

Chapter 2

Principles of Physical Conditioning

In the Beginning...

In order to understand why and how we can improve our fitness, it's helpful to think about a different time. Whether we believe in evolution or creation or some combination of the two, our bodies were designed for living off the land through periods of feast and famine, the changing seasons, and a general lack of medical care.

Not that long ago, food was hard to come by. Hunting involved confrontation with animals intent on staying alive, making it dangerous work. Food bearing plants attracted other people intent on keeping the bounty to themselves. In the absence of cooperation, fighting could ensue, leaving the victors with the spoils and the vanquished hungry.

When times got tough, we needed a way to get better at hunting or fighting while keeping our need for food to a minimum. We also needed a way to store up during the good times in preparation for the bad.

So, our bodies ended up with the ability to get stronger and faster so that we could work harder and longer as the need arose. When physical demands were easier, our bodies could scale back to reduce our need for food while storing excess energy for use in the future. This reduced the need to put ourselves at risk.



Our food wasn't always "ready to eat."

Our legacy of this adaptable physiology is that we get weaker with the inactivity that comes with modern life, shedding unneeded muscle, bone, and blood until we are shells of our ancestral capabilities. We are also predisposed to store the excess calories that are so readily available to us, making us fatter than we could have ever gotten under the harsher conditions of history.

Make a Plan

The good news is that you can use this adaptability to your advantage. Increase your activity, and your muscles and bones get stronger and more functional. Create a caloric deficit, and you will gradually deplete your stores of fat.

Of course, fitness is just not as easy as this sounds. The mental effort required to *choose* to exercise day after day after day can be difficult to summon, and the physical discomfort of forcing your body to *consume itself* can be unbearable.

The best way to help with both is to have a plan, including a set schedule of exercise and recovery, goals to achieve, and checkpoints along the way. This reduces your choice, which reduces the chance you will choose to cut back, take an unneeded day off, or quit altogether. Every day, you already know what needs to get done, and you've scheduled your day accordingly.

This plan also helps you to organize the rest of your life around your exercise. Though certainly times will come where exercise is not your top priority, those times can be reduced with enough forethought and creative scheduling.

Progressive Overload Training

Let's start with a definition of what we're trying to do when we want to increase our fitness, whether it's cardiovascular fitness, strength, speed, whatever. It's called *Progressive Overload Training*, and it helps to break the phrase down in reverse.



Fitness programs should incorporate exercises that mimic functional movements in your desired activity.
(left, Vadim Ternovski)

The "training" part means that we're performing activities with the purpose of improving our fitness. We set aside time from our day to exercise. We join a health club or a running group or a swim team. We expend effort and endure discomfort short term to see long term results.

The "overload" part means that we are asking our bodies to do more than

they are usually required to do in a normal day. Our bodies respond to this overload by increasing fitness to better handle the same load in the future. Two ways that we can overload our bodies are with a higher intensity (e.g., run faster or lift heavier weights) or with a higher volume (e.g., run farther or lift more frequently).

The "progressive" part means that we are gradually increasing the amount that we do each day over the long term. This does not mean that we increase the amount every time we work out. Rather, we attempt to achieve a new level of performance over an extended period of time, measured best in months and years rather than in days and weeks.

The SAID Principle

The *SAID Principle*, or *Specific Adaptation to Imposed Demands*, refers to how precisely our bodies adapt to the stresses they endure. The process of tanning is the perfect example of SAID. Stay in the sun long enough, and the skin will respond by increasing its pigment.

However, this pigmentation occurs only within those areas receiving sunlight and in correlation to the amount of exposure. A razor-thin line delineates areas of differing exposure, such as from wearing a bathing suit.

The body's response to training is very specific, much like the skin's response to sunlight. Cycling improves our abilities at cycling, running improves our abilities to run, and lifting improves our abilities to lift, etc., more than for any other activity. So, the best way to get better at anything is to do lots of that specific thing (e.g., more diving).

Of course, we know that we can supplement our direct participation in a sport with other types of training. The SAID Principle, however, tells us that exercises that mimic motions in our sport will have the greatest impact on our performance. This is important to keep in mind as divers, since we have distinct needs for our fitness. We need muscular strength to manage our gear, and we need a robust circulatory system to efficiently decompress. This is why the best divers dedicate training time to lifting weights *and* stressing the cardiovascular system.

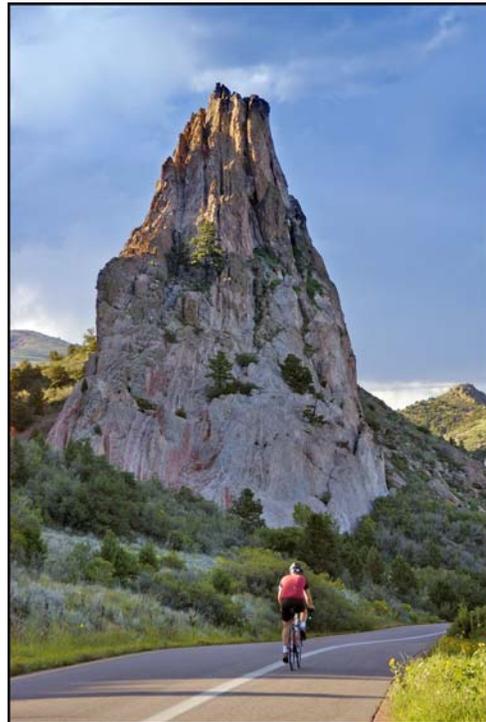
Strength vs. Endurance

What specific exercises constitute strength training and what constitute endurance training? This is actually a continuum, since every exercise will both strengthen and improve endurance. However, some exercises emphasize one over the other, and we ideally want to include both since they complement each other.

Strength training is a term which describes any kind of training that is done with the purpose of increasing the maximum power that a muscle can achieve. Obviously, weight training is a part of this, but activities like sprinting, plyometrics, and hill running can also be considered strength training. They all share in common an emphasis on short, high intensity muscle contractions, and they all will result in an increase in maximum power.

Endurance training is a term which describes any kind of training that is done with the purpose of increasing a muscle's resistance to fatigue. More relevantly, exercise that uses large muscle groups for extended periods of time are typically considered *cardiovascular* endurance training. The same physiological changes that occur as a result of increased cardiovascular fitness have a significant impact on our decompression (see **Chapter 5 – Cardiovascular Conditioning and Dive Safety**).

This is where the swimming, cycling, running, etc., play an important role. We care not only about increasing our legs' resistance to fatigue, for example, but we also care about conditioning our hearts and lungs. Curling dumbbells isn't going to do much to affect this, since small muscle groups like your biceps will fatigue before becoming a great burden on your cardiovascular system. That's why it takes repetitive use of large muscle groups, such as your legs in cycling, as well as



A hilly ride is a great way to improve both muscular strength and endurance.

multiple muscle groups working together, such as in swimming, to improve our cardiovascular systems.

Can we develop strength along with endurance? Absolutely, and that's exactly what we're going for when we incorporate weight lifting into our cardiovascular training programs.

Choosing an Activity

Enthusiasts endlessly debate which activity is "the best" for developing fitness, but they're missing the point. Until you get to a competitive level, your cardiovascular fitness depends more



The best sport for building your fitness is whatever sport you are willing to do consistently.

on the amount of time and consistency of effort spent exercising rather than on how you choose to do it. The SAID Principle dictates only that we must stress our hearts and lungs to improve our cardiovascular fitness. Thus, the activity that will result in the fastest and most lasting gains in fitness will be the one that you enjoy doing most.

Cross-training can help to alleviate the boredom of a routine. However, if you are beginning a new exercise program, focus on one sport until you develop a good base of fitness before branching out into other activities. Besides, a good program involves many different types of workouts with frequent changes in schedule regardless of the sport.

Adaptation vs. Habituation

In response to a new stress, your body responds through *adaptation*. That is, your body adapts your physiology to make future encounters with the new stress easier to handle. This process requires additional sources of energy and nutrition. It also expends resources that might be utilized in other ways, such as for energy stores in preparation for famine (i.e., body fat). As such, adaptation is a costly process that the body will use sparingly.

Your body is programmed to recognize patterns. This holds for poetry and music, plaids and checkerboards, and it holds for exercise routines, too. If your exercise schedule is the same from day to day or week to week, your body will begin to recognize that pattern. At a primal level, your body realizes that if you made it through last week, then you can make it through the next without the need for any further increases in fitness. Your body will then reduce the rate of adaptation until it achieves a level of maintenance. This is known as *habituation* and is responsible for the plateau that typically happens eight to twelve weeks into a new exercise routine.

The key to progressing your fitness over the long term is to *avoid habituation by avoiding exercise patterns*. By continually changing your exercise, you can perpetually remain in a state of adaptation, seeing your fitness increase month after month, year after year.

In other words, a little extra mental effort in planning can result in greater gains in fitness for the same amount of physical effort.

Exercise Makes Us Weaker

Exercise makes us weaker. It depletes us of energy and nutrients and damages our muscles, bones, and connective tissues. It puts us in a state that is vulnerable and unsustainable.

In response, the body stores additional calories in the muscles and liver, where it is more readily available for use. It reinforces the fibers of muscles and connective tissues, and it lays down additional matrix in the bones. This process can only happen with rest.

Recovery Makes Us Stronger

When we rest, we heal. Our energy and nutrient levels are best restored when they are in low demand. Our muscles and bones heal best when they are unstressed.

If your exercise has provided the right amount of stress, then your recovery will result in an incremental increase in fitness. Cut that recovery short, however, and you will not allow your body to adapt to the stress. Microtrauma will accumulate until your fitness backslides with fatigue, injury, or even illness. This is known as *overtraining*, which can be just as damaging to our health as undertraining.

Of course, this cycle of exercise and recovery needs to occur within a certain range. We still need activity nearly every day to maintain an elevated metabolism favorable to ongoing gains in fitness. We just need to make sure that our schedule is in balance, that our activity is matched with the right amount of recovery without disrupting our momentum.

Frank Aponte, a diver and triathlete, paraphrases Confucius when speaking about this balance. "Training without rest is labor lost. Rest without training is perilous."

Microcycles and Macrocycles

There are two basic ways to vary an exercise program in order to leverage both the principle of adaptation and the principle of recovery. Short-term variations in an exercise program are called *microcycles*, while long-term variations are called *macrocycles*.

Microcycles are the variations of a typical exercise week. Instead of waking up every morning and doing the same run followed by the same eight strength exercises, you change from day to day. One day you might run three miles. The next day might focus on leg strength. The next might be a five mile run. The next might focus on core strength.

Each day's change in exercise focus gives the body a new stress to adapt to while providing a chance for the body to recover from the previous stress. In the example above, your body is recovering from your five mile run as you condition your core muscles.

Microcycles can be expanded to include changes in exercise from week to week. While you might do step ups, leg extension, and leg curl one week to strengthen your upper legs, you could vary your plan by doing bench squats, standing lunges, and bridges the next week. In fact, every chance to avoid a routine set of exercises should be exploited.

Macrocycles are variations on a greater scale, often referred to as *periodization*. A training season might be separated into periods lasting several weeks or months, with each period having a different fitness focus and intensity level.

In this guide, you will begin with an *acclimation phase* easing you into a new level of cardiovascular and strength training. This is followed by a *build phase* emphasizing increases in strength training intensity. The next phase, called the *endurance phase*, utilizes your strength gains to improve your cardiovascular conditioning. The final phase is the *recovery phase*, in which the overall intensity of training is reduced to promote recuperation for both your body and mind.

Microcycles and macrocycles work together to keep your fitness moving forward in part by minimizing repetition, thereby minimizing habituation. Additionally, by moving through periods of generalized and specialized training, you can generate new capabilities while maintaining what you already have gained.

Varying Cardiovascular Intensity

Certainly, varying specific strength training exercises is an obvious way to cycle our training, but how can we vary our cardiovascular training other than by changing our training times or distances?

While training *volume*, or the measure of how much cardiovascular exercise we get, certainly plays a large role in developing our fitness, training *intensity* seems to have an equally important role. If you achieve a certain level of cardiovascular fitness and then reduce your training intensity, you will see measurable reductions in your capabilities. However, if you maintain your training intensity, yet reduce the volume, you can maintain your cardiovascular fitness for months.

Though it might appear that we should maximize our training intensity each workout, we can't just go out and race every day. Our bodies can't tolerate that level of accumulated stress. Instead, we need to achieve a high level of training intensity in short, meaningful periods within a workout that we can otherwise tolerate. This is generally accomplished through three different types of cardiovascular workouts: *interval training*, *tempo training*, and *LSD training*.



Running 400-meter sprints is one of most challenging forms of interval training.

Interval Training

Interval training alternates set periods of high intensity and recovery. This cycle allows us to exercise at much higher levels than we could sustain continuously, albeit for short periods of time. While intervals can range from several seconds to several minutes, longer intervals are just what we need to create the type of fitness we desire as divers.

Tempo Training

Tempo training falls between interval and LSD training, consisting of sustained, moderately high intensity. At the peak of your conditioning, tempo training should be performed at 80-85% of your maximum heart rate, or a 7 or 8 on the RPE scale.

In short, tempo training conditions your body to efficiently process metabolic wastes while delivering energy to the muscles at a high rate.

LSD Training

Long, slow distance training, or *LSD*, represents the fundamental workout in building cardiovascular endurance. This is where your cardiovascular system is forced to work for the longest time during your program. You train your body to spare your glycogen stores and burn fat more easily.

LSD training also conditions your muscles to emphasize the use of slow twitch muscle fibers over fast twitch muscle fibers. The importance of this effect for divers is covered in greater detail in **Chapter 5- Cardiovascular Conditioning and Dive Safety**.

LSD training should be at a minimum of 70% of your maximum heart rate, or a 5 or 6 on the RPE scale, but generally not more than 80% of your maximum heart rate. The emphasis of LSD training is in sustained, low stress cardiovascular effort, not on speed.

How do we know how hard to work?

In order to plan our workouts, we need some way of measuring our intensity. The two most readily available methods are the *RPE scale* and *heart rate training*. Each method is examined in **Unit 2- Cardiovascular Conditioning**.

Author's Note

This article on the principles of physical conditioning is an excerpt from **Fitness for Divers**, a book written by diver and fitness professional Cameron L. Martz. Please visit <http://www.divefitness.com> to find more information on this book and download other fitness articles written specifically for divers, including free workouts, fitness news, and training tips updated weekly.