on your front leg. The back leg is mainly for stability.
- Ascend to the start position by pushing through the front foot.
- Do all your reps on one side then, when you can't do another in good form, switch feet and work the other leg.

## SPLIT SQUAT PROGRESSION

When you start this exercise you may be able to get a good effect without adding weight. It is a challenging position for the muscles of the thigh, both front and back.

1. **Bodyweight**. Do the move with no added weight. Think “resist – pause – lift” as you descend, stop and then come up again. Count reps or time. When you get to either 90 seconds or 12 slow deliberate reps on each leg it is time to move on to the next level.
2. **Dumbbell**. This is the same move, but this time hold a dumbbell in your hand on the working side – the front leg. Again descend (resist) stop (pause) and ascend (lift). Move slowly minimising momentum. When you are unable to do another rep, stop and switch legs remembering to swap the dumbbell to the other hand. Once it takes you either 90 seconds or 12 slow deliberate reps on each leg, move on to the next level – add a tiny amount of weight to the dumbbell at the next workout.

## **GYM OPTION: LEG PRESS**

Of course at the gym you might choose to do a wall sit or a split squat. You will also have another option – the leg press machine. Ask the instructor to show you how to use the machine and to select an appropriate weight.

As explained by Bill DeSimone in the box above, try to ensure that the curves in your spine are matched by the seat of the machine. Adjust the seat so that there is some space between your calves and hamstrings and your thighs and torso as you start. Push smoothly to a position with your knees slightly unlocked, pause and then return to the start.

In terms of progression add weight when you are able to complete either 15 repetitions or to keep going longer than 90 seconds. Then build up again. Remember work hard: always try to add another rep, or a few more seconds of work.

## ***AN UPPER BODY PUSH***

The next move focuses on the major extensor muscles of the upper body – those that push things away from your body, by straightening the arms. Again we will look at a bodyweight, a dumbbell and a gym machine option.

## **BODYWEIGHT OPTION: THE PUSH UP**

The basic upper body push will be the push up. You will have all seen it done – at gym class in school or in army basic training in films. It is a basic but very effective exercise. It still forms the core of what I do week by week.

However, in the push up posture is vital. Many people lack the basic strength to perform a push up properly and effectively. Before we let ourselves loose on a push up we first need to master the plank.

## THE PUSH-UP PLANK

A push-up plank is a pre-requisite for doing a push-up. Unless you can hold this position you have no right doing pushups. Spend time developing the necessary strength in your "core" so that you are able to hold a good, solid aligned posture. Only then will you progress to a push up. There is no point in telling you to do 10 push-ups if you can't hold this position – each rep would be a disaster!



- Start off in the "push-up plank position": face down, arms straight, hands shoulder-width apart, with a straight line running from your head to your ankles (see picture). This is also the top position of the push-up.
- Keep everything tight: tense your stomach, squeeze your buttocks together, keep your neck packed, looking at the floor and keep breathing easily.
- Hold this position, gradually building up (10 seconds, 20, 30, 45) until you are able to hold it for 1 minute. This is the first step in your progression. Then you move onto the push-up.

Don't think of this as an easy move or a useless excuse for an exercise. This is an excellent move in its own right. Developing strength in this move will develop strength and resilience throughout your body. **If all you were able to do was a wall sit and a plank held for 1 minute each then you would be a lot stronger than most of the population.** (That was in fact a competition – the *Hillfit Minimum* – on the Facebook Group recently!)

## THE PUSH-UP

The next exercise in the routine is the push-up. The push-up is a fundamental upper-body exercise developing strength in the pushing muscles of the chest, triceps and shoulders but also training postural control and core stability. It is my favourite exercise! However, the full push-up is a hard exercise and most people need to work up to it, so I have given a series of progressions to help you work up to the full push-up and then beyond. **Keep in mind that this is a moving plank** – the whole body is kept still and rigid, just the arms bending at the elbows and shoulders.



## PROGRESSION TO PUSH-UP

1. **Wall push-up:** Stand facing a wall at arms length. Touch the wall with your fingertips, arms shoulder width apart and then bring your palms down to the wall. Bend your elbows, bringing your head to the wall and then press back up. Move slowly and under control. Even though you are standing up, keep tense in that plank position. Once you can get 12 smooth repetitions or you last longer than 90 seconds, move to progression 2.
2. **Knee push-up:** Get in the push-up plank position, with everything taut. Instead of your toes being on the ground, do the exercise with your knees on the ground, torso straight, palms flat on the ground, hands shoulder width apart, lower your chest to the ground and then push yourself up. Be sure to get a full range of motion at the top. Once you can get 12 smooth repetitions

or you last longer than 90 seconds, move to progression 3.



3. **Desk push-up:** Stand a few feet away from a secure, hip- height object (e.g. table or desk) and grab the object with straight arms, shoulder-width apart. Keeping your torso straight in that plank position, lower yourself until your chest touches the object, wait a second, then push yourself back up. Again, don't count repetitions but work to time and keep moving until you fail. Once you can get 12 smooth repetitions or you last longer than 90 seconds, move to progression 4. The photos below show the exercise using a bench, but you could use a table or the counter in your kitchen.



4. **Full push-up:** Start off in the “push-up plank position”: face down, arms straight, hands shoulder-width apart, with a straight line running from your head to your ankles. This is the top position of the push up. Keep the straight line from ankles to head and bend the arms to lower the body until your upper arms are parallel with the floor, then reverse direction. Keep your elbows in rather than flared out, with maybe a 45 degree angle between your upper arms and your torso. Body weight should be lifted by the arms; don't be tempted to use the lower half of your body to pull yourself up. Move smoothly and under control.



Keep your head neutral (don't drop your forehead to the ground), and keep your core and buttocks tight throughout the motion. Move slowly and under control, paying particular attention to slow "turn-arounds" at the top and bottom of each movement. Once it takes you longer than 90 seconds to fail, move to progression 5.

5. **Weighted push-up:** Put on a rucksack containing weight, e.g. a few bottles of water, and start the progression again.

Remember, it is all about progression. Keep trying to get stronger, little by little. Always hold your body rigid and straight as that moving plank; keeping tense abs and glutes will help to do this. Watch yourself in a mirror, video yourself with your smart phone or have a friend watch you to check your form so that you do not make the mistake of sagging as you get tired. Also remember to keep your speed slow and smooth - many people do the pushups way too fast in an effort to squeeze out more reps with horrible form. You are only cheating yourself to do that. There is no one to impress, just be patient and you will get stronger.

## DUMBBELL OPTION: FLOOR PRESS

The dumbbell floor press works the pushing muscles very similarly to the pushup. There is an advantage however in that you can tailor the weight more precisely to one that is appropriate to your strength level, so that progression – the magic ingredient – is easier to attain. We can do that to some degree with our pushups at different angles, but the dumbbells are more precise. If you are a just starting, you might not have the strength yet to do pushups; using light dumbbells you can get just enough resistance to allow you to build up strength so that you eventually be able to do pushups. On the other hand, if you are very strong, basic pushups are not much of a challenge and it can be tricky to add weight in a backpack. The dumbbell floor press allows weights far in excess of your bodyweight so that you can keep challenging your muscles as you get stronger.

You may see people doing this exercise on a bench at the gym, but I actually prefer the floor based version for a few reasons.

- They are simpler in terms of equipment. All you need is the dumbbells and the floor.
- They are safer because if you fail and can't control the weight, your shoulders are protected because the weights will hit the floor before your shoulders hyperextend. That wouldn't be the case on a bench where your could seriously wrench your shoulder.
- They are safer because they limit your range of motion; the floor safely limits your range of motion and as such it does not allow your elbows to drop behind the plane of your back. One of the guidelines that Bill DeSimone mentions is that if you cannot see your hands then you may be overstretching the shoulder. The floor prevents this.





So, lying on the floor, have your upper arms so they are roughly half way between being tight to your sides and at 90 degrees to your body. Hold your shoulders down and back. Keep your shoulder blades in - pretend you are squeezing a coin between them throughout the exercise.





Push up slowly while breathing out. While pushing the weights up, you are using two motions that combine for a maximum lift. Think not only about pushing the dumbbells up, but also squeezing your upper arms together. Do not lock out your elbows, stop just short of that and reverse the motion, slowing lowering the weights, until the back of your arms just kiss the floor.

Take great care getting the dumbbells into position. One option is to do the exercise one arm at a time. This allows the free hand to assist with getting the bell into position and can help with protecting you in the event that a dumbbell slips. For all of these exercises, you can always search on YouTube to find demonstrations.

## **FLOOR PRESS PROGRESSION**

Use the same style that we have already discussed - “lift – pause – resist” as you press the weights, stop and then lower them under control. Count repetitions or time. When you get to either 90 seconds or 12 slow deliberate reps it is time to move on to the next level – this time by adding a little weight to the dumbbell. Add as little as possible, the tiniest weight you have at the next workout and keep progressing.

## **GYM OPTION: CHEST PRESS MACHINE**

Again, if you are at the gym you could still use pushups or dumbbell floor presses (which might get you some strange looks). There is another option at the gym however, a chest press machine. Ask the instructor to show you how to use the machine and to select an appropriate weight. A video of a typical set up is at

<http://youtu.be/G8ChLZZ6J8w>

Apply the same technique as we have described for the other exercises. Maintain good posture. Lift, pause, resist as you press the handles of the machine away from you. Keep elbows slightly unlocked at the finish and do not hunch your shoulders forward.

Don't go for an extreme stretch at the start of the movement. Again, protect the delicate shoulder – as Bill DeSimone explains “while looking straight ahead keep your hands in your peripheral vision during the set.”

Count repetitions or time. When you get to either 90 seconds or 12 slow deliberate reps it is time to move on to the next level – this time by adding a little weight to the machine. Add as little as possible, at the next workout and keep progressing.

## **AN UPPER BODY PULL**

Now we turn to a move to strengthen the pulling muscles of the upper body. The “row” will work the opposite muscles to the push-up, the muscles of the upper back and arms. It can be hard to address this motion without using machines or dumbbells, so if you are not comfortable with the suggestions below, be encouraged that the plank position you hold in the push-up will stress these muscles of the back to some extent. However, we will work these muscles more directly with the “towel row” and other options.

### **BODYWEIGHT OPTION: THE TOWEL ROW**

This option makes use of a sturdy towel, but you could also invest in a set of suspension straps like the TRX straps. Search for these on Amazon.

**Towel rows:** Find a big beach towel and tie the top two corners together forming a knot at one end. Place the knot over the top of a door and shut it so that the towel is jammed. Take care to make sure that the towel is secure over the top of the door so that you are not going to fall backwards.



**For safety, please ensure that the towel you choose is robust enough to support your weight and that you have put it over the side of the door so that you are pulling it shut, not open.**

Hold the towel with both hands, place your feet near the door, then lean back. As in the push-up, keep everything tight and tense in a plank position.



Squeezing your shoulder blades together, pull yourself towards the door using your arms. There should be a line from your head to your heels with just your arms moving.



Lift, pause and resist as you pull up and then lower yourself. Keep the shoulders down and back, packed into their sockets and try to imagine that you are pulling with your elbows.

As in the other exercises count repetitions or time. When you can achieve 12 smooth repetitions or you last over 90 seconds, it is time to make the exercise harder by adding weight - put on a rucksack with weight (e.g. a few bottles of water) while you perform the exercise.



***Again, always take great care that the towel is secure over the top of the door so that you are not going to fall backwards.***

Holding the towel can be quite hard on your grip, so you might want to investigate a suspension training set up with handles like the TRX or Jungle Gym Straps.

### **DUMBBELL OPTION: DUMBBELL ROW**

An important principle with this exercise is to keep the entire body stationary except for the arm with the dumbbell, which moves up and down slowly. The other three limbs remain completely motionless and both shoulders remain stationary. If you have to jerk it up, you are using too much weight!



The starting position is with the right arm locked out leaning on a table of chair, both legs on the floor, knees slightly unlocked. Your arm and legs form a tripod to support you with your bodyweight spread among your feet and the arm on the table. Keep your shoulders and hips aligned and parallel to the floor, with your chest thrust out. Maintain that posture and squat slightly to pick up the dumbbell. Squeeze the dumbbell up towards your hip, thinking about pulling the dumbbell, then your elbow and then your shoulder towards your hip.

Move smoothly, don't jerk the weight. Don't twist around the spine either, just lift, pause and resist as the bell rises, then is lowered. When you can't get another repetition in perfect form, bend your knees to return the weight to the floor and then work the other side of the body.



## **DUMBBELL ROW PROGRESSION**

Move the weights under control. Count repetitions or time. When you get to either 90 seconds or 12 slow deliberate reps it is time to move on to the next level – this time by adding a little weight to the dumbbell. Add as little as possible, the tiniest weight you have at the next workout and keep progressing.

## **GYM OPTION: SEATED ROW**

Again, if you are at the gym you could still use dumbbell rows, but there will be other options too, usually some sort of seated row set up. There is another option at the gym however, a chest press machine. Ask the instructor to show you how to use the machine and to select an appropriate weight.



Apply the same technique as we have described for the other exercises. Maintain good posture. Lift, pause, resist as you pull the handles of the machine towards you. Maintain an upright posture to encourage you to squeeze your shoulder blades together. Hold the shoulders in place and pull with your elbows.

Count repetitions or time. When you get to either 90 seconds or 12 slow deliberate reps it is time to move on to the next level – this time by adding a little weight to the machine. Add as little as possible, at the next workout and keep progressing.

## **HIP HINGE**

The final move that we will do is a “hip hinge”. This is a fundamental movement pattern, how you should bend forward to pick things up from the floor. We should bend forward from the hip joints rather than the spine, protecting the lower back joints from excessive pressure, which potentially contributes to lower back pain.

When you ask many people to bend forward to touch their toes, they will bend from their upper backs and stick their necks out rather than stick their bums out as they hinge at the hip. They bend at their lower back rather than at their hips. When you hip hinge you use the ball and socket design of the hips and the surrounding gluteal muscles rather than abusing the spinal joints.

For a healthy and safe back we want to strengthen the hip hinge movement and the muscles that perform it, to help improve the ability to use the hips. Being able to move better at the hips means less strain on the lower back and on the knees. The gluteal muscles are powerful muscles, not using these muscles can seriously limit your ability as a hillwalker. As we will see in the next chapter when we think about how to walk efficiently, they are also the prime movers in our gait.

## **PROPER POSTURE**

The buttocks (the glutes, consisting of gluteus maximus, gluteus medius and gluteus minimus) are some of the most powerful muscles in the body. They are essential for good posture and fundamental to walking and climbing, pulling the legs back as we step forward. They are also involved in picking up heavy objects as we “hinge” at the hip. Unfortunately, too often the glutes do not work as they should; they can get weak and lazy, perhaps due to the amount of time we spend sitting, and then



“forget” how to contract, resulting in bad posture (some physiotherapists talk about *gluteal amnesia*!). When posture is poor, your weight will not be carried through the appropriate structures. This leads to inappropriate tension in muscles, excess wear-and-tear in joints and reduced efficiency in your movement, so that walking will be harder. All this sets us up for injury, pain and an inefficient gait.

Colin Gordon of Edinburgh Deep Tissue Massage ([www.edinburghdtm.com](http://www.edinburghdtm.com)) says:

*“When we are sitting the glutes are stretched. Over time this causes them to become inactive, weak and tight. Their primary role is to stabilise the pelvis when we walk or run. If this muscle can’t do its job properly it will reduce stability in the pelvis as we move. This causes muscles in the upper body to have to work harder to stabilise the torso since we lack the foundation of a solid pelvis.”<sup>10</sup>*

## BODYWEIGHT OPTION – HIP EXTENSION

The hip extension helps to fix the damage, activating and strengthening the glutes. This will “wake them up” so they fire properly when we stand, walk, or run and can be used as a warm up before exercise to “switch on” your buttocks. This is probably not the most “congruent” exercise in terms of biomechanics, but it is simple to learn and a good place to start in working the glutes.

- Find a padded but firm surface, e.g. a carpeted floor, thick yoga mat or even use a foam sleeping pad. Lie flat on your back, legs bent, feet drawn near the buttocks, heels pushing into the floor. Place the extended arms beside your hips for stability.
- Squeeze your buttocks together and push through the heels to lift the pelvis. Raise the hips by tightening the buttocks, thrusting your groin upwards. There should be NO movement in your feet.



- Make sure you begin the exercise by actively contracting your glutes or else the hamstrings will contract first. Think of holding a large coin between your buttocks. Try to get your hips in line with your upper legs.



- Hold the hips raised with buttocks clenched for a second, then lower, maintaining the tension in the glutes. Move slowly and continue until you cannot do another repetition with good form.

## HIP EXTENSION PROGRESSIONS

Again, move smoothly lift, pause and resist as you complete the hip extension. Count repetitions or seconds and if you can complete 12 repetitions or take longer than 60 seconds move to add resistance. One option is to rest a rucksack across your groin. Add weight to the sack – again maybe some bottles of water as you get stronger. Another option is to do the exercise one leg at a time, as shown below.



## DUMBBELL OPTION?

I am not going to offer a dumbbell option for this move. There are options like a deadlift or reverse lunge, but these can be tricky to learn and often quite risky without care and proper instruction. I'd rather you stick to the hip extension to work the glutes, thinking of the move more as a corrective exercise to wake up the muscles and teach them to fire, with the majority of your effort going into the squat, push and pull.

## HIP HINGE GYM OPTION

Gyms will often have a lower back machine. Ask the instructor to show you how to use the machine and to select an appropriate weight. These will vary in design from gym to gym so I can't be too specific here about how to use it. Just maintain the same basic principles that we have been through – good posture, controlled movement.

## THE HILLFIT STRENGTH ROUTINE – SIMPLE BUT EFFECTIVE

That is it: three movements, plus the hip extension, done properly once or twice a week. Don't underestimate the potential of this simple routine. To be honest, the meat is in the wall sit and the push up. If they are progressing you will be getting stronger. These are basic moves but they are engineered to do a task, to work the target muscles intensely, and to do it safely with the fewest barriers in terms of risk, equipment, skill acquisition or time.

The Hillfit Strength Routine	Options (pick one)
Lower Body Push	Wall Sit – dumbbells optional as you progress Split Squat - dumbbells optional as you progress Leg Press – gym option
Upper Body Push	Plank Push up Floor Press – with dumbbells Chest Press machine – gym option
Upper Body Pull	Towel Row Dumbbell Row – with dumbbells Seated Row machine – gym option
Hip Hinge	Hip Extension / bridge Low Back machine - gym option

Don't think you need equipment or that you have to join a gym. You don't need to spend money to train. Your muscles need hard intense exercise; that can come from a machine in a gym or from a push up. The muscles can't tell the difference although your wallet might!

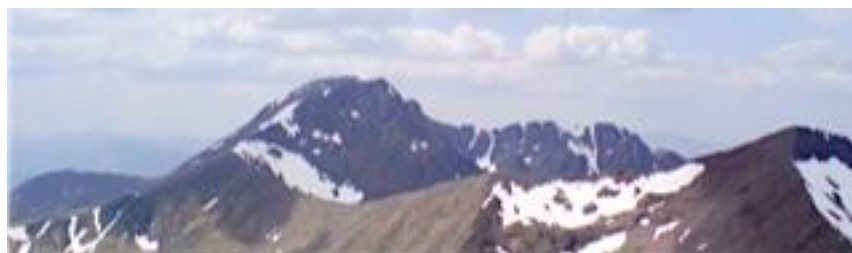
**YOU DO NOT NEED BUMBBELLS OR A GYM!** The wall sit, pushup, towel row and hip extension will do wonders. The other options have been included in v 2.0 to give some variety and options for those that want to explore weights or the gym.

If you enjoy training and want some more variety then after a few months you can look to buy a cheap set of adjustable dumbbells and learn some new exercises, or think about joining a gym to access other equipment. The principles of exercise, i.e. safe, simple and hard, will always remain the same but with some added resistance there are a few more moves that are possible. One or two books that I recommend in the appendix would give you some ideas for effective training with dumbbells, particularly Fred Fornicola's book, *Dumb-bell Training for Strength and Fitness* (see Resources).

## **CHAPTER SUMMARY**

**We are going to strengthen all of the muscles in the body since they are all involved in good posture and efficient walking. The first principle is safety so we will pick movements that are safe and easy to learn. We will focus on gross body movements – squat, push, pull and hinge. The key is progression, challenging your muscles with a little more than they have done before so that they are forced to grow and adapt.**

## **PART 3: APPLYING YOUR STRENGTH TO THE SKILL OF WALKING**



Having outlined the Hillfit Strength Routine and given you some options for how you can begin to develop useful strength through some simple exercises, I want to turn now to think about walking itself. Getting stronger is one thing, but it is not the focus for us as hillwalkers. Our concern is to be better at walking.

### ***EFFICIENT WALKING***

Becoming a more skilled walker will bring important benefits to your days in the mountains. The more efficient you are at walking the less work will be involved in each step. If each step takes less energy then you will be able to keep going for longer and not find yourself tiring as quickly. You will no need as much energy to walk and you will not need to get as much fuel to the muscles, so you will not get out of breath so fast.

There is a lot to walking efficiently, but in this section I just wanted to give a few ideas for you to consider.

### ***WALK THIS WAY***

When you take up a new sport your main focus is on developing skills. A golfer will spend time and money on lessons, books and videos to learn how to hit the ball, then occupy hours at a driving range, practising the golf swing. And hillwalking? Because we all walk, we think we know the skills already. Well, although it is natural to walk, the way that you normally walk is neither automatically efficient nor safe.

## **SAVING ENERGY**

I have sometimes defined “hillfit” in terms of not getting out of breath – that’s the signal that your system is switching fuel from fat to the more limited sugar. But irrespective of conditioning or strength, sometimes the way you walk (your “gait”) takes far more effort than it should. You can feel “fitter” by improving your walking technique.

Imagine a high-powered engine in a car with flat tyres. Driving will cost more effort and cause more wear-and-tear than it should. Gait is the same. Conditioning – the engine – might be fine but there could be wasted energy and needless wear-and-tear on your body due to the way you move over the ground.

## **GRACE AND GRAVITY**

The biomechanics of an efficient and safe gait can be complex, but there are two key ideas: grace and gravity.

Think about moving gracefully. You sometimes see people taking bigger, jerky strides, feet landing far ahead of them, or pumping their arms vigorously. In each case they are trying to walk faster. In reality, when our feet land far in front of us, it is like applying the brakes. When arms are flapping around it creates excessive movement that slows us down. Although it feels counter-intuitive, stay compact and move smoothly, with smaller but more frequent steps. Grace is also about posture, if the body is not aligned correctly – maybe you slouch - certain parts have to carry the load of other parts; this can waste energy, create tension and may lead to injury.

We live in a world dominated by gravity. Efficient movement should adjust to this environment and take advantage of gravity to use less effort. Instead of pushing off your back foot to drive yourself, lean forward from the torso and, as your body “over-balances”, lift your leg and step forward to restore balance.... and repeat.

When your centre of mass (COM) is over your support foot (the one on the ground), you are stable and balanced. As you overbalance and “fall forward”, change the support: i.e. put your other foot on the ground, directly under your COM, to minimise braking impact forces, bringing you back into balance. Keep falling forward and changing the support foot: you will be walking assisted by gravity. Don’t worry too much about the physics: taking shorter steps and leading with the torso while maintaining an aligned posture is the main thing.

## ***GRACE UNDER PRESSURE***

So, being “hill-fit” is not just about conditioning or strength; how you walk is as important: an efficient gait requires less exertion. Move smoothly with good posture, letting yourself fall forward from step to step so you do not waste effort. If your heels are thudding into the ground, take shorter steps with slightly unlocked knees, so your heel lands lightly, directly below your centre of mass. Stay tall and graceful, focussing on leading with your torso, not your head or pelvis.

The body should move as a single piece - an unstable “floppy” torso, maybe due to weak muscles, will disturb your balance and cost energy. When your posture is aligned your weight goes through the appropriate structures, avoiding wasted energy and wear-and-tear. This is also a reason to watch the weight and fit of your pack. A heavier rucksack may cause you to bend over at the hips, so minimise pack-weight and use the hip-belt to take the strain off your shoulders.

## ***HE MARCHED THEM UP TO THE TOP OF THE HILL.....***

In the paragraphs above I tried to get across the idea of walking with momentum provided by gravity to minimise the effort, falling not pushing forward. The same principles apply when you hit the hills.

Uphill walking naturally promotes good style: you automatically tend to take shorter steps with your body “leaning forward”. Practice using stairs: put your right leg two steps up with the knee bent and your left leg straight. Lean forward so your weight moves onto and past your front (right) foot. As your weight moves forward, smoothly straighten your right leg while swinging your left knee so the foot lands a couple of steps up, under your centre of mass. Now your right leg is straight (with unlocked knees) and the left is bent in front of you. Lean your weight forward and



take the next step. It is all about minimising the energy required, not pushing or squatting the ground away from you but swinging the legs forward.

### **....AND HE MARCHED THEM DOWN AGAIN**

I know some people who find downhill walking much more difficult than going up. The key is control, making sure that gravity doesn't overwhelm you! Keep your feet beneath you, not extended way ahead and not left behind, or else your strides will get too big and you'll start "flying" downhill with huge impact forces on your knees and ankles. Strong thighs and a solid posture will help you hold your legs quite tight around a vertical line going through the ball of the support foot, but still try to relax as you move. Of course, these tips are focussed on "mechanics". Moving on "technical" ground, e.g. scree, is another challenge beyond the scope of this chapter.

What does all this mean? How do we put these ideas into practice? For that explanation I am going to hand over to Steven Sashen :

#### **HOW TO WALK**

*By Steven Sashen*

I expect (and kind of hope) that many people reading the title of this section will think, "Uh, I don't need instruction about how to walk. I've been doing it all my life." I also expect (and definitely hope) that others will read the title and think, "Finally, the answer to my most burning question! I've been worried that I'm walking wrong."

For those of you in the first group, let me ask you this: Do tribal women in Africa with water jugs balanced on their heads walk in the same way that Olympic race walkers do? And, do either of those people walk the way you do?

I'd bet that the answer you found for both of those questions is No. That's because **walking isn't just walking**. There are ways of walking that are more or less effective, more or less efficient, more or less healthy and strong. And if you accept that premise, that could put you in the second group. Now, for those of you in the second group, I have what could seem like bad news. **There is no one answer to "How do I walk."**

This article will not reveal the hidden secret of locomotion that only wizened Tibetan lamas from the Drepung monastery have taught to their senior disciples, or the geometrical relationships between your lower extremity joints that is optimal for effortless, pain-free walking, or the best footwear you can use for carrying a 200 pound pack on a 1,000 mile hike over broken glass.

It'll actually do something better. It'll show you how to become your own best teacher and discover your own secrets for walking efficiently, enjoyably, and easily!

### BAREFOOT RUNNING

Before we can discuss walking, let's review of the premises behind, and arguments supporting barefoot running:

*Landing on your heel, especially with the ankle forward of the knee and the knee almost straight, sends shock through the joints -- the ankle, the knee, the hip, and up the spine.*

This isn't good. Running barefoot reduces the likelihood that you'll land on your heel... because it hurts. Landing on the forefoot or midfoot, with a bent knee and the ankle not front of the knee, reduces the force going through your joints, allowing you to use the muscles, ligaments, and tendons as natural springs and shock absorbers.

### FOOT STRIKE IS THE WRONG TARGET

So, what does all this have to do with walking? Well, the whole conversation about foot-strike rarely came up prior to the barefoot running boom. **Now it's practically dinner party conversation**, where the barefoot gang looks down their noses in disgust at shoe-wearing heel-strikers. And the increase in the volume of the foot-strike conversation has led to another question, which probably nobody asked prior to the publication of **Born To Run**. This is a question I'm emailed almost daily, namely, "**How should my foot strike when I walk?**" It sounds like a reasonable question. If there is some optimal way for your foot to land when you run, there must be a "right" way for it to land when you walk, right?

Well, there's debate among the barefoot running research community about whether a forefoot strike is better/worse than a midfoot strike, or whether foot strike is idiosyncratic and different for different runners. There's even an argument about whether heel striking is as evil as most barefoot runners take it to be. How can this be?

Simple. Because ***heel strike is the effect of other aspects of your biomechanics, not the cause.***

Think about it. The only way you can change how your foot lands on the ground is what you do with your ankle, your hip, and your knee. To not land on your heel when you run, you probably need to bend your knee more than you usually do. But that alone could cause you to trip over your toes, so you also need to bend your hip a bit more. And then you may relax your ankle a little rather than pulling your toes towards your knee.

So "land on your forefoot" is really just a cue for "bend the hip and knee and relax the ankle," but if you told someone to change their hip, knee and ankle joint angles, they'd be too confused to even take a step.

Well, it's similar with walking. **Where your foot lands isn't the issue. How you move your foot through space is.** When you walk, your foot can land in one of three ways: touching the forefoot first, followed by the heel dropping to the ground; landing basically flat-footed, probably touching the midfoot first, or; touching/rolling over the heel... which is sort of still a flat-footed landing but with the heel contacting first.

Which one of these happens is a function of how fast/slow you're walking, whether you're walking up/down hill, and what kind of surface you're on.

Really, there's no need to worry about foot-strike. It'll take care of itself... if you pay attention to this next thing.

## BAREFOOT BENEFITS

First, you'll want to be barefoot, or as close to barefoot as possible. Why? Because there's value in being able to articulate the foot and to letting the nerves in your feet actually feel the ground.

Many podiatrists recommend barefoot walking as a cure for plantar fasciitis. Many chiropractors and orthopedic physicians recommend barefoot walking to cure lower back pain. Being barefoot can help with plantar fasciitis because, when you're out of shoes, especially on uneven surfaces, you'll use your feet in a way that "pre-loads" the plantar fascia, putting them in a strong position when you need them.

Being barefoot can help with lower back pain because... well let's take a look at that one more closely. Imagine standing on one leg. If I asked you to start walking, most people would basically swing their free leg out in front of them and, at the right moment, push off the toes of the back leg to pivot over the front foot, which has landed on the heel way out in front of you.

You basically walk "behind your feet." One interesting thing about walking behind your feet is that ***you're never really off balance***. We'll come back to that idea in a moment.

## USE YOUR BUTT

Now, imagine being on one foot again. If I asked you to contract whatever muscle or muscles you can think of that would move you forward, which one(s) would you tighten. Remember I said "move you forward." Falling forward doesn't count, so the answer is not "ankle" (leaning) or "abs" (as in, bending forward until you fall).

The answer is the muscles that are referred to as the "prime movers" in our body: The glutes and hamstrings. Tighten the glutes and hamstrings and you'll actually MOVE forward. **And stronger glutes and hamstrings protect the lower back.**

But after you tighten your glutes and hamstrings you will eventually get off balance and fall on your face... unless... you put your other foot down to stop you.

### WALK ON TOP OF YOUR FEET

And here's where it gets cool. If you simply place your foot down where it'll stop you from falling (rather than swinging it out in front of you like you usually do), it'll land closer to your centre of mass, more flat-footed, with a slightly bent hip and knee, and with the now front leg in a biomechanically stronger position. You will have planted your foot.

If you repeat this -- using your glutes and hips to move you forward, and placing your foot instead of swinging your leg forward -- you'll be supporting your lower back... and your knees, and your hips, and even your ankles. Your foot-strike will take care of itself. You'll feel like you're walking "on top of your feet" rather than behind them.

And this makes you stronger, whether you're going for a stroll or carrying a 50lb pack on a trail (which, by the way, will be easier because your engaged glutes and hamstrings support your lower back).

When think about staying **on top of your feet**, and using your glutes and hamstrings, you'll naturally discover the easy and efficient ways to walk in any situation. You'll understand it from the inside out, from your own experience, not from some guidebook about how many inches behind your knee you should have your ankle when you're walking up a 10 degree incline in 50 degree weather on a Thursday.

Combine this with feeling the world because you're barefoot or in some truly minimalist footwear (be warned, most major shoe companies claim their product is "barefoot" when it's about as close to barefoot as a pair of stilts), and I guarantee that your next walk or hike will be a revelation... and a lot of fun.

*Steven Sashen is an All-American Masters sprinter (one of the fastest men over 50), who loves to hike with his wife around his home of Boulder, Colorado. He's the developer of Xero Shoes Barefoot... PLUS! sandals, a modern take on the Tarahumara huaraches sandals. <http://www.xeroshoes.com>*

## **WALKING AS A BALANCING ACT**

So Steven describes walking as a series of forward falls, powered by the glutes. You place your foot beneath you where it stops you from falling over, recreating balance. When you walk through a boulder-field, carefully hopping from one wobbly rock to another, you become acutely aware of the importance of balance! What can we do to improve balance?

## **WHAT IS BALANCE ANYWAY?**

To keep you balanced, your centre of gravity over your base of support, your brain brings together information from three different systems:

- The **visual** system - you see the position of your body in relation to your surroundings;
- The **vestibular** system – your inner ear detects movement in different planes;
- The **proprioceptive** system – sensors in your muscles and ligaments (“proprioceptors”) plot the position of your body in space.

If the brain senses that you are overbalancing, corrective action is taken: muscles unconsciously contract or relax until balance is restored.

## **PLOTTING BRAIN MAPS**

Neuroscientists explain that the proprioceptive system supplies the brain with data to plot a “movement map” of the body’s position in space. With correct information from the sensors in your skin, joints and muscles, that map is clear and you will move and balance well. If the data is not accurate, that map is “fuzzy” and your movement will not be good.

## **ARE ANKLES YOUR ACHILLES HEEL?**

One consequence of poor balance is ankle sprains. Acute ankle sprains account for 3-5% of all UK A&E attendances, about 1.5 million each year. As you walk the foot is supposed to roll slightly inwards as it hits the ground. If you don't balance properly as you step forward, the foot rolls outwards stretching the ligament on the outside of the ankle; if this happens with enough force, a sprain occurs.

If you have had an ankle sprain, you are more likely to suffer another. Researchers have shown that previously injured ankles produce worse balance, leading to more injured ankles, not just due to weak muscles but those brain maps. "Once someone has sprained an ankle, the sensory receptors in the ligament are also damaged," says Dr. Jay Hertel, Professor of Kinesiology at the University of Virginia. Thus, when those neural receptors are damaged, the brain no longer receives reliable signals about how your foot and ankle are positioned relative to the ground.

## **BETTER NAVIGATION WITH BETTER BRAIN MAPS**

How can we get clearer maps to aid our balance? One "low-tech" tactic, tested by scientists, showed that ankle sprains can be avoided with a simple exercise: stand on one leg; don't wobble; hold for a minute; repeat. This is not primarily strengthening the muscles of the ankle, important as that is, but stimulating the neural receptors to give accurate information to the brain. Researchers also recommend building this training into everyday life: "One of the exercises we give people is to stand on one leg while brushing your teeth, and to close the eyes, if it's too easy," Hertel says. "Do that for two or three minutes a day and you're working your balance really well".

Standing on one leg for a while each day might not seem like cutting edge sports science, but try it and see how your balance and movement improve. In the section below, Todd Hargrove gives some more ideas on how to improve your balance, working on these brain maps.

## BALANCED THOUGHTS

*by Todd Hargrove*

Ever noticed that some people walk with a smooth, gliding step, as if they are walking on air? While others tend to plod along with a heaviness that looks painful? Here's a little information, and some simple exercises, that may help you to become a lighter on your feet.

Mobile and coordinated feet and ankles are essential for proper balance and shock absorption while walking. Research shows that feet are a critical source of *proprioception*, which means the processing of sensory data about joint position that the brain uses to balance and coordinate the body. Feet are literally the foundation for walking, so if their performance is suboptimal, everything built on top will be compromised.

Here are some simple exercises you can do to improve the mobility, coordination and proprioception in your feet and ankles.

### CIRCLES

Raise one foot in the air while sitting or standing. Circle the foot from the ankle very slowly and carefully so that the big toe makes a circle. Try to make the circle absolutely perfect, and be very mindful of the places where the circle gets sloppy, or your movement gets a little jerky or uncontrolled. These are the exact places where you need to slow down to regain control of a subtle but important movement.

Now see if you can make the circle while keeping the toes passive, so that all the motion happens at the ankle. Once that is easy, make different shapes such as figure eights or clovers. Or write the alphabet.

But make sure always to maintain the quality of your movement. Just "going through the motions" will cause you to fall into familiar grooves, and miss the subtle movements that you habitually avoid.



## WAVES

As before, raise one foot in the air. Flex your toes downward to the floor without moving from the ankle. Keep the toes down, and then flex the ankle down so the whole foot points down. Now keep the ankle pointed down, but fully lift the toes to the ceiling. When the toes are lifted, lift the ankle.

Repeat this several times, and start smoothing the motion out, so that the toes are always leading the movement of the ankle up and down in a wave-like motion. Make this smoother and easier with each repetition. Try to spread the toes as they lift and move them together as they go down.

Now try this in reverse, with the ankle leading and the toes following. Don't be surprised if you get a little cramping or feel a little spastic in your foot - this is an indication that your intrinsic foot muscles are being asked to do something they haven't done in a long time. The more you practice this, the less cramping you will get, and this is a sign that you are regaining neurological control over some previously sleepy foot muscles. That's a good thing!

## CONTROL OVER FOOT CONTACT AND ARCH HEIGHT

Place one foot on the floor in a sitting or standing position and notice which parts of the foot make contact. Ideally, there should be three major points of contact - the ball of the big toe, the ball of the little toe, and the heel. Try to equalize the pressure of the three points on the ground.

You may notice that one point is "lighter" on the floor than the others (this point may be different on one foot than the other.) Using your intrinsic foot muscles, try to press the light point into the ground while maintaining pressure on the other two points. You might feel some muscles working in the arch of the foot that are normally very lazy.

When you have established a nice even contact between the three points, try to "shorten" the foot by sliding the ball of the big toe, just a little bit along the floor, in the direction of the inside of the heel. This will lift your arch. Try not to curl the toes down, and keep the ball of the big toe pressed solidly into the floor at all times.

If you can't do this (which is common!) you can use your hand to mold the foot into the desired movement a few times, then try it again actively and see if the movement is easier. Try to minimize the effort to make the movement, as well as any unnecessary muscle contractions in other areas.

Once this movement gets clearer, you will gain better awareness and control over the muscles that create the arch in your foot, and this will make your feet better at creating balance, shock absorption, and efficient force transmission into the ground.

After doing these exercises, walk around a little and see if you can notice any changes in your walking. Chances are, if you change your feet, you change some other things too, in your knees, your hips, or even your back, or maybe just your overall sense of lightness and ease in walking.

Enjoy!

*Todd Hargrove is a Certified Rolfer and Feldenkrais Practitioner living in Seattle, Washington, USA. You can read more about how to create efficient and pain free movement at his blog [Bettermovement.org](http://Bettermovement.org).*

## **WARMING UP**

One thing that has not been mentioned so far is the idea of “warming up”. There are some real benefits that come from preparing your muscles and connective tissues for the stress of exercise. Exercise scientists look at things like increased heart rate, body temperature and blood flow to the muscles, reduced muscle viscosity and better “extensibility” of tendons and ligaments. All these mean that your body will be able to handle movements better. Within the **Hillfit Strength Routine**, most of these benefits will actually come *during* the exercise. You do not need to worry too much about warming up, especially if you follow the performance principles and are moving slowly so that force is minimised. The first few repetitions prepare the muscles, connective tissue and joints for the harder work that follows as you approach failure.

However, there is one practice that I do want to warn against as a preparation for exercise, whether you are thinking about strength training or hill walking. Let's put it simply: do not stretch before your exercise.

## **STRETCHING – MAGIC MOVEMENTS?**

People think that stretching before activity is good and we hillwalkers are as prone to this assumption as other athletes. I've seen hikers stretching before they hit the mountain. Surely it prevents soreness, avoids injury and prepares muscles for the rigors of exercise?

Strangely enough, while people are busy stretching, sports scientists have published studies showing that static stretching before exercise does not prevent injuries, will not reduce soreness and, in many cases, will actually make you slower and weaker!

## **INJURY, SORENESS AND PERFORMANCE**

Static stretching is where you hold a position at the very edge of your muscles' range of motion. There is evidence that this increases the muscle's range of motion, but in fact this is not necessarily a good thing! Studies have found no proof that stretching prevents injury.

Despite what you might think, there is also no evidence that stretching stops muscle pain after exercise. One review found "very consistent" evidence that post-exercise stretching has "minimal or no effect on the muscle soreness experienced 1-3 days after [exercise]." A recent article in the British Journal of Sports Medicine commented on an update of this research with a title that said it all: "Stretching before or after exercise does not reduce delayed-onset muscle soreness."

Other studies have indicated that stretching before exercise may make you *slower*, *weaker* and *less efficient*, not something that you want for a day on the hill! This phenomenon is not yet fully understood, but there are a couple of possible explanations:

- Static stretching of the spring-like muscles and tendons makes them less able to store energy, so that they get "loose" when you walk and then become less efficient;
- Stretching may have a "neuromuscular" effect by disrupting the signal between brain and muscles.

It is probably a combination of these factors, but whatever the cause, stretched muscles tend to be weaker and perform less well.

## **SO HOW DO YOU WARM UP?**

If stretching is not good, what should you do to warm up? In terms of your strength training, as I said the benefits that you want from the warm up will come early in each exercise and prepare you for the tougher final “failure” end of the set.

For your actual hiking a good way to prepare is with “dynamic stretches”: moves that put your muscles through the range of motion required for walking, without the extreme reach-and-hold poses that can cause problems. Begin to walk slowly, gradually getting to your usual pace and then introduce some dynamic drills:

- March for 10 steps, lifting your knees high with each step;
- Kick your heels up behind you for a few steps so they almost touch your buttocks;
- Swing your arms back and forth;
- Finally take some long, lunging steps.

These moves will prepare your muscles, increase heart rate, body temperature and blood flow, helping you walk efficiently without damaging your performance.

### **CHAPTER SUMMARY**

**Walking is a skill, a complex choreography of scores of muscles moving in coordinated patterns to move you across the ground. Becoming more efficient in how you move will make walking easier – every step will take less energy and so you will be able to go further with less effort. You will not get exhausted or out of breath as quickly. You need to practice the skill of walking, thinking about how you can move gracefully and efficiently. An efficient gait is also a safe one with the posture set up to direct the forces through the appropriate structures, minimising wear and tear.**

**This is different from your strength and fitness training. Get stronger and fitter (the same thing) with you exercise and then apply that strength to your walking. Think of a climber. They need a certain amount of upper body strength to pull themselves up a crag. However without the skill of being a good climber all the chinning strength in the world is not going to help them climb the rock. You need to walk and walk lots to learn and develop the skills of being an efficient walker.**

***Get stronger then put that strength into practice as you learn to walk well.***

## PART 4: BEYOND STRENGTH



So we have discussed the importance of strength to you as a hillwalker for both your performance and health. We have considered how to get stronger with a simple set of safe exercises. We have even spent a little time thinking about how to apply that strength to the skill of hillwalking, so that you become a more efficient walker. At the foundation of all this is the simple idea that I want you to have more fun in the outdoors and that happens when your activity is easier....and that happens when you get stronger. But there is more to health and fitness. In this brief chapter I want to highlight just a few other things that need to be considered as we think about how we can set ourselves up to perform well on the hill and to be healthier overall.

### ***LISTEN TO YOUR MOTHER!***

I've been thinking and writing about strength, health and fitness for a while and recently I was struck by the fact that so much of the advice that is given boils down to the advice that our mothers and grandmothers used to give us! There is wisdom in all that advice. Generations of experience and experimentation distilled that wisdom, although unfortunately much of it is now being rejected. It is science but not rocket-science. We need to return to and practice some of that old wisdom:

***Stand up straight, get to bed early, eat your greens, don't snack between meals, stop worrying so much, wear sensible shoes, brush your teeth, get some sunshine and fresh air.*** Just for a few paragraphs I want to tease out some of that wisdom.

## **STAND UP STRAIGHT**

Don't underestimate posture in walking or in general. Posture sets you up of an efficient gait and redirects the forces that flow through your body as you walk so that they are transmitted through the most appropriate structures, minimizing wear and tear. Art DeVany ([www.arthurdevany.com](http://www.arthurdevany.com)), a great innovator in health and fitness says "Learn to stand and walk like you are proud of your body. Lift your heart and look out over your cheekbones... pull your shoulders down rather than back... feel your weight through your heels...". These are simple cues that will help to align your stance. Don't get stressed about this, just practice, stand and walk in this posture when you remember. Of course a major enemy of good posture is the chair.

## **BEWARE OF YOUR CHAIR!**

You might hit the hills for a few hours each weekend, but how do you spend the bulk of your time during the week? Most people might do some exercise, but the majority of our lives are spent sitting down. Our modern lifestyle is more sedentary than that of any previous generation. Today's jobs, transport and leisure activities mean we are sitting more than ever before in human history. One recent study found that, on average, people now sit for over 9 hours per day: longer than is spent sleeping.

## **SITTING IS KILLING YOU.....**

Our bodies were not built for life in a chair and research has highlighted the danger that so much sitting poses to health. Scientists have found that time spent sitting is associated with increased risk of mortality. Those who sat "most of the time" were more likely to die during the following 12 years than those who "almost never" sat, even after controlling for age, smoking, body weight and physical activity. Even if they exercised, people who sat for over 6 hours per day had a higher risk of death than those who sat for under 3 hours per day. Another study said watching television for an average of 6 hours a day could shorten life-expectancy by almost 5 years!

## **SITTING TOO MUCH TO BE HILL FIT?**

As if this is not bad enough, your ability to enjoy the hills is also at risk. Sitting impacts vital muscles, leaving you with a body that is simply not set up for walking. When your posture is wrong your weight will not be carried through the appropriate structures, leading to tensions in muscles, excess joint wear-and-tear and reduced movement efficiency, all of which mean that walking will be harder and less fun.

## **A PAIN IN THE BUM**

Key muscles at risk are the gluteal muscles (your buttocks). Colin Gordon of Edinburgh Deep Tissue Massage ([www.edinburghdtm.com](http://www.edinburghdtm.com)) says “When we sit the gluteals are stretched. Over time this causes them to become inactive, weak and tight. Their primary role is to stabilise the pelvis when we walk or run. If the muscles can’t do their job properly it reduces stability in the pelvis as we move. This means muscles in the upper body must work harder to stabilise the torso, since they lack the foundation of a solid pelvis.” Injury, pain and an inefficient gait often follow.

## **REMOVE THE CAUSE - STAND UP FOR YOURSELF!**

Most of us might be stuck in jobs that require sitting, but we need to get up as often as practical. Limit sitting and instead move whenever you can. Try to break up your sitting, interspersing it with “movement breaks”: walk or stretch every fifteen minutes or so; maybe stand up to make phone calls and go for a walk at lunchtime. Also undo the damage. The hip extension / glute bridge exercise we have already looked at in the last chapter can help. We want to fix the damage from sitting, activating and strengthening those gluteal muscles. Their major function is to extend the hips, pulling the legs backwards. This exercise will “wake them up” so they fire properly when we stand, walk, or run.

### **MOBILITY**

*By Colin Gordon of Edinburgh Deep Tissue Massage*

You’ve started down the path of improving your strength to aid the enjoyment of getting out into the hills. Another aspect of fitness that you should look at is what we’ll call **mobility work**. What is it and why would you want to spend time on it?



## WHAT IS MOBILITY?

Mobility as we'll use the term here is about having **a full range of movement (ROM) in all your joints** - something, barring injury, which we should all have. Examples of the type of ROM we should have are

- 135° of hip flexion; and
- 70° of internal rotation of the humerus.

This is regularly missing in patients that I treat. A more dynamic and perhaps easier example to understand is the ability to sit into a full squat. Inability to perform a squat can flow from issues at the ankle, hip or even the upper back. These can each cause problems with the movement so that we either cannot squat at all or we make “compromises” to achieve it, which highlight different problems depending on where the compromises occur. The bottom line is that we should be able to do this very natural movement, but often we can't.

“Mobility work” is often used to refer to everything from static stretching to yoga to strength training as all done appropriately can help towards being able to move well through a full ROM.

## WHY BE MOBILE?

Why should we do mobility work? As I say above you should have, barring injury, a full ROM in all your joints. If you don't you are setting yourself up for problems down the line somewhere either in terms of injury or simply the problems with moving well and functionally into old age. Pain is a poor indicator that there is something wrong with how you move as the body/brain is very good at making changes to allow us to continue to do our daily tasks and will take quantity of movement over quality every time. We compromise and avoid problem positions. As such we tend to lose ROM pretty slowly and it can be some way down the line and with any number of movement compromises before we notice any change or pain.

## STRENGTH AND MOBILITY

Strength and mobility also go hand in hand with one another, almost like two sides of a coin. You can distinguish between them but they can't be separated. Improving your strength can improve your ROM and improving the ROM, in those areas that it is restricted, can aid your strength by placing you in a better position to generate force.

Also, not all ROM problems are simply flexibility issues; they can often be strength problems. For example, in the hamstrings an apparent flexibility issue of short/tight hamstrings can actually be due to poor stabilisation of the lumbo/pelvic region that results in the brain attempting to create some sort of stability by tightening the hamstrings and thus limiting the amount of movement that can occur. This is something I have demonstrated with a number of clients by passively checking straight leg hip flexion with and without the abdominals braced. Getting stronger here will increase ROM as the stronger muscles create stability instead of the tight hamstrings.

### TOO MUCH SITTING

The big problem areas for most people are in the hip and thoracic spine. Years of sitting at a desk through school then work, coupled with a reduction in general activity levels result in these areas “seizing up”. You could almost describe the soft tissues around the hip as getting stuck and matted together, especially the glutes and hip flexors; they either become what we might term *short*, in the case of the hip flexors, or *stretched* in the case of the glutes. Whilst they aren’t actually shortened or stretched they are placed in a situation (sitting) where they seem only to work in a shortened or lengthened position.

A basic start to addressing these issues can be found in a few simple movements and a couple of rubber balls or foam roller.

### COBRA STRETCH

One of the best things that can be done for both the hips and thoracic spine is the Cobra position from yoga (look it up on YouTube) as it opens up the front of the hips and encourages extension through the thoracic spine. Lying face down in a press up position squeeze the glutes and lift the rib cage up off the ground looking to keep the pelvis and lower abdomen in contact with the ground. Try and hold the top position for several deep breaths before returning to the floor then repeat.

### HIP FLEXOR STRETCH

Take a step forward as though doing a lunge and drop down into bottom position, this is the starting point. From here we need to make sure that we keep the torso rigid and move forward as a unit and not merely extend the lumbar spine.

To start we contract the glutes and abdominals then shift our weight forward on the front leg. We're looking for a gentle stretch somewhere in the front of the hip here which could be anywhere from the front of the thigh to around the area of the lower abdomen, think around jeans pocket. With this one we want to spend a good couple of minutes slowly moving further into the movement never really forcing it. Again, search on YouTube for "hip flexor stretch".

### **FOAM ROLLER**

Using a foam roller or a couple of rubber balls taped together (go to your local pet shop and get a couple about the size of a tennis ball and tape them up so they look like a peanut) position yourself on the ground with your knees bent to 90° with the roller or "peanut" under your upper back. Place your hands behind your head, bring the elbows together and tuck your chin onto your chest and tighten the abdominals. Keeping your glutes in contact with the ground flex and extend the upper back.

### **SQUAT**

The squat is my go to movement for keeping the whole of the lower body working well and shows just how mobility work and strength work blend into one another. Possibly the best way of performing the movement is the goblet squat (again look it up on YouTube) though you don't need to have a kettlebell or dumbbell, or anything at all really, to perform the movement. Simply holding something high on the chest will encourage the correct pattern.

- Begin with the feet placed about shoulder width apart and with the feet turned slightly out.
- Holding your chosen goblet, squat down pushing your knees out so that your elbows brush the inside of your thighs in the bottom position keeping the chest up then
- Rise to the start again.

Hopefully these simple tips can help you with some insight into mobility work. I would suggest checking out Kelly Starret's mobility WOD website where you can get a hold of a lot of great tips for free. Eric Cressey, Bill Hartman and Mike Robertson have a great product on how to look for and correct any mobility deficiencies you may have. I would also suggest checking out some local yoga classes in your area.

## **GET TO BED EARLY**

As a hill walker, one of the simplest things you can do to improve your health and fitness is something you already do each day. You probably enjoy it. Generally it happens in bed, but sometimes you do it elsewhere – on the floor, the sofa or even in the bath! Doing it outdoors, in a tent or under the stars, brings a special pleasure. I am talking about sleep and I want you to get more of it!

Too often we overcomplicate our fitness ‘regime’, looking for secrets to improve performance; a big one is rest and recovery. We neglect the basics; an important one is sleep, which is a foundation of health and fitness. Before you think about a new exercise or tweaking your diet, make sleep a priority and see what happens to how you look, feel and perform.

## **HOW IMPORTANT IS SLEEP?**

Sleep is more important than we realise! It is easy to start cutting back on sleep: we stay up late watching TV or surfing the internet; we worry about things; too much coffee (or coffee at the wrong time) leaves us stimulated and awake at bedtime. It is easy to sleep too little, but this has major health consequences. In men, poor sleep can lower testosterone levels, a hormone critical to maintaining muscle-strength and bone-density. A night of missed sleep activates an area of the brain responsible for the desire to eat, so bad sleeping habits tend to be followed by weight-gain and a greater risk of obesity and diabetes. Scientists have found that just one night of missed or inadequate sleep is enough to make you as insulin-resistant as a type 2 diabetic. Lack of sleep is associated with higher blood pressure, slower reaction times and generally poor athletic performance; the Centres for Disease Control, in the USA, recently announced that shift work (and the concomitant bad sleeping patterns) is a known carcinogen.

## **LACK OF SLEEP IS A STRESSOR**

When you neglect or have poor quality sleep, your body takes it as a signal that you are under threat: something in your world is preventing you from sleeping. Your body reacts to this by releasing stress hormones to help you face the threat. These ‘fight or flight’ hormones prepare you to react quickly to a specific event, e.g. a battle to win or an animal to escape from, but such threats aren’t continual and long-term. If elevated for an extended period, these hormones, primarily cortisol, can make you immune-compromised, chubby and forgetful! That is what happens when we live lives of

ongoing chronic stress and habitually lack sleep. However, while being in sleep-deficit makes exercise harder, those who exercise tend to sleep more and reap the associated health benefits.

## **HOW MUCH SLEEP?**

You probably need more sleep than you get! Most need at least 8 hours of sleep each night in a darkened room. You should wake refreshed without an alarm clock. If you get enough sleep you'll recover faster from exercise, have better memory, fewer allergies, less inflammation and it will be easier to lose body fat, all because those stress hormones are under control. So, go to sleep, in a dark room for 8 hours per night, minimum.

## **EAT YOUR GREENS AND DON'T SNACK**

Diet and nutrition is one of the most heated areas of debate out there. It is a topic that attracts almost religious zeal in some. Gurus abound, offering you their latest secret promising you all sorts of magical success: you will lose fat, perform better and feel great if only you buy my wisdom. Of course most of it is a load of rubbish. People are getting rich selling you some pearls of wisdom that boil down to some very simple truths.

- **Calories matter** – if you eat more calories than your body burns day by day then you will gain fat. How many do you need? It will vary from person to person, but start off with about 15 calories per pound of bodyweight. So if you weigh 12 stone, that is 168lb so aim for 2520 calories a day. If you want to lose weight you will need to eat fewer calories. Maybe 12 or 10 per lb, just shave a few calories off and be patient.
- **Get enough protein** – protein is the most satiating nutrient (it makes you feel fuller and less hungry) and it has a higher “thermic effect” (it takes more calories to digest). Aim for maybe 0.6g – 1g of protein per pound of bodyweight.
- **Get some fat** – fat is not the enemy. Some fats (transfats) are bad, but study after study has shown that your body needs fat to be healthy. Be balanced though – each gram of fat contains 9 calories, over twice the calories in a gram of protein or carbohydrate, so you can soon start to take in a lot of calories when you load up on fat. Don't fear egg yolks, butter or cream, just be sensible with it.

There are questions around seed oils too, so focus on olive oil, coconut oil and animal fat – all of which are stable and healthy. Aim for .5g per lb of bodyweight.

- **Fill up the rest of your calories with carbohydrates** – potatoes, rice, bread if you can cope with it (increasing numbers of people are sensitive to gluten, a protein in wheat). Eat some fruit and lots of green vegetables...which are basically calorie free!
- **Eat real food** – you know: meat, vegetables, fruit, nuts, fish: ingredients not packages. Check out Michael Pollan's Food Rules or search on the internet for the ideas around **JERF: JUST EAT REAL FOOD**. Real food is full of micronutrients, (vitamins, minerals, phytochemicals and other compounds that we have not even discovered yet) which have a profound impact on your health. They tend to be big on volume and lower in calories, so you can eat more bulk before eating too many calories. In fruit and veg this comes with fibre that also brings other health benefits.

If you do nothing else, track your intake for a few days in a food diary. You can just write it down or use one of the online apps like **Myfitnesspal.com** that has a massive database of foods and will work out your calorie, protein, carb and fat intake. Just looking at your daily intake like that for a while can often open your eyes to just how much and how well (or not) you are eating.

I've been round the block a few times with respect to fad diets (low carb, paleo, etc etc) and it all comes back to simply being sensible. ***Eat enough, not too much and make it mainly real food.***

If you want to learn more about nutrition I've listed some sources in the back of the book. You could also look at the services of a diet coach who will sketch out a meal plan for you with targets for calories, protein, carbs and fat. I've worked with Kyle Hunt of [Huntfitness.com](http://Huntfitness.com) and the accountability that working with a coach brings is great for motivation and commitment.

## ***SENSIBLE SHOES***

In the last chapter we looked a little at the amazing complexities of the human foot. Through the foot we sense the world around us as we walk, stand or squat. Our feet provide our brains with data that allows them to adjust our stance and motion to keep us in balance and maintain a healthy posture. Unfortunately so often we lock those feet up in thick, stiff shoes that blunt the input of that sensory data so the brain does not have much information with which to work. Philip Beach – osteopath and author of *Muscles and Meridians - the manipulation of shape* - rails repeatedly against shoes, which he describes as ‘sensory deprivation chambers’. He explains that feet are as biologically important as the eyes, ears, nose and hands from a sensory perspective, and he points out important links between the feet and low back through feedback neural loops. ***“Shoes... are sensory deprivation chambers that cut down the raw information we need to stand and walk in our precarious upright manner.”*** Beach recommends walking on pebbles and other tactile surfaces to retain good balance and reduce musculoskeletal pains. If you don’t want to go that far at least try to go barefoot at home as much as possible, and wear simple, thin shoes and boots that keep your feet mobile and able to access information from the ground that you are walking over.

## ***STOP WORRYING SO MUCH - GET SOME SUNSHINE AND FRESH AIR***

Every week I seem to discover a friend or colleague is taking antidepressants. Between 1999 and 2009 the number of prescriptions for these drugs each year almost doubled and since 2006, has risen from 16 million to 23 million. A principle I use to guide my thinking on fitness and health is: “what were humans built and designed for?” I believe our brains are “hard-wired” to expect regular activity outdoors in a natural environment. When this is missing, it is no surprise that we develop health issues, including depression. Instead of pills we need hills!

Scientists researching “green exercise” now recognise that exposure to nature has a *synergistic* effect: exercising outdoors in natural settings *amplifies* exercise’s beneficial effects on physical and mental health. Walking is good for you... but walking outside in the hills is even better.

## **THE NHS – A NATURAL HEALTH SERVICE**

Studies have found clear benefits from exercising in nature or walking in the great outdoors. Self-esteem went up and blood pressure went down when volunteers walked in pleasant rural scenes rather than urban cityscapes. Levels of anger, depression and confusion were each reduced after “green exercise” of all types (walking, cycling, fishing, nature conservation, woodland activities, horse-riding and boating). The effects are for young and old alike: elderly adults tend to live longer if their homes are near a park or other green space, regardless of social or economic status; students perform better on cognitive tests when their bedroom windows overlook natural settings; children with ADHD have fewer symptoms after outdoor activities in lush environments; residents of housing estates report better family interactions when they live near trees. The health effects are wide-ranging too: eye studies show that time spent outdoors is related to reduced rates of short-sightedness (myopia) in children and adolescents.

Research has also shown that dose-responses for both intensity and duration showed large benefits from short engagements in green exercise. Both self-esteem and mood showed greatest changes for the least duration: just 5 minutes outside has a big effect!

## **GET OUT THERE!**

Our bodies and minds crave the sensory stimuli provided by hill, loch and sea. We will never be truly healthy without the varied natural input of the outdoors. Even a few minutes in nature, e.g. a 5-minute walk at lunchtime, will make you feel better. Your body works and heals best in its natural habitat. Grab every opportunity to get outside and think about defending your green spaces – we need to preserve them to keep us healthy!

### **CHAPTER SUMMARY**

*Stand up straight, get to bed early, eat your greens, don't snack between meals, stop worrying so much, wear sensible shoes, brush your teeth, get some sunshine and fresh air!*



## **PART 5: PUTTING IT ALL TOGETHER**



Well, I am coming to the end. This has become longer than I had intended, but I hope that what is in here is useful and will help you to have more fun in the outdoors, which is what this is all about. As I said in the start of the book getting fitter can remove some distractions – the breathlessness, the wobbly legs – that can stop you from really enjoying all that the outdoors have to offer in their peace, grandeur and beauty.

### ***OTHER WAYS TO SKIN A CAT***

Remember, what I've presented in this book is focused on getting you stronger. However, I don't pretend that this is the only approach that would work. There are other programmes and methods out there. Ultimately what is important to me is that you do some strength training. Do it safely and always give the priority to your walking, but if you choose to follow a different routine then that is still cool! The Hillfit approach I think offers some advantages. It is lightweight: simple, safe and functional. You can do this at home with minimal equipment. You might not become Mr Universe but you will get stronger with little time investment.

## **PUTTING THE PIECES TOGETHER**

That being said, how do we put all this together? I've covered lots of different things here from strength exercises to balance and mobility work. All of that stuff might seem a bit overwhelming and load of extra stuff to fit into your week given that I am supposed to be keeping everything simple and minimal. Well hopefully in the next few pages I can reassure you that it is not too much to take on.

## **THE BASICS**

Before we think about “training”, go back over some of the stuff in the last chapter. Try to get the rest of your life in order: get enough sleep, eat well, try to minimise the time you spend sitting and limit the chronic stress in your life. Unless you get these basics in place all of your training and exercise will just dig deeper and deeper into your reserves. You need to give yourself the resources to recover and grow not just so that you can perform well on the hill but, more importantly, so that you can be healthy and effective in your normal life. Make sleep and recovery a priority. Treat yourself well: rest, recover and eat. Laugh as much as you can and ease up on the stress and worry. It is often easier said than done, but try to find ways in your life to release stress be it through prayer, meditation, time with friends or whatever.

## **EACH AND EVERY DAY**

Do not make it a chore, but try to work in some “maintenance” work each day, just to keep your joints, structure and brain working well. Think about the balance exercises that Todd Hargrove described in Part 3. While watching TV or maybe while sitting on the bus do some circles and waves with your feet, remembering to aim for good clean movement. When washing the dishes or having a pee, try standing on one leg to work on your balance –to get those proprioceptors active and connecting with your brain.

Make time for some mobility exercises too, as Colin Gordon described. If you are picking something off the floor or from a low shelf, squat down trying to settle in a nice deep squat, your pelvis sunk between your legs. Maybe try watching the TV while lying on your front for a while, every now and again rising into a cobra pose. Do not get obsessive about it, but just try to build some of these things into your daily life.

More and more research is being published which is indicating that it is ongoing daily activity – lots of standing, walking - that is important for health rather than infrequent exercise sessions stuck on top of a life which is otherwise spent sat down: driving, working at the PC or slumped in front of the TV. Sit if you must, stand when you can and walk whenever possible.

Strength Coach Dan John recently pointed to a good idea:

“I have one bit of advice for my older clients: watch all the television you want, but you must be on the floor sitting when you do. Try this. You'll find soon that you roll, pivot, twist, change, and flop the whole show.”

Try it! You will find yourself active, moving around and working in all sorts of mobility exercises and stretches as you spend some quality floor time! Remember what Tim Anderson wrote about the amazing impact that crawling can have, tying your body together and providing a solid foundation for all of your other activity. ***I agree with him that a simple baby crawl can reset much of your mind and body.***

## **WALK WHEN YOU CAN**

Try to get out and walk whenever you can, not primarily for the “exercise” but for the other benefits that it brings. Getting out of the office for a quick walk at lunchtime, if possible in green space, has amazing psychological benefits. Walking after a meal, in fact even just standing, can improve your insulin sensitivity, so that your body will put the glucose from your food somewhere safe – into your muscles – rather than sending it to fat storage or elsewhere. Doing lots of walking will also help you to develop the skill of walking. Walking is as much a skill as a good tennis serve or a golf swing. Think about how you take each step and become an expert efficient walker. It will make you safer and able to move further with less effort.

## **STRENGTH TRAIN**

Make time once or twice a week for some strength training. The Hillfit Strength Routine has been designed to offer some simple progressive exercises that you can do at home with minimal equipment, using safe movements that are simple to learn and do not require much in the way of skill. There are also options for using a cheap set of dumbbells or if you want to train in a gym.

Give your walking the priority though. If you are doing a big walk on a Saturday, don't do your strength training on the Thursday or Friday or else you might find yourself too sore and tired to perform well on the hill. You need to make sure that you arrive at the mountain fresh and recovered. So with a big walk on Saturday, maybe train on the Sunday evening or Monday. If you feel recovered by Wednesday, squeeze another session in but make sure you get enough rest, sleep, food and recovery in before you next big walk. The mountains are the focus – build your training around them and your planned days out. If you are going to be away from the hills for a while maybe train more often, but when you are getting out more regularly then cut back on the strength training so that you can enjoy the hills without being wrecked from the other training.

## **ON THE HILL – DON'T STRETCH YOURSELF**

So you have arrived at the car park for your big walk. Ahead of you is a day of 8 or 9 hours: maybe 20 miles and 10,000ft of ascent. Do not worry about stretching before you start, just begin to walk slowly, gradually getting to your pace and then introduce some dynamic drills: march for 10 steps, lifting your knees high with each step; then kick your heels up behind you for a few steps so they almost touch your buttocks; swing your arms back and forth; finally take a some long, lunging steps. These moves will prepare your muscles, increase heart rate, body temperature and blood flow, helping you walk efficiently without damaging your performance.

## **JUST WALK**

Then walk! Think about your gait: try to be graceful and efficient maintaining a good posture. Reflect on the ideas of Steven Sashen and all of the skills that your daily mindful walking has taught you. However, remember that this is all about enjoying the mountains! Look around you. Soak in where you are and what you can see. Use

an easy pace and gait that you can maintain for the long haul. Enjoy where you are and what you are doing. Hopefully if you apply the ideas in this book then there will be fewer things to distract you from all of the joy that the hills can give you.

## **AND ENJOY IT**

Because when you enjoy it walking is easier! Grin and Bare it - smile your way up the hill! Plodding up an endless hillside after a series of depressing false summits you feel finished - the tank is empty and you feel drained! But then you look up and see the slope ease and the summit is in view. Your pace quickens....it all feels easier! There is still power in you legs. What changed? New research is shedding light on what really causes fatigue and what we can do to keep it at bay and keep going, with some important lessons for hillwalkers and backpackers.

## **RUNNING ON EMPTY**

The traditional understanding is that exhaustion results from physical factors e.g. limited delivery of oxygen and fuel to the muscles decreased blood flow to the brain, which mean that muscles are no longer able to generate power, no matter how hard you try.

A group of exercise scientists, led by Dr Samuele Marcora, recently examined these assumptions. They got some fit students to test the maximum power that they could generate on a bike in a 5 second burst. Then they asked them to cycle hard to exhaustion – a point when they just couldn't carry on any more. Immediately – 1 second later - the students' maximum power was tested again and strangely despite the exhaustion they were able to push out significant power! That 1 second was nowhere near enough to allow the muscles to recover and refuel. What was going on?

## **GIVING UP OR GIVING OUT?**

Dr Marcora believes that the only explanation is psychological. In his “psychobiological” model of exhaustion, it is not how hard something is but how hard it feels. The key is perception of effort. We don't become exhausted because physical factors stop us moving but because it feels too hard to go on. The brain

kicks in a safety mechanism to protect you from harm. Psychologically you disengage from the task....practically you give up.

He has further tested this theory by looking at how exhaustion is affected by factors that make effort seem harder. Mental fatigue and lack of sleep for example make things feel harder so we stop sooner despite physically being able to go on. Similarly racing a competitor or taking caffeine can make things seem easier and keep going longer.

## **HILLWALKING SO IT FEELS EASIER**

How do we apply this to our hillwalking? In an email to me Dr Marcora stressed that training is still important! When you are stronger, well conditioned and walking with an efficient technique it will feel easier. Other factors also have a role - getting enough sleep and minimising stress for example. Think about who you are walking with too – if your friends are fitter and zooming ahead that might make things seem harder for you, bringing on exhaustion as you choose to give up sooner.

## **DON'T FROWN!**

One intriguing line of research that Dr Marcora is pursuing is looking at facial expressions. Perception of effort is quite subjective and hard to measure but in a recent study he has found that as exercise starts to feel harder people start to frown. Working backwards it also seems that learning to frown less makes the exercise seem easier. Smiling works even better. Next time you are struggling up a mountain and sense a frown, relax your face, smile and see if suddenly it seems a bit easier!

## **BACK TO THE BEGINNING**

So we have come full circle – I started off talking about enjoyment and that is where we finish. Being fitter lets you have more fun in the hills. And having fun really does make it feel easier!

**CHAPTER SUMMARY**

*Remember it is all about enjoying your days on the hill. Set things up so that it will feel easier: sleep, rest, recover and eat well. Build mobility and balance work into daily life. Stay active. Crawl around. Do some strength training but schedule it so that you recover before you hit the hill.*

*Now go and have some fun!*

## REFERENCES

These are just a few of the studies and pieces of research that are referred to in the text. Where possible I've given the link to the study so you can read more. However in this day and age, Google is your friend! Use it to search out the information and ideas that you want to study. Lots of scientific research is available via pubmed and increasingly research is published in open access journals too so you can read the whole study.

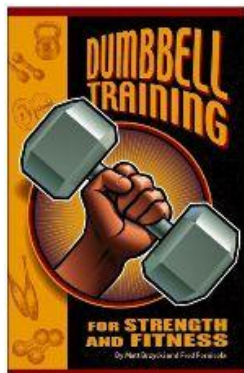
I've not put a load of references in the text; for a reason why, I will quote Matt Stone of [180 Degree Health](#) in his book [Diet Recovery 2](#)

*What you may be surprised NOT to see in this book is hundreds of studies referenced. This is actually a cheap and weak tactic used by many in the health field to falsely give their theories credibility. This book is not written on Pubmed crutches. Anybody can snoop around Pubmed or something similar looking to validate a theory. It is time-consuming, and fairly pointless, but it looks impressive to those who are blown away by the number of footnotes in front of them. ....I speak more in terms of basics, common sense, experience (personal and of others) and what just flat out works!*

That being said, I've collected a few resources that you might find useful background.

## BOOKS

### [Dumbbell Training for Strength and Fitness](#)



Fred Fornicola in this book outlines some simple straightforward dumbbell exercises and puts them together in basic routines. The principles he applies are those that we have examined in this booklet – safe, effective and intense exercise.

You can order the book directly from Fred through his website: [http://www.premierepersonalfitness.com/products\\_books\\_dumbbell\\_training.php](http://www.premierepersonalfitness.com/products_books_dumbbell_training.php)

[Congruent Exercise](#) by Bill DeSimone

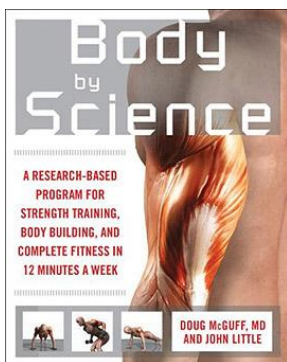


"Your workout shouldn't hurt' Weight training has undeniable benefits: improved muscle tone, strength, and self-esteem, to start. But experience shows that with those benefits come the risk of joint aches, injuries, and accidents. Can you get the benefits of weight training with less risk to your shoulders, back, and knees? Yes, and Congruent Exercise shows you how. You will discover: How the conventional wisdom in the gym compares to proper muscle and joint function; how to perform both home and gym exercises to minimize the risk of injury, while making your effort more productive; the biomechanics of why and how that works."

**Contact Bill DeSimone to find out more about this excellent resource:** email him at [optimalexercise@comcast.net](mailto:optimalexercise@comcast.net) with "Congruent Exercise" as the subject line. Bill posts updates and excerpts at [www.facebook.com/CongruentExercise](http://www.facebook.com/CongruentExercise)

[The book is available from Amazon](#)

### [Body by Science](#)



In Body By Science, bodybuilding powerhouse John Little teams up with fitness medicine expert Dr. Doug McGuff to present a scientifically proven formula for maximizing muscle development in just 12 minutes a week. Backed by rigorous research, the authors prescribe a weekly high-intensity program for increasing strength, revving metabolism, and building muscle for a total fitness experience.

[The Body by Science website is here](#) with some great articles and information.

## **CONTRIBUTORS**

<http://www.bettermovement.org/> Todd Hargrove

<http://tasfitness.blogspot.co.uk/> Tim Anderson

<http://congruentexercise.blogspot.co.uk/> Bill DeSimone

<http://skylertanner.com/> Skyler Tanner

<http://xeroshoes.com/author/steven/> Steven Sashen

<http://jamessteeleii.blogspot.co.uk/> James Steele II

<http://www.kylehuntfitness.com/> Kyle Hunt

<http://www.edinburghdtm.com/> Colin Gordon

**FAVOURITE HILLWALKING BLOGS**

<http://tracksterman.tumblr.com/> Tracksterman

<http://tramlite.com/> Colin Ibbotson

<http://www.summitandvalley.com/> Martin Rye

<http://stevenfallon.blogspot.co.uk/> Steven Fallon

<http://tms.nickbramhall.com/blog/> Nick Bramhall

<http://www.petesy.co.uk/> Peter MacFarlane

**OTHER USEFUL BLOGS**

Check out some of the useful blogs that examine the science too, such as

<http://alanaragon.com/> Alan Aragon

<http://anthonycolpo.com/> Anthony Colpo

<http://www.anti-agingfirewalls.com/> Anti-Aging Firewalls

<http://carbsanity.blogspot.ca/> The Carbsane Asylum

<http://blog.cholesterol-and-health.com/> The Daily Lipid

<http://conditioningresearch.blogspot.ca/> Conditioning Research

<http://www.ergo-log.com/> Ergo Log

<http://examine.com/supplements/> Examine

<http://gokaleo.com/> Go Kaleo

<http://healthcorrelator.blogspot.com/> Health Correlator

<http://huntgatherlove.com/> Hunt Gather Love

<http://paindatabase.com/> Pain Database

<http://saveyourself.ca/> Paul Ingraham

<http://thescienceofnutrition.wordpress.com/> The Science Of Nutrition

<http://suppiversity.blogspot.ca/> Suppiversity

<http://weightology.net/> Weightology

<http://wholehealthsource.blogspot.ca/> Whole Health Source

<http://www.thebodymechanic.ca/> Greg Lehman

## IDEAS FROM THE TEXT

Colin Gordon and I have discussed the importance of strength in several conversations. Check his blog post at <http://www.edinburghdtm.com/blog/2011/03/a-week-in-exercise/>.

*Building Muscle Doesn't Require Lifting Heavy Weights, Study Shows.*  
<http://www.sciencedaily.com/releases/2010/08/100811125943.htm>

*Current gym dogma holds that to build muscle size you need to lift heavy weights. However, a new study conducted at McMaster University has shown that a similar degree of muscle building can be achieved by using lighter weights. The secret is to pump iron until you reach muscle fatigue.*

The full research is at Burd et al. "Low-Load High Volume Resistance Exercise Stimulates Muscle Protein Synthesis More Than High-Load Low Volume Resistance Exercise in Young Men". *PLoS ONE* (2010); 5(8): e12033 DOI: 10.1371/journal.pone.0012033

## STRENGTH TRAINING

**Resistance Training to Momentary Muscular Failure Improves Cardiovascular Fitness in Humans: A Review of Acute Physiological Responses and Chronic Physiological Adaptations.**

Steele J, Fisher J, McGuff D, Bruce-Low S, Smith D. Resistance Training to Momentary Muscular Failure Improves Cardiovascular Fitness in Humans: A Review of Acute Physiological Responses and Chronic Physiological Adaptations. *JEPonline* 2012;15(3):53-80.

Research demonstrates resistance training produces significant improvement in cardiovascular fitness (VO2 max, economy of movement). To date no review article has considered the underlying physiological mechanisms that might support such improvements. This article is a comprehensive, systematic narrative review of the literature surrounding the area of resistance training, cardiovascular fitness and the acute responses and chronic adaptations it produces. The primary concern with existing research is the lack of clarity and inappropriate quantification of resistance training intensity. Thus, an important consideration of this review is the effect of intensity. The acute metabolic and

molecular responses to resistance training to momentary muscular failure do not differ from that of traditional endurance training. Myocardial function appears to be maintained, perhaps enhanced, in acute response to high intensity resistance training, and contraction intensity appears to mediate the acute vascular response to resistance training. The results of chronic physiological adaptations demonstrate that resistance training to momentary muscular failure produces a number of physiological adaptations, which may facilitate the observed improvements in cardiovascular fitness. The adaptations may include an increase in mitochondrial enzymes, mitochondrial proliferation, phenotypic conversion from type Ix towards type IIa muscle fibers, and vascular remodeling (including capillarization). Resistance training to momentary muscular failure causes sufficient acute stimuli to produce chronic physiological adaptations that enhance cardiovascular fitness. This review appears to be the first to present this conclusion and, therefore, it may help stimulate a changing paradigm addressing the misnomer of 'cardiovascular' exercise as being determined by modality.

Key Words: Aerobic, Metabolic, Molecular, Myocardial

### Evidence-Based Resistance Training Recommendations

Fisher J., Steele J., Bruce-Low S., Smith D.

*Medicina Sportiva* (2011); **15**(3): 147-162.

#### **Abstract**

Resistance training produces an array of health benefits, as well as the potential to promote muscular adaptations of strength, size, power and endurance. The American College of Sports Medicine (ACSM) regularly publish a position stand making recommendations for optimal achievement of the desired training goals. However, the most recent position stand (as well as previous ones) has come under heavy criticism for misrepresentation of research, lack of evidence and author bias. Therefore this paper proposes a set of scientifically rigorous resistance training guidelines, reviewing and summarising the relevant research for the purpose of proposing more logical, evidence-based training advice. **We recommend that appreciably the same muscular strength and endurance adaptations can be attained by performing a single set of ~8-12 repetitions to momentary muscular failure, at a repetition duration that maintains muscular tension throughout the entire range of motion, for most major muscle groups once or twice each week.** All resistance types (e.g. free-weights, resistance machines, bodyweight, etc.) show potential for increases in strength, with no significant difference between them, although resistance machines appear to pose a lower risk of injury. There is a lack of evidence to suggest that balance from free weights or use of unstable surfaces shows any transference to sporting improvement, and explosive movements are also not recommended as they present a high injury risk and no greater benefit than slow, controlled weight

training. Finally, we consider genetic factors in relation to body type and growth potential.

[A Critical Analysis Of The ACSM Position Stand On Resistance Training: Insufficient Evidence To Support Recommended Training Protocols](#)

Carpinelli RN, Otto RM, Winett RA

*Journal of Exercise Physiology online* (2004); 7(3): 1-60.

**Abstract**

In February 2002, the American College of Sports Medicine (ACSM) published a Position Stand entitled Progression Models in Resistance Training for Healthy Adults. The ACSM claims that the programmed manipulation of resistance-training protocols such as the training modality, repetition duration, range of repetitions, number of sets, and frequency of training will differentially affect specific physiological adaptations such as muscular strength, hypertrophy, power, and endurance. The ACSM also asserts that for progression in healthy adults, the programs for intermediate, advanced, and elite trainees must be different from those prescribed for novices. An objective evaluation of the resistance-training studies shows that these claims are primarily unsubstantiated. **In fact, the preponderance of resistance-training studies suggest that simple, low-volume, time-efficient, resistance training is just as effective for increasing muscular strength, hypertrophy, power, and endurance—regardless of training experience—as are the complex, high-volume, time-consuming protocols that are recommended in the Position Stand.** This document examines the basis for many of the claims in the Position Stand and provides an objective review of the resistance training literature.

[The role of skeletal muscle glycogen breakdown for regulation of insulin sensitivity by exercise.](#)

Jensen J, Rustad PI, Kolnes AJ, Lai YC.

*Frontiers in Physiology.* (2011);2: 112. Epub 2011 Dec 30. doi: 10.3389/fphys.2011.00112

**Abstract**

Glycogen is the storage form of carbohydrates in mammals. In humans the majority of glycogen is stored in skeletal muscles (~500 g) and the liver (~100 g). Food is supplied in larger meals, but the blood glucose concentration has to be kept within narrow limits to survive and stay healthy. Therefore, the body has to cope with periods of excess carbohydrates and periods without supplementation. Healthy persons remove blood glucose rapidly when glucose is in excess, but insulin-stimulated glucose disposal is reduced in insulin resistant and type 2 diabetic subjects. During a hyperinsulinemic euglycemic clamp, 70-90% of glucose disposal will be stored as muscle glycogen in healthy subjects. The glycogen stores in skeletal muscles are limited because an efficient

feedback-mediated inhibition of glycogen synthase prevents accumulation. De novo lipid synthesis can contribute to glucose disposal when glycogen stores are filled. Exercise physiologists normally consider glycogen's main function as energy substrate. Glycogen is the main energy substrate during exercise intensity above 70% of maximal oxygen uptake ([Formula: see text]) and fatigue develops when the glycogen stores are depleted in the active muscles. After exercise, the rate of glycogen synthesis is increased to replete glycogen stores, and blood glucose is the substrate. Indeed insulin-stimulated glucose uptake and glycogen synthesis is elevated after exercise, which, from an evolutionary point of view, will favour glycogen repletion and preparation for new "fight or flight" events. In the modern society, the reduced glycogen stores in skeletal muscles after exercise allows carbohydrates to be stored as muscle glycogen and prevents that glucose is channelled to de novo lipid synthesis, which over time will causes ectopic fat accumulation and insulin resistance. The reduction of skeletal muscle glycogen after exercise allows a healthy storage of carbohydrates after meals and prevents development of type 2 diabetes.

#### [Exercise restores leptin sensitivity](#)

Ropelle ER, Flores MB, Cintra DE, Rocha GZ, Pauli JR, et al.

IL-6 and IL-10 Anti-Inflammatory Activity Links Exercise to Hypothalamic Insulin and Leptin Sensitivity through IKK $\beta$  and ER Stress Inhibition.

*PLoS Biology* (2010); **8**(8): e1000465 DOI: 10.1371/journal.pbio.1000465

Reported in Science Daily here: [Exercising Restores Sensitivity of Neurons That Make One Feel Full](#)

#### **Abstract**

Overnutrition caused by overeating is associated with insulin and leptin resistance through IKK $\beta$  activation and endoplasmic reticulum (ER) stress in the hypothalamus. Here we show that physical exercise suppresses hyperphagia and associated hypothalamic IKK $\beta$ /NF- $\kappa$ B activation by a mechanism dependent upon the pro-inflammatory cytokine interleukin (IL)-6. The disruption of hypothalamic-specific IL-6 action blocked the beneficial effects of exercise on the re-balance of food intake and insulin and leptin resistance. This molecular mechanism, mediated by physical activity, involves the anti-inflammatory protein IL-10, a core inhibitor of IKK $\beta$ /NF- $\kappa$ B signalling and ER stress. We report that exercise and recombinant IL-6 requires IL-10 expression to suppress hyperphagia-related obesity. Moreover, in contrast to control mice, exercise failed to reverse the pharmacological activation of IKK $\beta$  and ER stress in C3H/HeJ mice deficient in hypothalamic IL-6 and IL-10 signalling. Hence, inflammatory signalling in the hypothalamus links beneficial physiological effects of exercise to the central action of insulin and leptin.

## **BALANCE**

### **Below-knee cast or aircast best for faster recovery from severe ankle sprain**

Acute ankle sprain accounts for between 3% and 5% of all UK emergency department attendances: around 1-1.5 million per year.

### **Ankle Sprains: An Uphill Battle**

Interestingly, what makes a runner more likely to experience another sprain after the initial injury isn't so much weakness, but a sensory issue. "After someone has suffered an ankle sprain, not only is the ligament structurally injured, the sensory receptors in the ligament are also damaged," says Dr. Hertel. Those receptors are responsible for proprioception, which is a function of the nervous system that helps a runner sense where the foot is in relation to the ground.

### **The Effectiveness of a Balance Training Intervention in Reducing the Incidence of Noncontact Ankle Sprains in High School Football Players**

Conclusion: The increased risk of a noncontact inversion ankle sprain associated with a high body mass index and a previous ankle sprain was eliminated by the balance training intervention.

### **How to Fix Bad Ankles**

When you damage the ligament, "you damage the neuro-receptors as well. Your brain no longer receives reliable signals" from the ankle about how your ankle and foot are positioned in relation to the ground. Your proprioception — your sense of your body's position in space — is impaired. You're less stable and more prone to falling over and re-injuring yourself.

## **GREEN EXERCISE**

J. Barton, M. Griffin and J. Pretty. [Exercise, Nature and Socially Interactive Based Initiatives Improve Mood and Self-esteem in the Clinical Population](#)

**Conclusions:** Green exercise as a health-promoting initiative for people

experiencing mental ill health is equally as effective as existing programmes. Combining exercise, nature and social components in future initiatives may play a key role in managing and supporting recovery from mental ill health, suggesting a potential 'green' approach to mental healthcare and promotion.

#### **Does Participating in Physical Activity in Outdoor Natural Environments Have a Greater Effect on Physical and Mental Wellbeing than Physical Activity Indoors? A Systematic Review.**

Compared with exercising indoors, exercising in natural environments was associated with greater feelings of revitalization and positive engagement, decreases in tension, confusion, anger, and depression, and increased energy.

#### **What is the Best Dose of Nature and Green Exercise for Improving Mental Health? A Multi-Study Analysis.**

Dose responses for both intensity and duration showed large benefits from short engagements in green exercise, and then diminishing but still positive returns. Every green environment improved both self-esteem and mood; the presence of water generated greater effects. Both men and women had similar improvements in self-esteem after green exercise, though men showed a difference for mood.

- "Dose responses for both intensity and duration showed large benefits from short engagements in green exercise, and then diminishing but still positive returns," they wrote. It appears the effect was even greater in the presence of water, such as a lake, stream or pond, so perhaps it would be more accurate to say that the most beneficial environment is a blue and green one. Exposure duration: both self-esteem and mood showed greatest changes for the least duration (5 min), both showed smaller positive improvements for <1 h and half-day activities, and both increased for whole-day activities.

#### **Science Suggests Access To Nature Is Essential To Human Health**

Elderly adults tend to live longer if their homes are near a park or other green space, regardless of their social or economic status. College students do better on cognitive tests when their dorm windows view natural settings. Children with ADHD have fewer symptoms after outdoor activities in lush environments. Residents of public housing complexes report better family interactions when they live near trees.



Humans living in landscapes that lack trees or other natural features undergo patterns of social, psychological and physical breakdown that are strikingly similar to those observed in other animals that have been deprived of their natural habitat

## Eyesight

A new analysis of recent eye health studies shows that more time spent outdoors is related to reduced rates of nearsightedness, also known as myopia, in children and adolescents. (American Academy of Ophthalmology. "More time outdoors may reduce kids' risk for nearsightedness, research suggests." ScienceDaily, 24 Oct. 2011. Web. 24 Oct. 2011.)

## STRETCHING RESEARCH

THACKER, S. B., J. GILCHRIST, D. F. STROUP, and C. D. KIMSEY, JR. [The Impact of Stretching on Sports Injury Risk: A Systematic Review of the Literature](#). Med. Sci. Sports Exerc., Vol. 36, No. 3, pp. 371-378, 2004.

Herbert RD, de Noronha M, Kamper SJ. [Stretching to prevent or reduce muscle soreness after exercise](#). Cochrane Database of Systematic Reviews 2011, Issue 7. Art. No.: CD004577. DOI: 10.1002/14651858.CD004577.pub3

[Stretching before or after exercise does not reduce delayed-onset muscle soreness](#) Br J Sports Med bjsports-2011-090599Published Online First: 17 October 2011

4. Jason Winchester et al. [Static Stretching Impairs Sprint Performance in Collegiate Track and Field Athletes](#) Journal of Strength & Conditioning Research: January 2008 - Volume 22 - Issue 1 - pp 13-19 doi: 10.1519/JSC.0b013e31815ef202

## PSYCHOLOGICAL LIMITS TO PERFORMANCE

[The limit to exercise tolerance in humans: mind over muscle?](#) - Marcora SM, Staiano W. Eur J Appl Physiol. 2010 Jul;109(4):763-70. Epub 2010 Mar 11.

[The face of effort: frowning muscle activity reflects effort during a physical task](#) de Morree HM, Marcora SM. Biol Psychol. 2010 Dec;85(3):377-82. Epub 2010 Sep 9.

