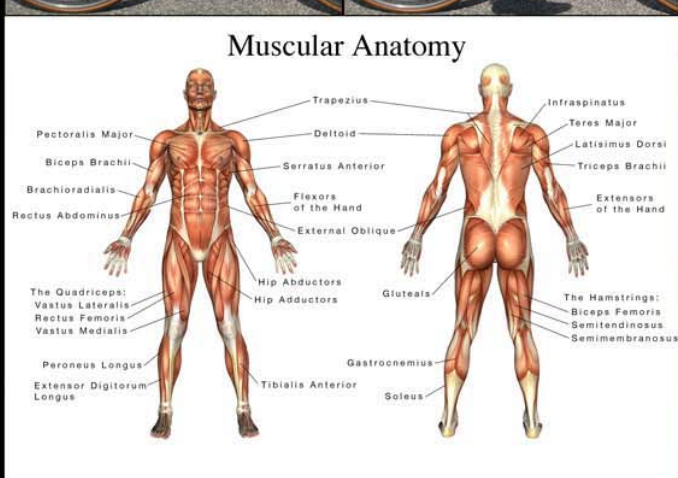
FITNESS FOR DIVERS

by Cameron L. Martz



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Cover artwork includes photo by Vadim Ternovski.

Warning

This book is about increasing diver health and safety above all. The following information is provided for educational purposes only. Use this information at your own risk. It is not intended to replace qualified medical advice. Seek approval from a physician before attempting any change in activity, and know your limits.

The workouts contained herein are guidelines, not prescriptions, and are not intended to replace the instruction of a qualified fitness professional. Complete and follow the recommendations of **Appendix A- PAR Q & YOU**.

This book and the information contained herein are not intended to instruct you about diving. No one should participate in diving without qualified instruction and successful certification.

Important Exercise Guidelines

1. Joint pain is never OK. Always be mindful of your joints, and stop immediately if you feel any joint pain.
2. Back pain is never OK. Always be mindful of your back, and stop immediately if you feel any back pain.
3. If an exercise feels odd or you are uncertain of a technique, stop immediately and seek the assistance of a qualified fitness professional.

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Introduction

Chapter 1
About This Guide

We've known for some time that exercise is important to good health. The reduced risk of heart attack and stroke, diabetes, cancer, and on and on, is reason enough to maintain a good regimen of fitness.

Recently, we've begun to reexamine the impact that our physical fitness can have on the safety and enjoyment of our diving. From handling our gear on the surface to handling problems underwater, the increased function that comes from conditioning our bodies can only make a day of diving easier. The idea of reducing our risk of decompression sickness is only icing on the cake.

Connecting the Dots

This guide is not intended to educate the reader completely on either exercise physiology or decompression physiology. Rather, it is intended to demonstrate the overlap between the two and point the path towards further knowledge. That is why the word "complete" is not in the title.

While I do attempt to provide an in-depth explanation of the physiology of fitness for divers, in the end, fitness is not rocket science. Move more, and your body will adapt to make future movement easier. *Any* fitness program involving cardiovascular and strength training can make you a healthier, safer diver.

That said, I feel that the cause and effect of physical conditioning and its impact on us specifically as divers is very interesting, and I hope most readers will agree. I have included references throughout the discussions on exercise and hyperbaric physiology, the majority of which can be found online. If you want a true understanding of what we know about these topics, I encourage you to read the original studies and draw your own conclusions from their results.

The Units

I have organized the chapters of this guide into seven units, each centered around a common topic:

> *Unit 1- Introduction*
> This unit, including this chapter, will acquaint you with a basic understanding of why we get out of shape and why we can get back in shape at any age. It also presents the need for a warm-up before exercise.

Unit 2- Cardiovascular Conditioning
The cardiovascular system arguably has the greatest impact on our bodies' ability to resist decompression sickness (DCS), or "the bends." A fit cardiovascular system can also help us to get through our days of diving with less overall fatigue, leaving more energy to enjoy the topside activities that come with vacationing in exotic locales.

This unit discusses the physiology of cardiovascular conditioning and its effect on the transfer of dissolved gas into and out of our bodies. This unit also discusses the importance and methods of measuring exercise intensity to ensure that you are working your body hard enough to improve without overdoing it.

Unit 3- Strength Training
Strong muscles and bones not only help us to carry our dive gear on the surface, they might also contribute to our resistance to DCS. This unit describes the proper way to strengthen the body, including demonstrations of the exercises used in the programs that follow in Unit 6.

Unit 4- Stretching
There are many ways to stretch each part of our bodies, all of which can give us flexibility we can use. This unit presents one such set of stretching techniques that prepare your body for the ranges of motion most often used in diving.

Unit 5- Dive Day
Our surface activities and nutrition can have direct impacts on how we handle our diving. If we are committed enough to both exercise and diving, we need to know how to organize the two around each other. We also need to know how to manage the heavy gear that comes with a day of diving without hurting ourselves. Proper lifting techniques are demonstrated in this unit, along with guidelines for exercising and eating on dive day.

Unit 6- The Programs
If you read only one unit in this book, this should be it. Following the fitness programs presented in this unit will improve your overall health while conditioning your body specifically for diving.

Unit 7- Appendices
Many readers skip chapters labeled "Appendix." However, some of the most important information can be found in this unit, including a summary of most research done on fitness and diving.

Every Dive is a Decompression Dive

While most divers think of "decompression" as extra time spent in the water to prevent the bends, all dives require decompression. It's just that most decompression performed by recreational divers is done on the surface as the gasses in their tissues return to surface pressure. Keep this in mind as you read references to decompression throughout this guide, as the information provided applies no matter how shallow you dive or how little time you stay at depth.

Mountain or Molehill

This book also contains many references to studies that show how a *lack* of fitness might increase our chance of getting bent. Any time we discuss the risk of decompression sickness, it is important to keep in mind that the overall risk of getting bent on a recreational dive is very small. Any increase in risk should be taken seriously but measured in terms of starting from that small, baseline risk.

Keep Training

While this book is about the need for consistent fitness training to be the best diver, I strongly believe that all divers should also be consistent with their dive training. The more time you get with a qualified dive instructor, the better your diving will be regardless of your fitness level. In fact, it is ultimately dive instruction and experience, not fitness, that can have the most profound impact on your safety underwater. Good physical fitness is truly important, but only as a complement to continued dive training and experience.

"Absorb What is Useful."- Bruce Lee

Some of the information in this guide is quite academic. Certain sections require an understanding of decompression and exercise physiology that is impractical to convey in one book. These sections are included to demonstrate how the various systems in our body adapt with exercise to better cope with the physics of diving.

For those readers who are more interested in getting to the point, I have made sure that the fitness programs stand alone. You do not need an understanding of decompression or exercise physiology to begin any of the programs in this book as all of the exercises are plainly described and demonstrated.

The programs are also designed to allow you to incorporate workouts from other resources and still end up with a plan that will improve your diving and overall health. There are many paths to fitness… you must chose the one that looks most interesting to you.

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.

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

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 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.

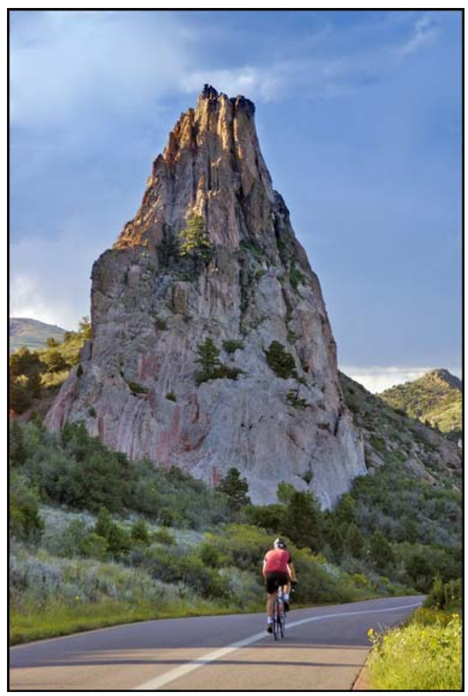
The body's response to training is very specific, much like the skin's response to sunlight. Cycling improves our abilities at cycling, running improves our abilities to run, and lifting improves our abilities to lift, etc., more than for any other activity. So, the best way to get better at anything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



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

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 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 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.

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

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.

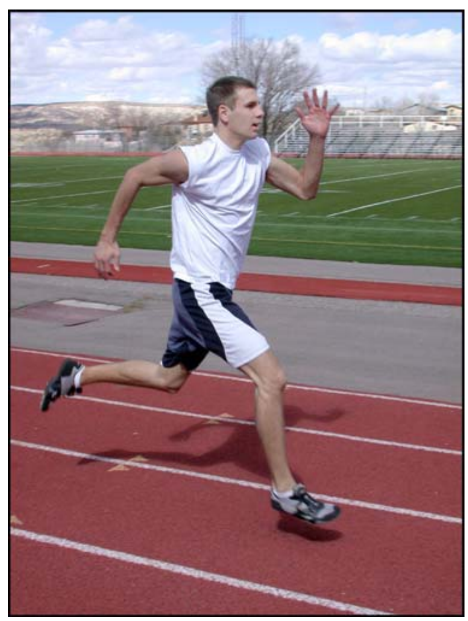
Microcycles and macrocycles work together to keep your fitness moving forward in part by minimizing repetition, thereby minimizing habituation. Additionally, by moving through periods of generalized and specialized training, you can generate new capabilities while maintaining what you already have gained.

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**.

Chapter 3
Age, Fitness, and Diving

After about 30 years of age, life gives each of us an important choice: use it or lose it. Those of us who choose to "use it" can maintain or even increase our fitness levels for decades. The rest of us fail to provide our bodies with enough activity to stave off the debilitating influence of Father Time. For example:

- Our fitness potential peaks in our mid-30s, then gradually declines until death.
- The average person gains about 3 pounds per decade starting at age 20.
- The average 60 year-old American male has a blood pressure of 140/90, where 120/70 is considered normal (Bush 1998).

Does this mean that diving becomes automatically riskier as we age? Hardly. However, while there are no upper age limits on diving, it remains prudent to consider the effects of aging on our dive safety and counter them with the appropriate amount of activity. The incidence of death in divers 50 to 70 years old is higher than average, though the primary cause is heart failure, a largely preventable disease (DAN 2004). Cardiovascular and strength training thus serve double duty in improving the quality and extent of our lives while preparing us for the diving we enjoy.

Slowing Down

When it comes to our fitness, we really live three "ages" simultaneously. Our *chronological age* is an indication of how long we've been alive. Our *biological age* is an indication of how our fitness and health compares to others of different chronological ages. Our *training age* is the length of time spent on a regular exercise program and has the greatest influence on our ability to achieve results for our efforts.

We commonly assume that the older we get chronologically, the less we will benefit from exercise. Contrarily, researchers are finding that age is no barrier to muscle adaptation, whether it be strength or endurance. Thus, the cause of age-related differences in fitness appears to be the cumulative effects of lifestyle choices. We choose to do less, and our bodies adapt. Reverse the downward trend at any age, and we will see our biological ages decrease. Maintain your activity level, and fitness becomes easier to keep over time.

Physiological Function

For most of us, the importance of fitness is not really about how fast we can run or how much we can bench press. Most immediately apparent is how our fitness levels affect our abilities to perform the basic functions of life- climbing hills or stairs, carrying the groceries, mowing the lawn, or walking the dog. The more strenuous our lifestyles, the more important our fitness becomes.

Diving is a unique activity in that we actually strive to *limit* our exertion, while the secondary benefits of our fitness remain critical to our health during and after our dives. Safe diving requires a strong heart, healthy lungs, and good perfusion of our peripheral tissues.

Though we have become conditioned to expect these things to decline as the natural course of life, we now realize that inactivity alone can account for major losses in functional level. It is common to find active people in their 50s with the measured functional level of an average 20 year old.

One of the most interesting explanations of our age-related decrease in activity comes from psychology. Some suggest that the older we get, the less we feel the need to pursue various activities that result in maintaining our fitness. We think, “been there, done that.” We look for easier ways of getting through our days, and through our wisdom, we find them.

So, declining fitness is not a natural course of life. It’s a socially accepted choice that we need to avoid, and it’s never too late to change our minds.

Most of us are familiar with the impact that exercise has on body composition, blood pressure, etc, but exercise also has some less well-known benefits. Exercise has been shown to:

- reverse hearing loss
- improve eyesight
- improve short and long term memory
- reduce arthritic pain
- improve glucose tolerance
- improve virility

This 57 year-old has the fitness level of a college athlete.

Muscle and Bone

Absolute muscle remodeling rates slow down with age. However, even 90 year olds experience the same *relative* increases in strength and endurance as younger adults. One study showed that men in their 70s who strength trained starting in their 50s had muscle size and strength equivalent to the 28 year-old researchers (Klitgaard, et al. 1990).

Training to achieve maximum peak bone mass when younger may reduce the effects of age and inactivity later. This is known as the “bone battery” concept. In other words, the higher the maximum bone density you achieve, the longer it will take for aging to lower that density below a safe threshold. This is regardless of genetic predisposition to degenerative diseases like osteoporosis.

Flexibility often decreases with age but can be improved with stretching. Again, the percentage gains achieved from a consistent stretching program remain the same across age groups.

Gas Exchange

Most significantly for diving, we see a reduction in the rate of pulmonary and peripheral gas exchange with age, but this reduction is both preventable and reversible with cardiovascular training.

VO2max, or the maximum rate at which our bodies can utilize oxygen during exercise, is the most relied upon benchmark of both cardiovascular fitness and effective decompression. While the average person experiences a 10% decline in VO2max per decade (Dehn et al. 1972, Jackson et al. 1995), research suggests that maintaining high activity levels can halt this decline entirely (Kasch 1990, Katzel et al. 2001).

Heart stroke volume decreases with age, along with a decrease in the capillary-to-muscle fiber ratio and arterial cross-sectional area. This means that less blood is flowing to the peripheral tissues (fewer capillaries), and the speed with which gasses cross into the bloodstream is reduced (which is a function of vessel cross-sectional area). Thus, tissue off-gassing is slowed, and oxygen is less effective at accelerating the decompression process.

That said, an active 65 year old has a higher level of cardiovascular function than a sedentary 30 year old (McArdle, Katch & Katch, p. 637). This difference can come from pursuing 30 minutes of focused exercise every day- hardly the schedule of an elite athlete.

Never Too Late, Never Too Early

In analyzing the best data we have to date, we see an overriding dictum. For those of us who do not participate in a consistent exercise program, neither youth nor maturity can act as an excuse for inactivity.

There is no age at which exercise is bad for you, whether you're just getting started or have been doing it your whole life. There are no exercises that are unsafe based purely on age, either. A 70 year old can follow the same program as a 30 year old when adjusted for baseline fitness.

Everyone should inform their physicians about their exercise programs, though even with significant health issues like diabetes, high blood pressure, coronary artery disease, etc., almost anyone can safely increase their activity with proper guidance. The earlier we start, though, the more benefits we achieve and the longer we can enjoy them.

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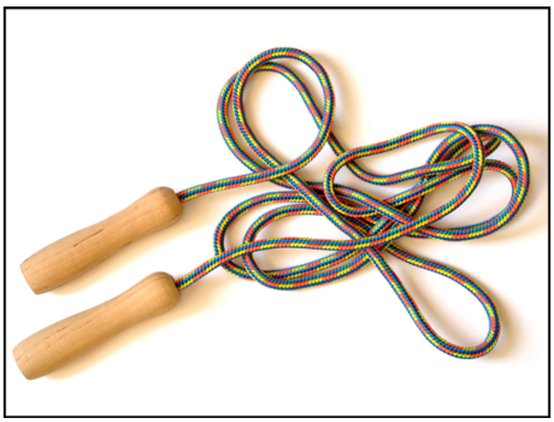
Chapter 4
Warming Up

Before we begin any discussion about exercise, we must understand the importance of the warm-up. The warm-up has to be one of the most underutilized performance enhancing techniques. Most exercisers have heard of it and many think they do it, but there is more to a warm-up than just starting out slowly.

Physiology of a Warm-Up

“Warm-up” is a literal term. As you use a muscle, its temperature increases due to the increase in chemical activity and the friction of the various fibers with each other and the surrounding tissue. This in turn reduces the viscosity of the muscle, which makes it not only more flexible, but also more efficient. In other words, a warm muscle wastes less energy than a cold muscle because it doesn't resist movement as much.



Five minutes of jumping rope will warm up all of the major muscle groups in your body.

At the cellular level, the pH of the muscles becomes more acidic with use due to the increase in metabolism. This acidity combines with the increase in temperature to accelerate the chemical reactions that take place within each muscle cell. Again, this increases the efficiency of the muscle.

At the vascular level, arterioles and capillaries open in response to the increased muscular activity. You can think of this as opening all lanes of a superhighway in preparation for rush-hour traffic.

A proper warm-up phase is necessary to get the most benefit out of each workout for two important reasons. First, it will reduce the chance of injury because the muscle is "looser" and therefore less likely to tear from stress (Safran 1988). Second, it will increase the work output of the muscle for a given energy input. You will achieve a higher level of performance during the hard part of your workout, which means that your body will have a higher quality stimulus to adapt. Simply put, you will be faster, stronger, and safer with a warm-up.

A warm-up phase also helps to prepare the mind for the task at hand, whether it be competition or a day of easy training. It can be the difference between waking up pre-dawn to the sound of a blaring alarm clock and the gentle nudges of birds chirping in the morning sun.

Warm-Up Intensity

A 1998 Canadian study (Stewart & Sleivert 1998) compared the benefits of warming up at several different intensities. Ankle and hip flexibility increased significantly at all intensities of warming up, though peak workout performance improved only in warm-ups of 60-70% relative VO2max. This level corresponds to an effort of 65-75% maximum heart rate.

That said, a warm-up involves a gradual increase in intensity, progressing from a very light effort to your target warm-up rate, eventually transitioning into your training zone. The early stages of a warm-up should feel like cheating. For new runners, this might mean that you walk the first few minutes rather than start out running.

You know you are warming up correctly if you notice gradual increases in your respiration and heart rates. You might find that you run eight steps for every breath, then six steps, then four steps by the time you reach your training phase.

Another rule of thumb is that you should find your speed is increasing without an increase in effort. This is an indication that your muscles are becoming more efficient, as described above, and your cardiovascular system is adjusting to meet their energy demands.

Warm-Up Time

There are no set standards dictating how much warm-up time is optimal. This is partially dependent upon individual physiology and partially dependent upon the type of training it precedes. You might spend 30 minutes gradually increasing your pace for a 4-hour bike ride, or 5 minutes for a 2-mile jog. The main rule of thumb is to provide your body with enough time to prepare for higher intensity without inducing fatigue.

Don’t shortchange yourself in warm-up time. Time invested in a proper warm-up will mean that you get more out of the remaining workout than you probably would by spending this time at a higher intensity.

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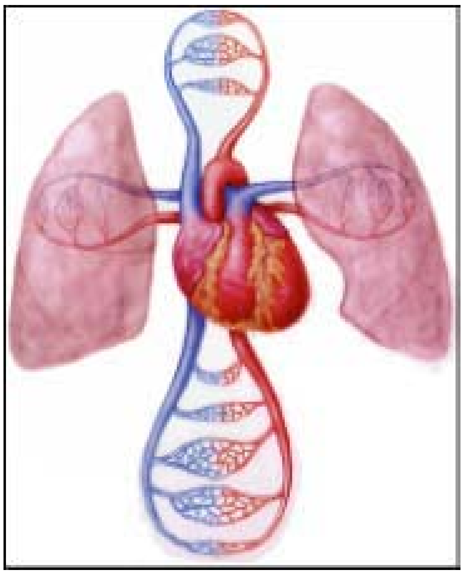
Unit 2
Cardiovascular Conditioning

Chapter 5
Cardiovascular Conditioning and Dive Safety

The Cardiovascular System

Your heart, lungs, and blood vessels constitute your *cardiovascular system*, which is responsible for carrying oxygen and nutrients to the various tissues in your body. It also carries carbon dioxide and other wastes away from your cells.



The cardiovascular system.

As every athlete knows, this system is trainable to become better and more efficient. Exercise places a demand upon the lungs to transfer more oxygen to the blood and expel more carbon dioxide than at rest. Exercise also places a demand upon the heart to deliver this oxygen-rich blood to the tissues in greater quantities and at a faster rate.

Over time, the lungs adapt to handle a greater amount of gas transfer, the heart adapts to pump larger volumes of blood, and the circulatory vessels increase in size and number to make this blood more accessible to the tissues requiring it. It just so happens that these adaptations serve the same purpose for eliminating breathing gasses during ascent from depth.

Cardiovascular Conditioning and Decompression

When you're diving, your cardiovascular system serves the additional role of equalizing the pressures of the gasses you breathe with those found in your body. At any depth below the surface, your cardiovascular system loads your tissues with a greater amount of dissolved gas (usually nitrogen and/or helium) than you have at surface pressure. This same system then removes excess gas from your tissues as you surface.

However, there is only a certain rate at which this removal can take place, which is why we can't just rocket to the surface at the end of our dives. If we did so, the excess gas would come out of solution and grow bubbles in our tissues, precipitating decompression sickness (DCS) if they grow large enough.

You can increase the rate of this removal by improving your cardiovascular fitness. The more blood vessels you have, the more pathways are available for removing excess gas. The stronger your heart, the better it can pump your blood through tight capillaries. The better your lungs, the faster excess gas is removed from the blood and exhaled through your regulator. These changes require you to condition your cardiovascular system through exercise.

Some experienced divers believe that exercise will do little for their diving since they already have a good breathing rate and efficient water skills. This is a very limited view of what their heart and lungs do for them. Achieving a high level of cardiovascular fitness does a lot more than just improve your gas consumption. It may also increase the safety of your dives in several ways:

- Increased physical reserves for dealing with problems.
- Delayed/reduced panic response.
- Increased rate of inert gas elimination.
- Reduced cost of free phase gas formation.

Increased Physical Reserves

This is a no-brainer. The fitter you are, the more physically demanding a task you can handle successfully. You can swim faster and farther. You can manage larger amounts of equipment. Your heart rate and respiration are lower, and gas consumption will increase less for a given increase in workload. There are no more obvious results of cardiovascular conditioning than these.

Imagine being able to upgrade your car from your current engine to one that is more powerful *and* gets better gas mileage. As your muscle cells adapt to exercise, they increase their number of mitochondria (the energy machines of the cell) and their quantity of aerobic enzymes (the oxygen-utilizing chemicals). With these adaptations, muscle cells become stronger while becoming much more efficient with the oxygen they receive. A fit diver will thus be able to perform more work with each breath of gas, or use less gas to perform the same amount of work as a less fit diver. Not only does this give you the capacity to do more during each dive, this also increases the chance that you can solve any problems that might arise.

Reduced Gas Consumption

Many divers who exercise have found that increases in their cardiovascular fitness have resulted in decreases in gas consumption. However, the mechanism for such an effect is a matter of debate.

Certainly, cardiovascular conditioning reduces the metabolic effort of delivering oxygen from the lungs to individual cells, especially those in skeletal muscles. In other words, the act of breathing requires less energy with increased fitness. This reduced effort means that less oxygen is required by the cardiovascular system itself at any given muscular *effort*.

Additionally, the general *muscle learning* that comes with training, often appropriately referred to as “body awareness,” might make a diver’s movements more efficient with increases in fitness. For example, a diver improving her cycling fitness might become a more efficient kicker as a natural consequence of their similarity. This increased efficiency means less oxygen is required by the skeletal muscles for any given muscular *effect*.

More controversially comes the question of metabolic efficiency of a given muscular *output*. In other words, does the muscle a diver use less oxygen to perform a given output as it becomes fitter? Maybe. As a muscle is conditioned to endurance training, it increases it’s reliance upon *slow twitch*, or oxygen utilizing, muscle fibers. These muscle fibers might be more efficient than *fast twitch* muscle fibers, which rely upon a system of oxygen debt and recovery for their metabolism. Several studies support this, finding that slow twitch muscle fibers work with greater mechanical efficiency than fast twitch muscle fibers (Pringle et al 2003, Willis & Jackman 1994, Horowitz et al 1994, Coyle et al 1992, Coyle et al 1991).

The Panic Response

An important side benefit of a reduction in heart rate and respiration relates to the panic response. The human brain responds to an increase in heart rate and respiration with an increased emotional response, whether it is love, anger, or panic. A feedback loop forms in a tense situation when a diver senses danger, then responds with an increase in physical activity. This causes the diver's heart rate and respiration to increase, which results in the brain increasing it's perception of danger, which then elevates the diver's heart rate and respiration, which then further increases the brain's perception of danger, and so on until the diver might no longer perform the appropriate response. Thus, the fitter you are, the further you might be from your panic threshold merely because your heart rate and respiration are not as affected by increasing physical demands (O'Sullivan & Bell 2001, Petruzzello & Landers 1994).

Most problems can be easily solved if panic is avoided. (Achim Schlöffel)

Increased Rate of Inert Gas Elimination

The rate at which inert gas is eliminated from the tissues of your body for a given pressure gradient depends upon the solubility and vascularity of the tissues and the efficiency of your lungs.

Some researchers speculate that fat tissue off-gasses much more slowly than lean tissue. Because of its design as a storage medium, fat tissue holds a greater quantity of dissolved gasses than other tissues. Research performed as early as 1907 (Vernon) demonstrated that fat can absorb five times as much nitrogen as water. Cardiovascular training, when combined with a healthy diet, will result in an increased ratio of lean tissue to fat tissue in a diver's body. The body of a fit diver might thus off-gas as a system faster than that of an unfit diver.

That said, evidence thus far has been equivocal in isolating a correlation between body fat and risk for DCS. While many studies find a link (Carturan et al 2002, Lehner et al 1991, Dembert et al 1984, Allen et al 1971, Philp & Gowdey 1964, Boycott 1908), others do not (Carturan et al 1999, Curley et al 1989, Wise 1963). Though this might seem as an excuse to hold onto a few extra pounds, a reduction in body fat increases relative VO2max and reduces body mass index, both of which have a strong, demonstrated correlations with DCS attenuation (Nikolaev 2004, Webb et al 2003, Carturan et al 2002, Carturan et al 1999). So, whether you chose to lose because you feel that fat itself is a risk or because you feel that a higher relative VO2max reduces your risk, reducing your body fat will likely bestow a decompression advantage.

Keep in mind that a reduction in adipose tissue, or body fat, reduces the amount of natural insulation a diver has. Thus, adequate protection from the water becomes even more important for the fit diver.

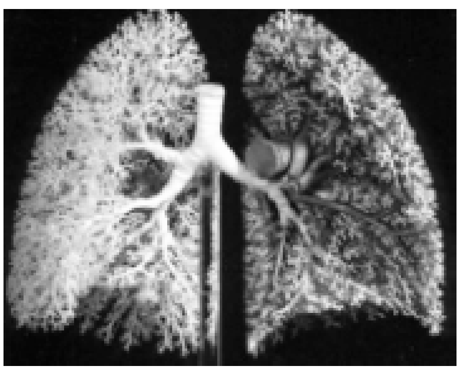
Cardiovascular training also increases the efficiency of the lungs through several mechanisms. As you overload your cardiovascular system through exercise, you stimulate your lungs to exchange carbon dioxide and oxygen, primarily, at a much faster rate. Your body adapts by increasing the vascularity of the lung tissue as well as increasing the surface area of the lungs at the *alveoli*. Not only is a greater quantity of blood present in the lungs of a fit diver, but the vascular changes also allow a faster rate of gas diffusion for each unit volume of blood. Fortunately, these adaptations are not specific to oxygen or carbon dioxide- a pressure gradient for any gas will result in an increased transfer of that gas from blood to lungs. We will return to the importance of these effects later.

Reduced Cost of Free Phase Gas Formation

Every dive produces bubbles, whether it be a thirty-minute shallow reef dive or a world record setting deep cave penetration. The size and amount of bubbles formed depend primarily upon the amount of dissolved gas and the rate of ascent. Mismatch the rate of ascent for the amount of dissolved gas, and the bubbles set in motion a series of problems leading to DCS.

According to some researchers, bubbles are not the only cause of blockages in the circulation. The arterial capillaries are generally large enough to allow the passage of many free phase bubbles. Rather, some believe it is the secondary effects of these bubbles that cause many of the blockages, or *emboli*, associated with DCS.

The emboli considered to be associated with DCS are thought to result from several sources. The body releases several types of chemicals in response to the vascular insult resulting from bubble formation, and these chemicals have been shown to reduce the blood supply to the tissues, even without the presence of gas emboli. Additionally, certain proteins involved in the body's defense against illness may adhere to the bubbles themselves, causing blockages and decreasing the permeability of the bubbles. These proteins not only increase the size of the bubbles, but they also increase the time required to clear the bubbles out of the bloodstream.



This rubber cast shows the vascularity of the lungs. (Anatomical Institute, Bern)

Divers must always keep in mind that our lungs are our first defense against the effects of breathing compressed gas. The diffusing capacity of the lungs is much greater than needed at rest. This built-in safety factor is what allows the lungs to act as a very effective bubble filter in the event of free phase gas formation in the bloodstream. The alveoli are designed to trap both solid and gaseous emboli, preventing them from traveling further through the circulation. Gaseous emboli are eliminated through diffusion, which as described above, is improved through cardiovascular conditioning. Cardiovascular conditioning further increases this safety factor by allowing the lungs to trap a greater quantity of bubbles within their increased surface area and vascularity.

Not all emboli are filtered by the lungs, however. Small bubbles can pass through the pulmonary circulation only to collect and form emboli elsewhere in the body. Also, the accumulation of proteins and platelets might occur throughout the circulatory system as a result of free phase gas formation. This is where the other vascular effects of cardiovascular conditioning may become so important.

The diameter of blood vessels varies based upon a number of factors, including vascular insult. However, cardiovascular conditioning increases the maximum possible diameter of many existing blood vessels. Thus, an embolus may travel further downstream before becoming lodged. The further down the circulation an embolus can pass, potentially fewer branches will be blocked and less tissue will be affected.

Cardiovascular conditioning increases collateral circulation, which means that a given mass of tissue may have more pathways from which to receive oxygen-rich blood. Thus, if an embolus becomes lodged in one pathway, the tissues of a fit diver may receive more blood than those of an unfit diver via other pathways. This preserves perfusion and maintains a pressure gradient to shrink the bubbles.

Cardiovascular conditioning also increases the efficiency with which cells utilize the oxygen they receive. In other words, tissues of a fit diver require less oxygen to maintain their base metabolic rate than those of an unfit diver. This has to do with an increase in aerobic enzymes contained with in the cells, as well as a few other structural changes to the cells. Thus, tissues of a fit diver may better survive a reduction in blood supply compared to those of an unfit diver.

Opening the Oxygen Window

Technical divers performing in-water decompression schedules should make themselves familiar with the concept of the *oxygen window*. In effect, the oxygen window exists as a consequence of oxygen metabolism and results in a reduced gas tension in blood compared with tissues in the body. This reduced gas tension speeds off-gassing and reduces the potential for bubble formation during decompression.

Cardiovascular conditioning widens the oxygen window through several mechanisms:

- The increased concentration of capillaries in skeletal muscles brings the blood “closer” to metabolizing tissues, allowing a greater number of cells access to blood oxygen for a given cardiac output.
- The increased concentration of aerobic enzymes increases the removal of oxygen from a given volume of blood for each cell.

These two results act in synergy to significantly increase the difference in arterial and venous blood oxygen concentration compared to untrained individuals. It is this training effect on the oxygen window that is arguably the most fundamental benefit cardiovascular conditioning has on decompression and dive safety.

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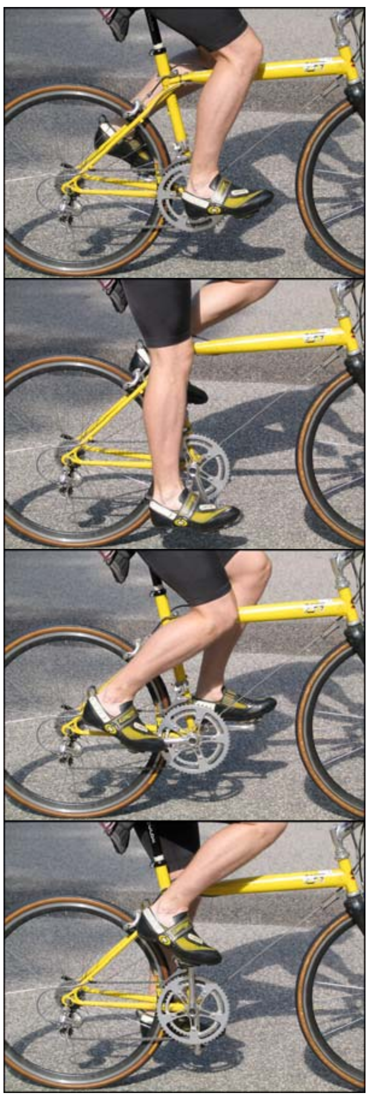
Chapter 6
Methods of Cardiovascular Training

[*Note: Entire books are devoted to detailing everything a neophyte should know about cycling, swimming, and running. The purpose of this chapter is merely to generate interest in these activities as means for getting in shape for diving. For further information, please refer to the resources listed in each section*.]

Triathlon could be the official second sport of divers. Swimming, cycling, and running (a.k.a., "The Big Three") each provide a diver with a great way to develop fitness. They can also complement each other when combined together in a cardiovascular training program.



Cycling

Cycling provides divers with a surprisingly effective way to improve kicking technique, all the while acting as an excellent source of cardiovascular conditioning. Additionally, you get much needed ankle flexibility from proper cycling technique, which requires clipless pedals (pedals with a spring-loaded binding) and cycling shoes.

Look at the profile a cyclist riding from left to right, and impose a clock on his right leg:

1. At the 3 o'clock position of the stroke, the heel drops below the ball of the foot, and the cyclist pedals as if scraping mud off the bottom of his shoe. This preloads the calf muscles and begins the transfer of work from the quadriceps to the hamstrings.
2. This continues until the 6 o'clock position. The hamstring is pulling the heel back as the calf begins to plantar flex the foot (i.e., points the toes). This is similar to running.
3. By the 9 o'clock position, the toes are pointed below the ankle, and the hip flexors and quadriceps engage to thrust the knee upward and forward. The tibialis anterior (muscle on the shin) begins to pull the toes towards the knee.
4. At the 12 o'clock position, the foot is nearly level, and the quadriceps are kicking the foot forward. The foot levels out between the 12 and 3 o'clock positions before repeating the whole process.

The movement consisting of "1" and "2" above is very similar to the power phase of a diving frog kick. "3" and "4" develop the recoil phase of the diving frog kick, or the power phase of a flutter kick. (As an aside, notice that with clipless pedals and good technique, you get 360 degrees of power delivery-very efficient use of your leg muscles.)

Avoiding Injury
Cyclists are at risk of two types of injury: *traumatic* and *overuse*. The most common injuries from crashing are abrasions and shoulder injuries. The most common overuse injuries include knee, lower back, and neck strain.

Crashing or colliding with motor vehicles is often caused by being in the wrong place at the wrong time. However, cyclists can reduce their time in the danger zone by obeying the laws of the road and riding defensively.

Helmets, gloves, and shatterproof glasses can also reduce a cyclist's chance of traumatic injury while riding. Most crashes result in either the cyclist's head or hand hitting the ground before any other part of the body, so common sense dictates protective gear in those areas. Shatterproof glasses, however, are not so obviously necessary, though they protect a cyclist's eyes from the impact of rain, flying insects, and debris kicked up by passing motorists.

Cyclists can reduce their risks for overuse injuries by purchasing a bike of the right size and having it professionally adjusted to their unique dimensions and riding style. This will ensure that their muscles are working in their most efficient ranges of motion while their joints are not overstressed. Frame size, seat position and height, stem height and length, crank length, and bar width are all dimensions that should be matched to the rider.

Additional Resources
The Cyclist's Training Bible
by Joe Friel (Velo Press, 2003)
Friel's "Bible" is the authoritative text on creating and executing a world-class training program for cycling. This is a technical book meant for serious beginners and competitors.

Bicycling Magazine's Cycling for Health and Fitness
by Ed Pavelka, Editor (Rodale Books, 2000)
This book is a good introduction into cycling for fitness. Topics include how to choose a bike, how to avoid common cycling mistakes, and how to keep your knees healthy.

Running

Along with fitness walking, running is one of the most portable forms of cardiovascular conditioning available. You can run almost anywhere in nearly any weather. Plus, you only need a pair of good running shoes and appropriate clothing- equipment that is inexpensive and easy to take along.

Proper shoes are the first defense against running injuries.

In addition to being a very effective way to burn calories, the controlled impact of running also stimulates our bones to retain more minerals and increase in density. While this has not been formally examined, any increase in mineral density might reduce the effects of bone damage from DCS or repetitive diving (see **Chapter 10- Strength Training for Diving**).

Avoiding Injury
While it is commonly said that running is bad for your knees, this is not necessarily the case. Certainly, bad running is bad for your knees. However, many runners remain active well into their advancing years without injury. The secret is in wearing the proper shoes and running a schedule that is appropriate to your fitness.

All runners should begin with fresh shoes dedicated to running. The midsole, or the cushioning of the shoe, compresses the entire time it is under load, whether it is walking, running, or even just standing around. Wearing a pair of running shoes around all day will greatly shorten their useful life as this protective layer of the shoe breaks down.

While this might seem like an expensive strategy at first glance, keep in mind that a pair of shoes too old for running are perfectly fine for kicking around the mall or mowing the grass. Most experienced runners replace their shoes every 300-500 miles, retiring the old ones to casual wear instead of buying shoes specifically for that purpose. This is one of the many reasons to log your training miles.

Running shoes come in many different varieties. At one extreme are very flexible, highly cushioned shoes for runners with naturally efficient gaits. At the other are relatively rigid, broad shoes designed to control the movement of each foot through the rolling impact of a stride. A runner with a good gait running in motion control shoes will have their good biomechanics limited, increasing their susceptibility to impact injuries. A runner whose foot moves in a less optimal path through each footfall will wallow in a shoe with too much cushioning. This can cause knee and hip injury from joint misalignment while under load.

Additional Resources
The New York Road Runners Club Complete Book of Running and Fitness
by Gloria Averbuch (Random House, 2004)
Though many good references for runners exist, this is the one they try to copy. It is currently on its 4rd edition, meaning that they work to keep the info up to date. Containing information from fitness running to marathon training, runners of all abilities can benefit from reading this book.

runinjuryfree.com
Jeff Galloway has one of the most controversial training programs- all of his racing includes walking breaks. Check out his website for a great way to step up your walking program to running or even as a way to improve your performance over longer distances.

Fitness Walking

The most important distinction to be made between walking as most people know it and fitness walking is intensity. “Walking” is a way to get from “Point A” to “Point B” on foot. “Fitness walking” involves a fast pace, an exaggerated arm swing, and very little conversation between workout partners, if at all.

Fitness walking can be used as conditioning before starting a running program, or it can be a means to fitness by itself. The decision is influenced in part by the health of your joints and in part by what motivates you to exercise. Fitness walking is also great start for those who have a significant amount of weight to lose, as the extra weight will be hard on joints when running.

Avoiding Injury
The keys to avoiding injury while fitness walking are the same as for running. Start by getting fitted with a good pair shoes. Most fitness walkers find that running shoes are more comfortable and provide better cushioning than so-called walking shoes. Go to your local running enthusiast store and have them help you make the choice.

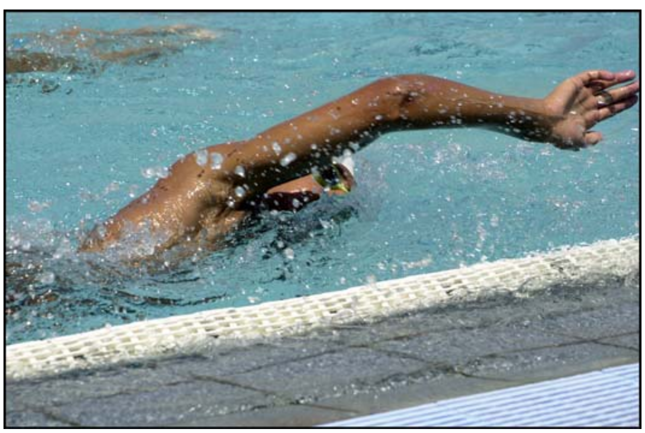
You must also plan your schedule carefully, with both adequate intensity and recovery built in.

Additional Resources
The Complete Guide to Walking: for Health, Fitness, and Weight Loss
by Mark Fenton (The Lyons Press, 2001)
This book provides a plan for an entire year of walking for fitness. Fenton covers beginning and advanced programs while providing readers the motivation to follow through.

walking.about.com
This website has sample programs, equipment reviews, and articles on everything you need to know about fitness walking. You can even join virtual training groups online for added accountability.

Swimming

Swimming has to be the most practical skill for any diver to have. Face it. We are just as much at the mercy of the water while we're on the surface as when we are at depth. Boats capsize, people fall overboard, and divers need rescuing at the surface. Without the ability to comfortably swim for extended periods, we would be taking unnecessary risks every time we head out for a dive.



Good swimming technique comes from practice and coaching.

Swimming for fitness also helps divers in several other important ways. First, the more time we spend in the water, the more comfortable we get. This comfort develops not only at the conscious level, but also at the subconscious.

We already know that our bodies undergo significant changes in reaction to being submerged. This is known as the *dive reflex*, and it demonstrates that at a primal level, our bodies view submersion as a life threatening event.

Though no research has specifically looked at this issue, many divers who have taken up swimming notice better control over some symptoms of the dive reflex. They are better able to control their respiration, resulting in better buoyancy control and decreased gas usage.

Finally, swimming increases the metabolic efficiency of your breathing more than any land-based activity. This is because our lungs are submerged, though we're breathing air at surface pressure. Even this very slight difference in depth forces the muscles used to expand your chest to work harder under the pressure of the water. As these muscles become conditioned, they require less energy to perform the basic task of breathing. This advantage exists both on the surface and while breathing compressed gas at depth because in both cases, the gas you breathe is delivered at the same pressure compressing your ribcage.

Fast Inhale, Slow Exhale

Swimming the crawl (a.k.a. "freestyle) further reinforces our comfort with breathing while our faces are submerged. Proper freestyle technique involves a long exhale with the face fully submerged. Inhalation is rapid and deep, with only a portion of the mouth breaking the surface for air.

When we're on the surface, we generally spend 50% of our time inhaling and 50% of our time exhaling. Not much thought is given to fact that half of the time that we are breathing we are exhaling. Many of us have the false impression that the only time we are getting oxygen into our body is when we're inhaling, when in fact, the entire respiration cycle involves having air in our lungs with gas exchange occurring between the lungs and the pulmonary circulation- oxygen is going to the blood and carbon dioxide is exiting to the lungs and into the air we exhale.

What this means is that when we change our breath cycle so that, for example, 10% of the time, we are inhaling, and 90% of the time we are exhaling, efficient gas exchange occurs all the while.

Why would we want to do this as divers? One of the most obvious places is during *buddy breathing*. During buddy breathing, we have a brief opportunity to breathe off a regulator. We then exhale for the entire time that we pass the regulator to our buddy, s/he breathes, then passes it back. We don't need to panic, and we don't need to feel that this is unnatural because our bodies can tolerate this. The entire time we are buddy breathing, we are still efficiently exchanging gases between the lungs and the blood.

Buoyancy control is also made easier with a freestyle-like breath cycle. The slower we exhale, the slower we are going to change our buoyancy. With a regular breathing cycle, our buoyancy tends to oscillate and can get away from us. Whereas with a quick inhalation and slow exhalation, we have an easier time stabilizing our buoyancy throughout the breath cycle.

Don't confuse this with *skip breathing*. We're not talking about slowing down the entire breath cycle so that we're building up dangerous levels of carbon dioxide, which would cause increased sensitivity to narcosis and oxygen toxicity.

Mouth Breathing

During freestyle, the nose remains submerged throughout the entire breath cycle, forcing swimmers to automatically become mouth breathers.

A term normally reserved as an insult on someone's intelligence, mouth breathing is an important skill to have as a diver. While your mask remains in place, the rubber skirt keeps water out of your nose. Lose your mask, and you must be able to continue to breathe without sucking water up your nose with each inhalation.

Trouble with mouth breathing is one reason why so many beginning divers have trouble with mask clearing drills. A little practice with the drill itself can certain get someone over the hump, but the same skill can be learned while improving fitness at the same time with some time spent swimming freestyle.

Avoiding Injury
Other than drowning, fitness swimming is not typically considered to be a risky activity. However, a swimmer's shoulders and knees are both susceptible to injury if proper technique is not used.

If you have any desire to swim well, invest the time and money in proper instruction. While books and videos are readily available, none can compare to the value and efficiency of good, personal coaching.

Additional Resources
You Local Fitness Pool
As mentioned above, a proper coach is the best way to learn more about swimming. Your local fitness pool should have information on coaching and adult swim classes.

usms.org
In the United States, the US Masters Swimming provides swimmers with organized practices and coaching. Geared to both the fitness swimmer and competitive athlete, USMS is a great way to take your swimming to the next level. Most teams accept anyone who can swim 400 meters of freestyle and are very welcoming of swimmers looking to improve their techniques.

totalimmersion.net
Terry Laughlin is one of the best swim coaches around, and he has done a wonderful job of translating what he knows into useful books and videos. If you cannot get a coach, this is the next best thing. Of particular help to swimmers working out on their own is Laughlin's "Freestyle Made Easy" DVD.

Complete Book of Swimming
By Dr. Phillip Whitten (Random House, 1994)
No book can provide all the benefits of a good swim coach, but Dr. Whitten gives us a good second-best. This covers stroke technique, flip turns, proper use of training aids (e.g., swim fins), and even nutrition. Of course, it also has an extensive section on sample training programs.

Cardiovascular Training Equipment

If there is an activity that you can easily do outdoors, someone probably makes a piece of equipment as an indoor substitute. You can row a boat, ride a bike, hike a mountain, or even cross country ski within the shelter of many gyms. Some equipment even has a built-in LCD television so you can keep track of your investments or watch your favorite program while exercising.

One of the biggest mistakes made every day in every gym the world over occurs when someone hops on a piece of equipment, sets their usual speed and resistance, then proceeds to grind out the whole workout in unwavering endorphin bliss. While certainly a way to burn calories and forget the stress of the day, such a habit is less than optimal for developing your fitness potential.

To achieve the best results for your efforts, you must begin with a proper warm-up, spend some time varying from high to low intensity, and wrap up with an easy cool-down. You can certainly plan and execute such a workout manually, but there are easier ways.

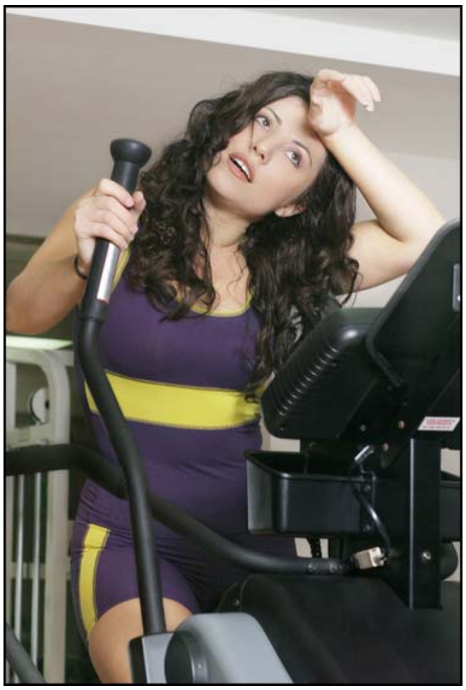
Getting with the Program
Most of the equipment made today includes some type of computerized control of resistance, speed, and incline. Preset programs simulate changing terrain or conditions, just as you would experience doing the real thing outside. This allows you to easily change your intensity throughout your workout without having to create a workout on your own. By choosing a different program each time you use a certain machine, you can vary your workouts even further.

You don't need to get wet to row a boat for fitness.

Indoor Multisport
Another way to vary intensity and fight mental fatigue, especially when your entertainment options are limited, is to switch machines mid-workout. For example, you can warm up on a rower, do some hills on an exercise bike, then finish up with a few miles on the treadmill. There are no rules to which order is best. Investing in a heart rate monitor can help you keep track of your intensity as you change modes of exercise.

Chapter 7
Rating of Perceived Exertion

An easy way to measure your training intensity is by using the *Rating of Perceived Exertion (RPE)*. The RPE is simply a numeric scale used to quantify the physical effort you feel during periods of activity. Instead of using an electronic device, you use your gut instinct based upon your perceived heart rate, respiration, muscular discomfort, and general fatigue. You do not base your rating on any one factor but instead on the overall sensation of effort.



You don't need technology to tell you when you're working hard.

How good do you feel?

The main drawback to RPE is that it relies upon your assessment of how you feel, which can be better or worse for the same exercise intensity depending on the kind of day you're having. A very recent British study (Hartshorn 2004) examined the repeatability of RPE during brief bouts of cycling, finding that subjects had difficulty regulating exercise intensity over recurring trials.

Another meta-analysis published in 2002 (Chen 2002) examined the research to that time and found that RPE is most highly correlated for males performing maximal efforts or unusual physical activity (e.g. swimming vs. cycling or walking). It remains uncertain why the same effect was not seen in female subjects.

However, RPE is good enough for our purposes, and it does not require any investment in additional equipment. Of course, heart rate monitors, as discussed in the next chapter, are available for those interested in a more precise measurement of exercise intensity.

Using the Scale

The original scale, developed by Gunnar Borg in 1970, ranged from a rating of "6" for no exertion at all to "20" for maximal exertion. While this scale continues to be successfully used by many, a ten-point scale seems to be more intuitive for some.

10-Point RPE Scale

Rating	**Effort**	**Example**
1	No Effort	Sitting upright.
2	Very Light	Dealing cards.
3	Light	Washing dishes.
4	Comfortable	Casual walking.
5	Moderate	Medium-paced walking.
6	Somewhat Difficult	Conversation is easily sustained.
7	Difficult	Conversation becomes difficult.
8	Extremely Difficult	Conversation impossible.
9	Nearly Unbearable	Effort of a 50m running sprint.
10	Maximum	Life or death effort.

Most workouts for beginners range from 4-6 on this RPE scale. Advanced exercisers and athletes should achieve intensities up to level 9 at least once each week for maximum fitness gains.

References

Chen MJ, Fan X, Moe ST., Criterion-related validity of the Borg ratings of perceived exertion scale in healthy individuals: a meta-analysis., J Sports Sci. 2002 Nov;20(11):873-99.

Hartshorn JE, Lamb KL., The reproducibility of perceptually regulated exercise responses during short-term cycle ergometry., Int J Sports Med. 2004 Jul:25(5):362-7.

Chapter 8
Training by Heart Rate

The heart supplies every other muscle in your body with the blood it needs to power your exercise. Because of this, its effort is directly linked to your exercise intensity.

Your radial pulse is usually strong and easy to find.

While rating of perceived exertion can be compared to sticking a wet thumb in the air to judge wind direction, your heart rate acts more like a weather vane. It provides a more objective evaluation of training effort and recovery effectiveness.

Taking Your Pulse

The most basic way to measure your heart rate is by taking your pulse. Using the pads on your index and middle finger, find the notch below the thumb on your opposite hand and press down lightly. Count the number of beats you feel during a period of ten seconds, and multiply this number by six. This is your heart rate in beats per minute (BPM).

Of course, finding your pulse, counting while watching a clock, then performing multiplication can be difficult enough at rest. Taking your pulse while running, cycling, jumping rope, etc., can prove to be nearly impossible to do without interrupting your exercise.

Heart Rate Monitors

You don't have to fumble with a stopwatch as you search for your pulse during a workout. Instead, you can use a heart rate monitor, the most accurate of which consisting of a chest-worn transmitter and a watch. For under $100, you can get a piece of equipment that measures heart rate as accurately as the most advanced EKG.

Having your heart rate at a glance is the most important benefit of using a heart rate monitor. Much like the tachometer in an automobile, a heart rate monitor can give you an instant readout of your cardiovascular effort.

Most heart rate monitors consist of a watch and a chest strap. Information from the chest sensors is wirelessly relayed to the watch.

Some monitors record heart rate every few seconds throughout a workout, allowing you to download this data to a computer. Downloadable monitors are generally several times the cost of pulse-only models, and spending too much time analyzing the extra information provided can be like missing the forest for the trees. However, for those with extra money to spend on techno gadgetry, watching the changing shapes of heart rate plots can be a fun way to monitor your fitness.

However you choose to measure your heart rate, you need to know what to do with the results.

Resting Heart Rate

Your *resting heart rate* is the frequency your heart beats when you are fully relaxed and lying flat on your back. By recording your daily resting heart rate, you can watch your improving fitness as the numbers go down over time. Your resting heart rate also serves as an indicator of general health and preparedness for intense exercise.

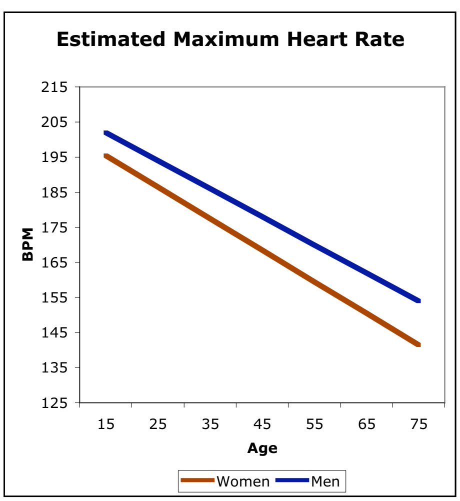
The best time to measure your resting heart rate is after a restful night before getting out of bed. You don't need a monitor to check your resting heart rate, but it helps. Have your monitor bedside, ready for when you wake in the morning. Put it on and record your heart rate after it stabilizes (it will temporarily rise from the effort of preparing your monitor).

Normal resting heart rate can be anywhere between 40 and 100 beats per minute. Resting heart rates in the low end of this range do not necessarily indicate better fitness than other people with higher resting heart rates. However, you should see your own resting heart rate decrease as your cardiovascular fitness improves.

Finding a morning heart rate that is higher than usual might mean that you are not fully recovered from your previous workout. It can also mean that you are overstressed, dehydrated, or on the verge of impending illness (see "Factors Affecting Heart Rate" below). **Appendix D** provides a way to easily plot and monitor your daily resting heart rate.

Maximum Heart Rate

Your *maximum heart rate* is simply the rate at which your heart beats during maximal exercise intensity. This number is most commonly estimated by subtracting your age from 220 beats per minute, giving you a figure usually within 10 beats of your actual maximum heart rate.



More recently, exercise physiologists have developed gender specific formulas that seem to be more accurate. The estimated maximum heart rate for men is 214-(.8 x age), and for women, 209-(.9 x age).

Of course, you can also measure maximum heart rate during controlled exercise tests supervised by a medical clinician or physiologist. Due to the extreme nature of these tests, it is not recommended that maximum heart rate be attempted without such supervision.

Whichever estimate you use, it is important to remember that your actual maximum heart rate may be higher or lower than the number you calculate by as many as fifteen beats per minute. This means that you must still rely upon your common sense when choosing an appropriate exercise intensity- if it feels too hard or too easy, then you're probably correct.

Also, maximum heart rates are *sport specific* because every sport uses a different amount and combination of large and small muscle groups. The more muscle groups used during an activity, the faster your heart will beat at maximum effort. For this reason, weight bearing sports, like running and cross country skiing, typically register higher maximum heart rates than non-weight bearing sports, like cycling and swimming.

Additionally, environmental factors vary by sport. Cycling provides its own breeze that aids in thermoregulation. Swimming allows even greater heat liberation to the surrounding water, resulting in the lowest maximum heart rate among most common forms of exercise.

After you have some experience training by heart rate, you will be able to make educated adjustments to your target heart rates in order to achieve appropriate exercise intensities.

Target Heart Rate

Your *target heart rate* for a workout is usually expressed as a percentage intensity. This percentage figure is a function of your maximum heart rate, which is why accurately estimating or measuring your maximum heart rate is so important.

Target heart rates are also typically given as a range of percentages, rather than one specific percentage, in consideration of the day-to-day variability in heart rate response to exercise. In other words, any given exercise intensity should still make sense to you regardless of what your heart rate is.

Target heart rates are calculated in two ways. The most common way is by multiplying your maximum heart rate by the target percentage. This is known as the *maximum heart rate formula*.

> <u>Maximum Heart Rate Formula</u>
> **target heart rate = maximum heart rate x % intensity**

A more effective, though more complicated, method of calculating target heart rates is known as the *Karvonen formula*. The Karvonen formula is based upon the difference between your maximum heart rate and your resting heart rate, or *cardiac reserve*, which is considered a more accurate measure of cardiovascular fitness than maximum heart rate alone.

> <u>Karvonen Formula</u>
> **cardiac reserve = maximum heart rate – resting heart rate**
> **target heart rate = (cardiac reserve x % intensity) + resting heart rate**

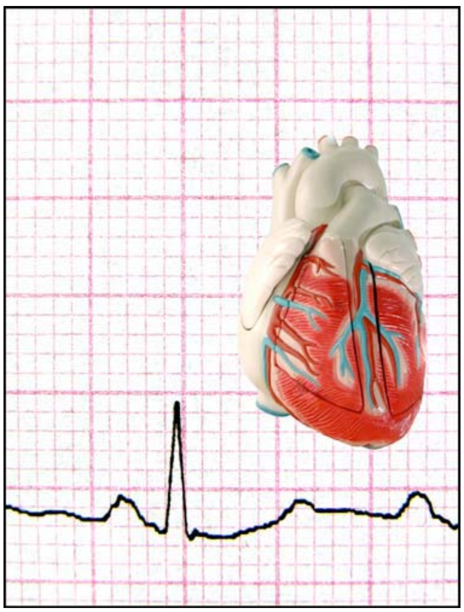
Note that most target heart rates are expressed as a percentage of maximum heart rate. These values can be used with the Karvonen formula by subtracting 10%. For example, a target heart rate of 70-80% MHR for a 35 year old male with a resting heart rate of 55bpm and an estimated maximum heart rate of 186bpm could be calculated as follows:

> <u>Maximum Heart Rate Formula</u>
> Target 70%MHR = 186bpm x 70% = **130bpm**
> Target 80%MHR = 186bpm x 80% = **149bpm**

Karvonen Formula
Target 70%MHR = ((186bpm – 55bpm) x 60%) + 55bpm = **134bpm**
Target 80%MHR = ((186bpm – 55bpm) x 70%) + 55bpm = **147bpm**

The main difference between the two values comes from a difference in resting heart rate. Someone with a lower resting heart rate will end up with lower target heart rates using the Karvonen formula than someone with a higher resting heart rate. This makes intuitive sense. We would only expect that a heart beating more slowly at rest would beat more slowly at all but the highest intensities of exercise, and this is reflected in the Karvonen formula.

If you are relatively new to exercise, the maximum heart rate formula is an accurate enough starting point for our purposes in this guide. More experienced exercisers would benefit from use of the Karvonen formula when calculating target heart rates for cardiovascular exercise. Whichever method you choose, be sure to adjust your target ranges based upon your personal experience over time.



In spite of the formulas and technology we have to monitor them, our hearts are still just specialized muscles.

Recovery Heart Rate

Your *recovery heart rate* is simply your heart rate at a certain interval of time after effort. When doing interval training, you will get a sense for how fast your heart rate drops after periods of high intensity. As your fitness improves, you will recover more quickly as indicated by a faster drop in heart rate.

If during interval training you find your rate of recovery is slower than normal, this can be a sign of a training or health problems. It might be a good day to pack it in early, get some rest, and rethink your training schedule.

You can also measure your recovery by checking your resting heart rate at various times after your workout is complete. Again, faster drops indicate improving fitness, while abnormally long recoveries signal a training problem.

Factors Affecting Heart Rate

Even when using something as high tech as a heart rate monitor, training by heart rate is still not an exact science. Many variables affect your heart rate, and these can change on a daily basis. For these reasons, the "heart rate monitor" in your head should still rule your decisions about training intensity. When your perceived exertion and your heart rate monitor conflict, consider the following factors and use your best judgment to guide your training intensity.

Factors Affecting Heart Rate

	Impact on Heart Rate
Increased Fitness	-
Cold	-
Recovery	-
Deconditioning	+
Illness	+
Dehydration	+
Heat	+
Humidity	+
Altitude	+
Stress	+

Chapter 9
Zone Training

As previously discussed, your body needs training variety in order to maximize your gains in fitness. If you trained at a high intensity every workout, every day, you would quickly burn out from overtraining. If you limited yourself to “aerobic threshold” workouts, you would never achieve your fitness potential.

Even though each of us varies in starting fitness level, natural abilities, etc., we can all use the same training templates if they are based upon relative effort levels. That’s where *zone training* comes into play.

Zone training quantifies the various intensities used during workouts in terms that can be easily measured or estimated on the fly. Different coaches may use different numbers of zones or apply them in different ways, but the end result is the same.

The cardiovascular workouts in this guide are based upon four training zones:

Training Zone	Avgerage %maxHR	Maximum %maxHR	Average RPE	Maximum RPE
Zone 1- Warm-up/Recovery	55-65%	70%	4-5	6
Zone 2- Endurance	65-75%	85%	5-6	7
Zone 3- Lactic Threshold	70-85%	90%	6-7	8
Zone 4- Maximum Capacity	70-85%	95%+	6-7	9+

For activities like cycling and running, terrain often dictates the nature of training intensity. Though flat areas can be approached with either high or low intensity, hill climbing is rarely the place for recovery or cool downs.

The workouts that follow are presented merely to provide examples that represent the overall concepts of zone training as used in this guide. Use your common sense to adapt these workouts to the training you have available. For swim training, incorporate workouts found in the resources listed in **Chapter 6- Methods of Cardiovascular Training**. Using these zones as a basis for comparison, you can also incorporate workouts from other resources into the schedules that follow.

Zone 1- Warm-Up/Recovery

The *warm-up/recovery zone* is used at the beginning of each workout to prepare your body for exercise. This zone is also used in conjunction with intervals of lactic threshold and maximum capacity efforts as a way to restore balance between metabolic waste production and elimination. Lastly, this zone is most appropriate for adjusting a new exerciser to the demands of cardiovascular conditioning.

Example Workout:
Continuous or Long Slow Distance (LSD) Training
Zone 1 LSD training consists of a pace that can be easily maintained for the training period specified, whether it’s a short recovery workout or a long distance day.

Zone 2- Endurance

The *endurance zone*, in conjunction with the recovery zone, is where your various metabolic processes are most efficient at generating work. Because this zone is often referred to as the "fat burning zone," many fitness enthusiasts misguidedly spend the majority of their training time here. Endurance zone training certainly has its place in improving cardiovascular fitness, but only in conjunction with higher intensity efforts.

Example Workouts:

Tempo Training

The name "tempo training" comes from the fact that these workouts are intended to prepare your body to work at a certain tempo, or pace. In **Zone 2**, the tempo chosen should be faster than a pace you might hold for LSD training, but not so fast that it requires recovery intervals.

Light Interval Training

This is the least intensive form of interval training, consisting of 3-5 minute intervals of moderate intensity followed by enough recovery for your heart rate to return to 60-65% of maximum.

Strides for Running

These workouts are sort of a "negative" hill workout in that your higher intensity is done on a downward grade. These workouts are designed to train your neuromuscular system to move at a faster pace without requiring as much energy for propulsion. After a warm-up, run down a slight grade at a fast pace while maintaining good form.

Hand paddles enable swimmers to experience faster swimming without increased energy demands.

Spins for Cycling

Like strides for running, spins are designed to train your neuromuscular system for a faster cadence without requiring additional energy for propulsion. Spins involve maintaining a cadence higher than your natural cadence while maintaining a smooth pedal stroke. If you bounce in your seat, then you are pedaling too fast.

Long Slow Distance

Once your cardiovascular fitness has gained momentum, you should be able to maintain a heart rate that is slightly elevated over a **Zone 1** effort for an extended period of time.

Zone 3- Lactic Threshold

The *lactic threshold zone* trains your body to buffer lactic acid, which is believed to be the major limiter of sustained efforts. Spending time in this zone also extends the period that your metabolism remains elevated post workout.

Example Workouts:
Tempo Training
Zone 3 tempo training involves holding a steady a pace that is somewhere between a **Zone 2** effort and what would be a race pace or all-out effort.

Moderate Interval Training
These workouts involve intervals of intensity lasting 5 minutes or more, allowing a gradual build-up of lactic acid. A series of mile repeats for running or grinding long, gradual hills for cycling are examples of moderate interval training.

Long Slow Distance with Pick-Ups
Like **Zone 2** LSD workouts, but interspersed with short intervals of moderately high intensity to stimulate lactic acid production and buffering.

Zone 4- Maximum Capacity

The *maximum capacity zone* pushes you to your cardiovascular limit. As with lactic threshold training, this zone forces your body to deal with great quantities of lactic acid. It also creates the maximum oxygen debt, which when cycled with recovery periods, trains your cardiovascular system to recuperate more quickly.

Example Workouts:
Tempo Training
Zone 4 tempo training involves race pace efforts over shorter distances. For example, you might run your 5k race pace for one mile, then recover for half a mile before running another mile at your 5k race pace. The longer the workout, the slower the tempo.

Sprints or Hill Climbs
These are all-out efforts for one to two minutes, followed by enough recovery to get your heart rate below 60-65% of maximum.

Unit 3
Strength Training

Chapter 10
Strength Training for Diving

SCUBA diving can mean lots of heavy lifting. From tanks to gear bags to weight belts, nothing is light in this sport. Strength training will not only make a diver more capable on the surface, but the resulting physiological changes may also reduce a diver's risk underwater.

Increased Physical Capacity

Strength training most obviously increases muscular strength, which means that a fit diver can manage large equipment more easily. Besides meaning that you will require fewer trips to haul all of your gear, decreasing surface physical exertion leaves more energy reserves for the dive itself.

Increased Bone Mineral Density

Weight bearing exercises, in general, stimulate bones to increase in strength, mainly through an increase in *bone mineral density* (BMD). Special cells, called *osteoblasts,* are mobilized to areas of stress within the bone tissue. The osteoblasts lay down a protein matrix which eventually calcifies into new bone tissue.

Divers can certainly appreciate the heat generating capacity of muscle during lengthy decompression. (Achim Schlöffel)

The greater the stress placed upon the bones, the greater the increase in BMD. Besides reducing the risk of stress fractures from walking around in heavy dive gear, an increase in BMD may also protect a diver from decompression-related bone damage, called *osteonecrosis*.

Decompression stress can impede the blood supply to the skeletal system, resulting in cellular death and a weakening of the bone tissue. Though no research has specifically looked at this issue, it is plausible that by starting with a strong skeletal system, divers suffering from DCS might experience less damage to the long shafts and joint surfaces of their bones. Additionally, divers that regularly stress their bones through strength training might heal any damage that occurs faster, as their bone modeling system is in a chronically higher state of activity.

Increased Thermogenesis

Lean muscle mass is also a source of heat generation for a diver on long exposures. The more muscle mass you have, the more heat your body can generate internally to make up for that being lost to the water around you. Keep in mind that both a calorie source and water are required for thermogenesis- for lengthy exposures or long days of diving, this means eating and drinking during surface intervals or on decompression.

Additionally, an increase in lean muscle results in an increase in resting metabolism, which can ultimately lead to fat loss, an increase in relative VO2max, and a decrease in BMI. As described in **Chapter 5- Cardiovascular Conditioning and Dive Safety**, these effects could result in a greater rate of gas diffusion into and out of the diver as a whole.

Effective Strength Training

The most effective way to increase strength is to overload the skeletal muscles with external resistance through a range of motion. In other words, lift weights.

Weight training does not require a 25,000 sq. ft. fitness facility, although there are many advantages to joining a gym when one is available. First, a greater variety of exercises can be performed in a full-sized fitness facility. Second, we are a social animal, motivated to perform our best when surrounded by our peers. Lifting in the presence of others usually pushes us to work harder than we would on our own. Third, getting out of the house reduces the chance we'll quit before the work is done.

Regardless of where you choose to train, the fundamentals stay the same.

Leveraging Compound Movement

A compound movement involves moving more than one joint through a range of motion. Examples of compound movements are listed in **Table 1** for each body part.

TABLE 1 Compound Movements

Body Part	Exercise
Legs	Bench Squat, Standing Lunge
Shoulders	Shoulder Press
Biceps	Monkey Curl
Triceps	Bench Dip
Chest	Dumbbell Chest Press
Back	Lat Pulldown, Bent-Over Row

Compound movements engage several muscle groups and help the body to increase the blood supply to the targeted body part. Besides acting as a warm-up, this increased blood supply facilitates the removal of lactic acid during and after activity and allows the muscles to perform a greater amount of work.

The warm-up effect is a great reason to begin with a compound movement when training a body part with several exercises during a workout. Additional compound movements can be included to complete the workout, or you can begin to isolate individual muscle groups with simple movements utilizing a single joint.

TABLE 2 Isolation Movements

Body Part	Exercise
Legs	Leg Extension, Hamstring Curl
Shoulders	Lateral Deltoid Raise, Front Deltoid Raise
Biceps	Dumbbell Biceps Curl, High Cable Biceps Curl
Triceps	Overhead Triceps Press, Dumbbell Triceps Kickback
Chest	Pectoral Fly (Upper, Middle, Lower)
Back	Rhomboid Fly, Straight Arm Kickdown

The Sum of the Parts

Isolation, or single joint, movements can be used to fatigue specific parts of your body while reducing the effect of other parts that may already be fatigued. You can build strength while increasing definition *at the same time* if you break large muscle groups into their parts and train them to complete fatigue.

For example, a good biceps workout could begin with chin-ups, which is a compound movement involving the biceps, several muscles of the back, and several muscles of the shoulder. The lateral head, or outer biceps, could then be targeted with dumbbell hammer curls, and the medial head, or inner biceps, could be targeted with straight bar concentration curls. Such a workout guarantees that each part of the biceps has been completely fatigued and stimulated to get stronger.

Isolation exercises can also be combined in one workout to fatigue the various muscles used in any given compound movement. Selecting one isolation exercise for each body part could create an effective whole body workout. **Table 2** lists a very small fraction of the isolation exercises available within an average fitness facility.

Strength Starts from the Ground

In order to lift anything, the body requires a strong trunk and steady legs. Neglecting leg and trunk strength is the biggest mistake made in every gym, every day. In fact, if you can only do one workout per week, focus on your legs, lower back, and abdominals. You'll be more capable in the long run than someone who focuses on his or her upper body.

Here's a good test for the next time you carry a heavy object: if you experience whole body fatigue or become winded before your arms feel like they're going to fall off, you need more leg work, not more arm work.

Compound leg exercises, like this hack squat, form a foundation of strength.

The Importance of Proper Form

The next time you are in a gym, observe how others perform various exercises and do your best not to look like they do. It's not that the proper form for strength training exercises is that elusive- books devoted to this topic (like this very guide) fill the shelves of every bookstore. Rather, the "more is better" mentality is as prevalent in the gym as it is on the typical monster truck. Most use too much weight for too many sets, requiring that they use a ridiculous amount of cheating if they even manage to move the weight around their bodies rather than the other way around.

Every exercise has a target muscle group or groups. These are the only muscles that should be moving through a range of motion. The rest remain relaxed or statically stabilize the body. Proper form is merely the motion required to keep the target muscles moving, the rest of the body still, and joints and internal organs protected from injury.

This is not just a matter of safety. Just as importantly, proper form is what leads to maximum gains for the effort expended. Once you break the proper form, you replace the effort required from the target muscle group with effort from entirely different muscle groups. Though your fatigue may continue to build, you are no longer performing the same exercise, nor are you effectively training your body.

Form Fundamentals

Each repetition should be on a "5 count": two counts to raise the weight, pause for one count, then two counts to lower the weight. The speed throughout should remain constant to limit the amount of momentum placed upon the weight. This will ensure that you are stressing the muscle throughout its range of motion.

Avoid relaxing the targeted muscle between repetitions. Don't let the plates touch in machines, lock out joints (such as the knees in leg press), or dangle the dumbbells from limp arms (such as in biceps curls). Maintaining tension on the muscle reduces elastic stress while increasing the fatigue generated by a given weight used.

Use a weight that will result in complete failure of the targeted muscle in 10-15 repetitions. Complete failure means that you are no longer able to maintain the proper form of the exercise for an additional repetition. Lower the weight for subsequent sets if necessary to remain within the 10-15 repetition range.

Recent research suggests that the great majority of strength conditioning comes from the first set performed to failure for each exercise. There are still important benefits to performing multiple sets, however. First of all, each repetition burns calories. The more reps, the more calories you burn. Second of all, you condition your motor neurons through repetition, so the more reps, the better you will become at performing the technique of a given exercise. Two to three sets per exercise balances efficiency of effort with a reasonable amount of repetition for learning and metabolic purposes.

Train with a Partner

Partners not only act as a source of *mental* motivation, but they can also assist us *physically* to perform beyond the level we can on our own.

The role of a training partner is not as some sadistic cheerleader, screaming in your face as you struggle against an immovable weight. Rather, a good spotter should provide just enough assistance to keep you moving at exactly the same pace from the first through the last repetition of a set.

This level of effort safely creates a greater level of stress on the muscles worked. However, this level of stress also requires a greater level of fitness to aid recovery.

Training Frequency

For strength training, significant results can come from two days per week, either by splitting the body and doing some parts each session, or by doing fewer sets of every body part each session (as you will see in the programs that follow). Adding a third day will result in even greater gains, but raw strength is not as much of an issue for the diver as is cardiovascular fitness.

Example 1: Two Day Split

Day 1	Day 2
Bench Squat	Lat Pulldown
Hamstring Curl	Bent-Over Row
Leg Extension	Dumbbell Chest Press
Adduction	Cable Pectoral Fly
Abduction	Shoulder Press
Seated Calf Raise	Lateral Deltoid Fly
Standing Calf Raise	Monkey Curl
Side Crunch	High Cable Biceps Curl
Straight Crunch	Bench Dip
Swimmers	Overhead Triceps Extension

Example 2: Whole Body Workout

Bench Squat
Hamstring Curl
Leg Extension
Standing Calf Raise
Lat Pulldown
Dumbbell Chest Press
Monkey Curl
Bench Dip
Shoulder Press
Straight Crunch
Swimmers

Avoid the Routine

Athletic conditioning depends upon the body's ability to adapt to new stresses. Eventually, however, the new stress becomes routine- the body *habituates* and ceases to increase in fitness (as discussed in **Chapter 2- Principles of Physical Conditioning**). By frequently changing the exercises used, an athlete can avoid strength plateaus. With all of the exercises and variations available, there is no reason to repeat a workout.

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Essentials of Strength Training and Conditioning, National Strength and Conditioning Association (Thomas R. Baechle, Editor), Human Kinetics, 1994.

Maximize Your Training: Insights from Leading Strength and Fitness Professionals (Matt Bryzcki, Editor), Masters Press, 1999.

Chapter 11
Equipment Options

Effective strength training requires that we apply resistance to our muscles as we move them through their safe ranges of motion. *Isometric exercises*, where we pit one muscle against another, do not meet these criteria because of their limited or nonexistent ranges of motion.

We will see better results if we apply some form of *external* resistance. This can come from our own bodyweight and gravity, as when doing crunches or push-ups, or it can come from resistance equipment, like machines or dumbbells.

Dumbbells are as simple as exercise equipment gets.

Many exercises in this guide rely solely on your bodyweight for resistance. The others can be easily performed with a set of exercise bands for resistance. This makes the programs that follow easy to sustain wherever you might do your strength training.

Dumbbells and Barbells

Dumbbells and barbells have been in use in one form or another for centuries. Simple in both function and form, these tools use only gravity as their source of resistance on the user. This means that exercises using dumbbells and barbells must be designed around a plane perpendicular to the ground. Incline, flat, and decline benches are thus required to work the body from all angles, yet certain muscle groups are almost impossible to condition without some other form of resistance (e.g. latissimus dorsi and the “lat pulldown”).

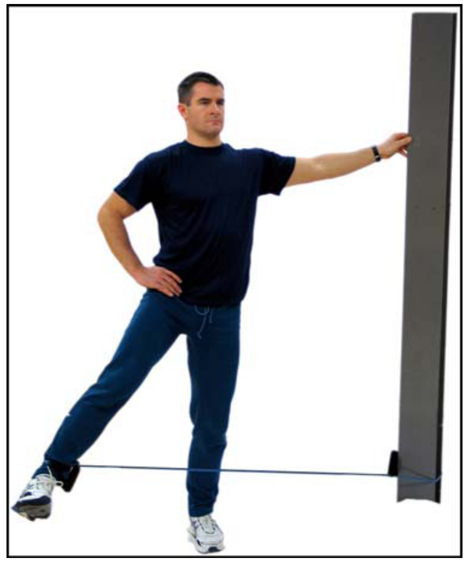
Advantages:
- Readily purchased or constructed at home
- Simplicity in set-up and use
- Highly durable
- Low maintenance

Disadvantages:
- Not very portable
- Angle of resistance limited, requiring awkward positions or additional equipment to work certain muscles

Exercise Bands

Exercise bands consist of a rubber tube or ribbon, usually found with handles at each end. These bands work through elastic tension, with variations in peak resistance coming from using bands of different thickness alone or in combination. Like a rubber band, however, this means that resistance can begin very light and end very heavy through an exercise’s range of motion.

Bands can be used alone or can be easily attached to a doorway or other immovable object to provide limitless angles of resistance. The bands can also be strapped to the legs, allowing easy isolation of muscles such as the inner and outer thigh.



Exercise bands provide resistance from angles difficult to reproduce with dumbbells.

Advantages:
- Inexpensive
- Portable
- Infinitely adjustable resistance
- Resistance from any angle

Disadvantages:
- Highly progressive resistance
- Sensitive to wear and tear

Home Gym

Home gyms have been available for decades, though only recently has the price of quality equipment dropped to affordable levels. Still more expensive than joining most health clubs, a home gym lets you perform a wide variety of exercises at your convenience. This can be a blessing or a curse, as the lack of social pressure often leads to less intensity and consistency than joining a health club.

Advantages:
- Convenience
- Variety of available exercises

Disadvantages:
- Cost
- Space required
- User maintenance required
- High attrition rate

Health Club Gym

You can't beat a full-size gym for the exercise variety it offers. You can usually find a complete set of dumbbells, barbells, and exercise bands in addition to commercial grade strength and cardiovascular equipment. Many health clubs have knowledgeable staff to instruct you on proper exercise form and safety, though you should always check for credentials before accepting advice from a trainer.

Advantages:
- Variety of strength and cardiovascular equipment
- Social environment
- Access to expert advice

Disadvantages:
- Intimidating for some
- Inconvenient
- Membership required

Improvised Resistance

When no equipment is readily available, you can still work out with improvised resistance. Books wrapped in hand towels, jugs filled with water or sand, and heavy luggage are just a few things that can be used as rudimentary dumbbells. With a little creativity, you can perform almost any freeweight exercise using ordinary household objects for resistance. However, safety should not be compromised in an effort to develop enough resistance. In other words, don't try to leg press your piano.

Advantages:
- Inexpensive
- Encourages adaptability

Disadvantages:
- Limited exercise options
- Limited resistance options

Sample Gyms

The fitness programs in this guide utilize exercises that require minimal equipment. While many of the demonstrations depict the use of dumbbells and cable towers, any of the following set-ups will allow you to perform every exercise listed with little form modification.

Traveling Gym

Exercise bands with door attachment and leg straps		$30
Jump rope		$15
Total		$45

Budget Home Gym

Exercise bands with door attachment and leg straps		$30
Exercise ball, burst resistant		$30
Dumbbells, adjustable with 40# of plates		$50
Jump rope		$15
Total		$125

Complete Home Gym

Bowflex Ultimate XTLU	$2000	
Exercise ball, burst resistant		$30
Dumbbells, adjustable with 40# of plates		$50
Jump rope		$15
Treadmill, LifeFitness T9i (optional)		$5000
Total		$2095-7095

Chapter 12
The Exercises

The exercise demonstrations that follow are organized into three main areas: floorwork, weight training, and calisthenics. The weight training exercises are further organized according to the major muscle groups they work, including the legs, chest, back, shoulders, biceps, and triceps. This is not to say that other muscles are not worked, as well. Many exercises require the use of several muscle groups in concert to perform the required movements. These additional muscle groups are listed with each demonstration.

Also listed are the areas of the body put *at risk* by each exercise. No exercise can be performed without risk, though proper form will certainly reduce that risk. That said, be certain to pay attention to the areas listed as “at risk” while performing each exercise.

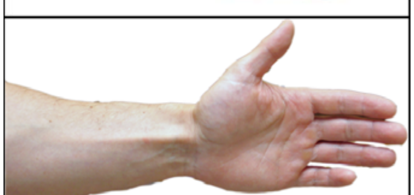
An illustration of the basic muscular anatomy is shown on the next page. Though you don’t need an understanding of anatomy to perform any exercise in the guide, it can certainly help you to see how the exercises work together to condition your whole body.

If the instructions and photo demonstrations are not clear, seek the advice of a fitness professional. Do not perform any exercise without being certain of its proper form.

Grip Variations

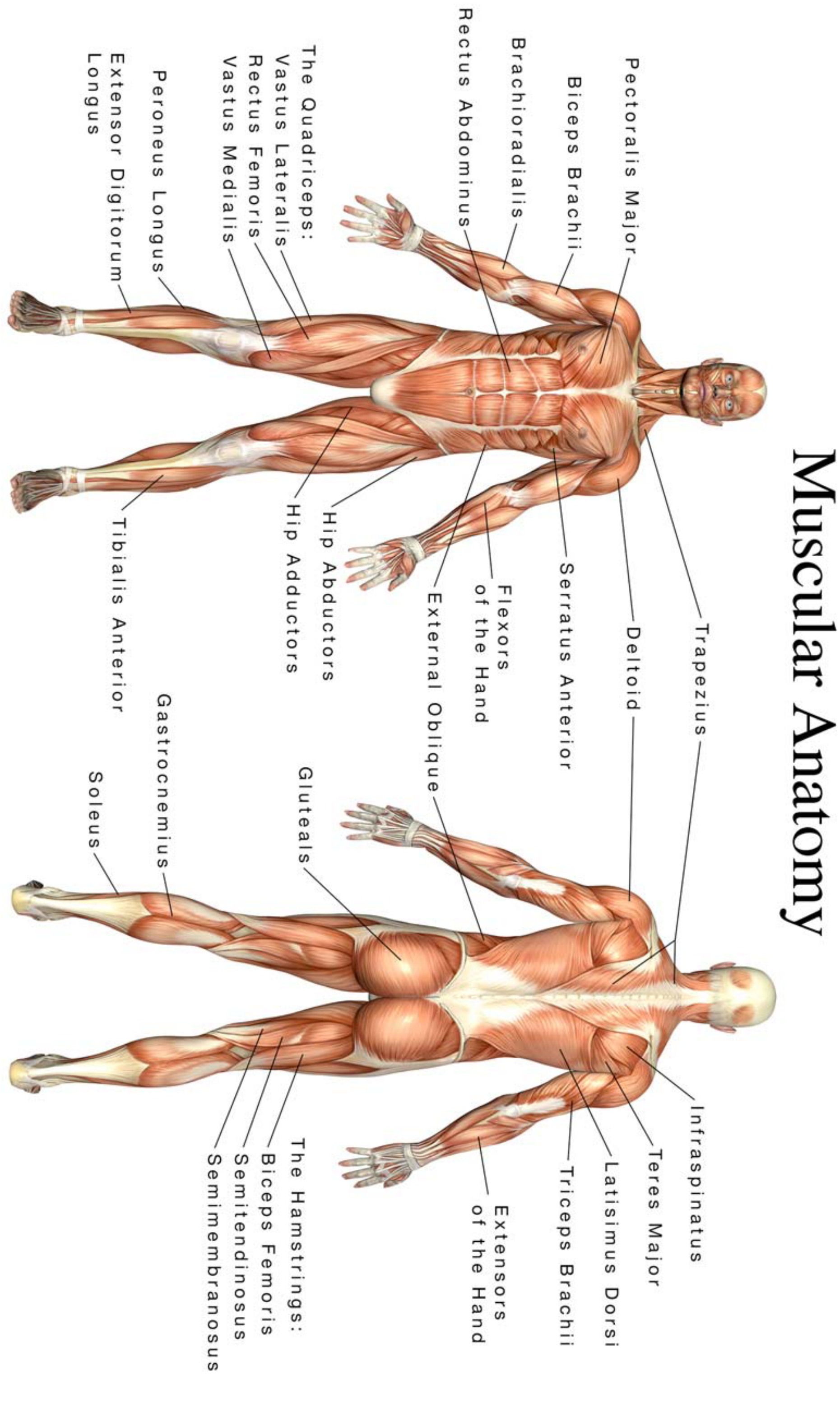
An easy way to vary the effect of many exercises is to change the pronation, or angle, of the hand. By doing this, different parts of the biceps, triceps, shoulders, and even the chest and back are emphasized. In the workouts that follow (see **Unit 6- The Programs**), overhand, parallel, and underhand grips are used at different times. When in doubt, use whatever grip feels most natural to you. Each is demonstrated below:

Overhand



Parallel

Underhand


Muscular Anatomy
Pectoralis Major
Biceps Brachii
Brachioradialis
Rectus Abdominus
The Quadriceps:
Vastus Lateralis
Rectus Femoris
Vastus Medialis
Peroneus Longus
Extensor Digitorum
Longus
Trapezius
Deltoid
Serratus Anterior
Flexors
of the Hand
External Oblique
Hip Abductors
Hip Adductors
Tibialis Anterior
Gluteals
Gastrocnemius
Soleus
Infraspinatus
Teres Major
Latisimus Dorsi
Triceps Brachii
Extensors
of the Hand
The Hamstrings:
Biceps Femoris
Semitendinosus
Semimembranosus

Floorwork

Push Up (Regular)

Muscles Worked: Pectorals, anterior deltoids, triceps, core stabilizers
At Risk: Shoulders, elbows, wrists
Equipment Required: Mat

1. Lie on stomach, hands flat on floor immediately to the sides the chest.
2. Keep body rigid and straight while pressing off the floor until arms are straight. Pause at top of push up.
3. Lower body until chest touches floor without resting.

Push Up (Modified)

Muscles Worked: Pectorals, anterior deltoids, triceps, core stabilizers
At Risk: Shoulders, elbows, wrists
Equipment Required: Mat

1. Lie on stomach, hands flat on floor immediately to the sides the chest.
2. Keep body rigid and straight while pressing off the floor until arms are straight, pivoting at the knees. Pause at top of push up.
3. Lower body until chest touches floor without resting.

Straight Crunch

Muscles Worked: Abdominals
At Risk: Lower back, neck
Equipment Required: Mat

1. Lie on back with knees bent and feet flat on floor. Place hands at sides of head.
2. Curl shoulders off floor without pulling on head. Keep your chin off your chest to reduce tension in your neck. Stop and pause when only your lower back remains flat on floor.
3. Slowly lower your shoulders until they touch floor without resting.

Side Crunch

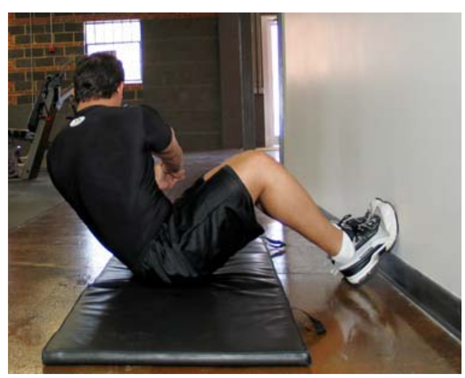
Muscles Worked: Obliques
At Risk: Lower back, neck
Equipment Required: Mat

1. Lie on back with knees bent and feet flat on floor. Rotate knees 45 degrees to one side.
2. Curl shoulders off floor without pulling on head. Keep your chin off your chest to reduce tension in your neck. Stop and pause when only your lower back remains flat on floor.
3. Slowly lower your shoulders until they touch floor without resting.
4. Complete entire set before switching to other side.

Russian Twist

Muscles Worked: Abdominals, obliques
At Risk: Lower back, neck
Equipment Required: Mat, solid wall or partner

1. Lie on back with knees bent and feet secured by a partner or wedged at the base of a solid wall. Clasp hands and extend arms in front of chest. Lift body off floor.
2. Rotate upper body to the right while keeping your arms extended directly in front of your chest. Pause when you have rotated as far as you can, then return to the upright, starting position.
3. Pause at the starting position before rotating to the left.



Superman

Muscles Worked: Lower back, rhomboids, shoulders, glutes, hamstrings
At Risk: Lower back, neck
Equipment Required: Mat

1. Lie on stomach with arms extended in front of shoulders.
2. Raise arms and legs off floor as high as possible while keeping them rigid and straight. Pause at highest point achievable.
3. Slowly lower arms and legs until they touch the floor without resting.

Swimmers

Muscles Worked: Lower back, rhomboids, shoulders, glutes, hamstrings
At Risk: Lower back, neck, shoulders
Equipment Required: Mat

1. Lie on stomach with arms extended in front of shoulders.
2. Raise arms and thighs off floor as high as possible while "swimming" arms towards the sides of your thighs. Pause when your hands reach your thighs.
3. Return to the starting position without resting your arms or thighs on the floor.

Note: Be sure to rotate your arms so that your thumbs point at each other at both the beginning and end of the swimming motion. This will reduce the tension in your shoulders.

Wave Offs

Muscles Worked: Lower back, rhomboids, shoulders, glutes, hamstrings
At Risk: Lower back, neck, shoulders
Equipment Required: Mat

1. Lie on stomach with elbows and knees bent 90 degrees.
2. Raise arms and thighs off floor as high as possible while squeezing elbows together. Pause at highest point achievable.
3. Return to the starting position without resting your arms or thighs on the floor.

Note: Keep forearms parallel to floor throughout exercise.

Flutter Kicks

Muscles Worked: Hip flexors, abdominals, quadriceps
At Risk: Lower back, hips
Equipment Required: Mat

1. Lie on back with legs straight. Place arms at sides and raise legs off floor.
2. Flutter kick in the air while keeping legs rigid and straight.

Note: Keep chin off chest to reduce strain on neck.

Bicycles

Muscles Worked: Hip flexors, abdominals, quadriceps
At Risk: Lower back, neck, hips
Equipment Required: Mat

1. Lie on back. Place arms at sides and raise legs until feet are pointing at ceiling.
2. Rotate legs as if riding a bike above your hips, making the largest circles possible with each foot.

Note: This exercise can be performed forwards and backwards for variety.

1

Forwards 4
Backwards 2

Forwards 2
Backwards 4

3

Adductor/Abductor Scissors

Muscles Worked: Adductors, abductors, hip flexors, abdominals, quadriceps
At Risk: Lower back, neck, hips
Equipment Required: Mat

1. Lie on back with legs straight. Place hands to the sides and raise legs off floor.
2. Rapidly cross your legs over each other then split them as wide as possible, alternating which leg ends up on top with each repetition.

Bridges

Muscles Worked: Glutes, hamstrings, lower back
At Risk: Lower back, neck
Equipment Required: Mat

1. Lie on back with knees bent and feet flat on floor. Place hands on floor at 45 degree angles away from body.
2. Lift hips off floor as high as possible while rolling onto your shoulders. Pause at highest point achievable.
3. Slowly lower hips until they touch the floor without resting.

Note: To increase difficulty, bridge using only one leg, keeping the other held straight in the air.

Mule Kick

Muscles Worked: Glutes, hamstrings, lower back
At Risk: Lower back, knees
Equipment Required: Mat

1. Begin on all fours. Raise one leg until knee is just touching the floor with knee bent at 90 degrees.
2. Push foot towards ceiling as high as possible. Pause at highest point achievable.
3. Slowly lower foot until knee is once again just touching the floor.
4. Complete entire set before switching to other leg.

Frog Pull

Muscles Worked: Glutes, hamstrings, lower back
At Risk: Lower back, hips
Equipment Required: Mat

1. Lie on stomach, propped up on elbows. Place soles of feet together with legs as straight as possible.
2. Squeeze feet together while bending knees as far as possible, pause, then straighten to starting position.

Saxon Side Bends

Muscles Worked: Abdominals, obliques, lower back
At Risk: Lower back
Equipment Required: None

1. Stand with a wide stance and arms held straight above head.
2. Slowly lean as far as possible to the side, emphasizing a “C” shaped curve with your body. Pause at the farthest bend possible.
3. Return to the starting position and pause before leaning to the other side.

Legs

Bench Squat

Muscles Worked: Quadriceps, hamstrings, glutes
At Risk: Lower back, knees
Equipment Required: Bench or chair, dumbbells (if needed)

1. Stand 15-20 centimeters in front of a secure bench or chair with feet shoulder-width apart. If using dumbbells, allow arms to hang at sides without unnecessary tension. Shoulders should remain back and head should remain up throughout this exercise to help maintain proper posture.
2. Slowly descend, arching your lower back and rolling your hips forward. Stop when your buttocks barely touch the edge of the bench without resting. Heels should remain flat, and the knees should not be bent more than 90 degrees (if this happens, use a taller bench).
3. After a brief pause, ascend slowly while exhaling until standing straight again.

Step Ups

Muscles Worked: Quadriceps, hamstrings, glutes
At Risk: Knees
Equipment Required: Bench or chair, dumbbells (if needed)

1. Place one foot on secure bench or low chair. If using dumbbells, allow arms to hang at sides without unnecessary tension. Shoulders should remain back and head should remain up throughout this exercise to help maintain proper posture.
2. Step onto bench, then slowly lower yourself back to the ground.
3. Complete set with one leg before switching to the other.

Note: If you knee is bent more than 90 degrees, then you must find a lower bench or chair.

Single Leg Squat

Muscles Worked: Quadriceps, hamstrings, glutes
At Risk: Knees
Equipment Required: Bench or chair, dumbbells (if needed)

1. Place the instep of one foot on a secure bench or chair behind you. If using dumbbells, allow arms to hang at sides without unnecessary tension. Shoulders should remain back and head should remain up throughout this exercise to help maintain proper posture.
2. Slowly descend, arching your lower back and rolling your hips forward. Stop when your knee reaches a 90 degree bend. Heel on floor should remain flat.
3. After a brief pause, ascend slowly while exhaling until standing straight again.

Standing Lunge

Muscles Worked: Quadriceps, hamstrings, glutes
At Risk: Knees
Equipment Required: Dumbbells (if needed)

1. Place feet shoulder width apart, then step directly forward with one foot. Your feet should still appear to be shoulder width apart from the front. If using dumbbells, allow arms to hang at sides without unnecessary tension. Shoulders should remain back and head should remain up throughout this exercise to help maintain proper posture.
2. Lower rear knee to floor without bending front knee more than 90 degrees. Stop just before knee touches floor, pause, then slowly rise to the starting position.

Note: An easy way to make sure that your front knee doesn't bend more than 90 degrees is to watch your toes throughout the exercise. If you can keep your front knee from blocking your view of your toes, then your knee cannot be bent more than 90 degrees.

Walking Lunge

Muscles Worked: Quadriceps, hamstrings, glutes
At Risk: Knees
Equipment Required: Dumbbells (if needed)

1. Place feet shoulder width apart, then step directly forward with one foot. Your feet should still appear to be shoulder width apart from the front. If using dumbbells, allow arms to hang at sides without unnecessary tension. Shoulders should remain back and head should remain up throughout this exercise to help maintain proper posture.
2. Lower rear knee to floor without bending front knee more than 90 degrees. Stop just before knee touches floor and pause. Step forward with your rear leg as you rise, and lunge forward with the other leg as described above.

Note: Make sure that your feet remain shoulder width apart as you step into the new lunge position.

Standing Leg Extension

Muscles Worked: Quadriceps, hip flexors
At Risk: Knees, lower back
Equipment Required: Cable tower or exercise band, ankle strap

1. Attach cable to one ankle and face *away from* pulley. Hold onto a chair or partner for balance, and lift knee as high as possible.
2. Extend leg slowly until straight, pause, then return to a 90 degree bend. You should maintain the position of your thigh relative to the floor throughout the exercise.

Note: For additional difficulty, perform exercise without holding onto chair or partner.

Standing Leg Curl

Muscles Worked: Hamstring, glutes, hip extensors, lower back
At Risk: Knees, lower back
Equipment Required: Cable tower or exercise band, ankle strap

1. Attach cable to one ankle and face *towards* pulley. Hold onto a chair or partner for balance.
2. Bend knee as far as possible, pause, then return to the starting position.

Note: For additional difficulty, perform exercise without holding onto chair or partner.

Quadriceps Cycling

Muscles Worked: Quadriceps, hip flexors, abdominals
At Risk: Knees, lower back
Equipment Required: Cable tower or exercise band, ankle strap

1. Attach cable to one ankle and face *away from* pulley. Hold onto a chair or partner for balance.
2. Rotate leg as if riding a bicycle, making as large a circle as possible.

Note: For additional difficulty, perform exercise without holding onto chair or partner.

1

3

2

Hamstring Cycling

Muscles Worked: Hamstring, glutes, hip extensors, lower back
At Risk: Knees, lower back
Equipment Required: Cable tower or exercise band, ankle strap

1. Attach cable to one ankle and face *towards* pulley. Hold onto a chair or partner for balance.
2. Rotate leg as if riding a bicycle, making as large a circle as possible.

Note: For additional difficulty, perform exercise without holding onto chair or partner.

1

3

2

Hip Flexion

Muscles Worked: Quadriceps, hip flexors, abdominals
At Risk: Knees, lower back
Equipment Required: Cable tower or exercise band, ankle strap

1. Attach cable to one ankle and face *away from* pulley. Hold onto a chair or partner for balance.
2. Keep leg straight and rigid as you raise foot forward as far as possible. Pause, then return to the starting position.

Note: For additional difficulty, perform exercise without holding onto chair or partner.

Hip Extension

Muscles Worked: Hamstring, glutes, hip extensors, lower back
At Risk: Knees, lower back
Equipment Required: Cable tower or exercise band, ankle strap

1. Attach cable to one ankle and face *towards* pulley. Hold onto a chair or partner for balance.
2. Keep leg straight and rigid as you raise foot reward as far as possible. Pause, then return to the starting position.

Note: For additional difficulty, perform exercise without holding onto chair or partner.

Hip Adduction

Muscles Worked: Adductors
At Risk: Knees
Equipment Required: Cable tower or exercise band, ankle strap

1. Stand sideways to pulley and strap cable to *near* ankle. Hold onto a chair or partner for balance, if necessary.
2. Keep leg straight and rigid as you sweep foot in front of other leg and as far away from pulley as possible. Pause, then return to starting position.

Note: Position yourself far enough away from pulley that you get as large a range of motion from side to side as possible.

Hip Abduction

Muscles Worked: Abductors, glutes
At Risk: Knees, lower back
Equipment Required: Cable tower or exercise band, ankle strap

1. Stand sideways to pulley and strap cable to *far* ankle. Hold onto a chair or partner for balance and cross far leg over near leg.
2. Keep leg straight and rigid as you sweep foot in front of other leg and as far away from pulley as possible. Pause, then return to starting position.

Note: Position yourself far enough away from pulley that you get as large a range of motion from side to side as possible.

Standing Calf Raise

Muscles Worked: Gastrocnemius
At Risk: Ankle, plantar fascia
Equipment Required: Step or other platform

1. Stand with the *balls* of your feet firmly on the edge of a step and your heels suspended.
2. Stand as tall as you can, emphasizing a squeeze in your calves. Slowly lower yourself until your heels are just below the edge of the step.

Note: To increase difficulty, do one leg at a time with other leg suspended in air.

Seated Calf Raise

Muscles Worked: Soleus
At Risk: Ankle, plantar fascia
Equipment Required: Solid wall

1. Lean against the wall as if sitting in an invisible chair.
2. Rise slowly onto the balls of your feet. Slowly lower yourself until your heels are just touching the floor, but not resting. Keep a contraction on the calf muscles from the first through the last repetition.

Note: To increase difficulty, do one leg at a time with other leg crossed over knee.

Toe Lift

Muscles Worked: Tibialis anterior
At Risk: Ankle, plantar fascia
Equipment Required: Step or other platform, bench (optional)

1. Stand or sit with the *heels* of your feet firmly on the edge of a step and the balls of your feet suspended.
2. Curl your toes upward, towards your knees, emphasizing a squeeze in your shins. Slowly lower your feet until your toes are just below the edge of the step.

Note: To increase difficulty, do one leg at a time (standing) or add weights as shown (seated).

Sock Grab

Muscles Worked: Muscles of feet
At Risk: Plantar fascia
Equipment Required: Sock

1. Remove your shoes and socks.
2. Grab a sock with the toes of one foot, lift it off the floor, and pause. Release.

Note: Exercise can be performed seated or standing.

Internal/External Ankle Rotation

Muscles Worked: Tibialis anterior
At Risk: Ankle, plantar fascia
Equipment Required: Step or other platform, bench (optional)

1. Stand or sit with the *heels* of your feet firmly on the edge of a step and the balls of your feet suspended suspended.
2. Draw large circles with your feet, moving clockwise with the left foot and counter-clockwise with the right for internal ankle rotation. Reverse direction for external ankle rotation.

Note: To increase difficulty, do one leg at a time (standing) or add weights as shown (seated).

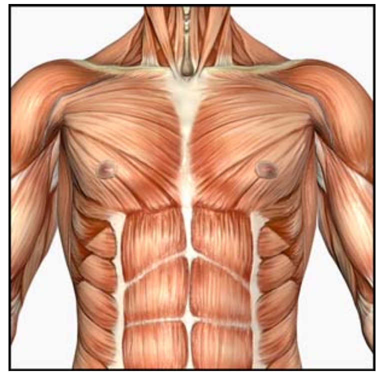
1

Internal 4
External 2

Internal 2
External 4

3

Chest



Dumbbell Chest Press

Variations: Overhand, parallel, or underhand grips on flat, incline, or decline benches
Muscles Worked: Pectorals, anterior deltoids, triceps
At Risk: Shoulders, elbows, wrists
Equipment Required: Bench (flat, incline, or decline), dumbbells

1. Lie on bench with feet flat on floor. Dumbbells should be to the sides of ribcage, even with pectoral muscles.
2. Slowly press dumbbells up, directly above pectorals, until elbows are straight but not locked. Pause, then return to starting position.

Note: When working with heavy weights, begin by sitting on bench with dumbbells on thighs. Roll onto back, lifting dumbbells into place with thighs. Reverse this process to put dumbbells on floor.

Dumbbell Pec Fly

Variations: Overhand, parallel, or underhand grips on flat, incline, or decline benches
Muscles Worked: Pectorals, anterior deltoids, triceps
At Risk: Shoulders, elbows, wrists
Equipment Required: Bench (flat, incline, or decline), dumbbells

1. Lie on bench with feet flat on floor. Arms should be stretched out to sides with elbows bent slightly, not straight. Dumbbells should not be allowed to drop below chest level at any point during exercise.
2. With arms remaining rigid, bring dumbbells upward in a clapping motion until they meet directly above pectorals. Pause, then return to starting position.

Note: When working with heavy weights, begin by sitting on bench with dumbbells on thighs. Roll onto back, lifting dumbbells into place with thighs. Reverse this process to put dumbbells on floor.

Standard Cable Chest Press

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Mid pectorals, anterior deltoids, triceps
At Risk: Shoulders, elbows, wrists
Equipment Required: Cable towers or exercise bands

1. Pull *upper* cables to sides of chest, then step forward into a lunge stance with either leg. With a straight back, bend at the waist so that the cables pull perpendicularly to your chest.
2. Press handles *forward* until elbows are straight but not locked. Pause, then return to starting position.

Incline Cable Chest Press

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Upper pectorals, anterior deltoids, triceps
At Risk: Shoulders, elbows, wrists
Equipment Required: Cable towers or exercise bands

1. Pull *lower* cables to sides of chest, then step forward into a lunge stance with either leg. Back should be straight.
2. Press handles *upward* until elbows are straight but not locked. Pause, then return to starting position.

Decline Cable Chest Press

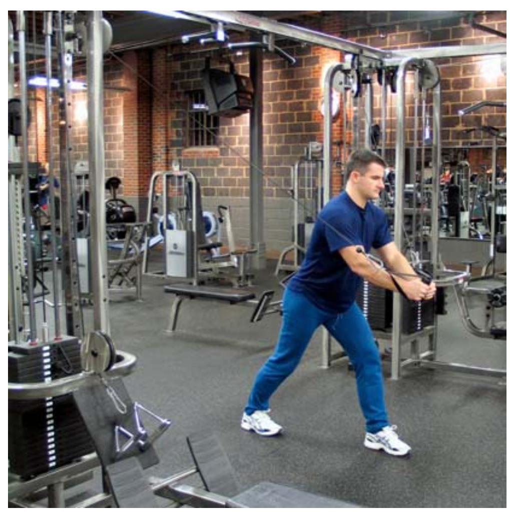
Variations: Overhand, parallel, or underhand grips
Muscles Worked: Lower pectorals, anterior deltoids, triceps
At Risk: Shoulders, elbows, wrists

1. Pull *upper* cables to sides of chest. Back should be straight.
2. Press handles *downward* until elbows are straight but not locked. Pause, then return to starting position.

Standard Cable Pec Fly

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Mid pectorals, anterior deltoids, triceps
At Risk: Shoulders, elbows, wrists
Equipment Required: Cable towers or exercise bands

1. Pull *upper* cables to sides of chest, then step forward into a lunge stance with either leg. With a straight back, bend at the waist so that the cables pull perpendicularly to your chest.
2. Once in the lunge position, stretch arms out to sides with elbows bent slightly, not straight. Hands should not be allowed to pass rearward of chest at any point during exercise.
3. With arms remaining rigid, bring hands *forward* in a clapping motion until they meet directly in front of pectorals. Pause, then return to starting position.



Incline Cable Pec Fly

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Upper pectorals, anterior deltoids, triceps
At Risk: Shoulders, elbows, wrists
Equipment Required: Cable towers or exercise bands

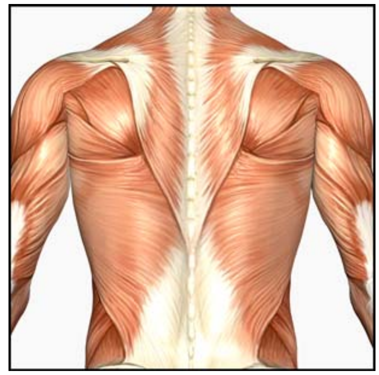
1. Pull *lower* cables to sides of chest, then step forward into a lunge stance with either leg. Back should be straight.
2. Once in the lunge position, stretch arms out to sides with elbows bent slightly, not straight. Hands should not be allowed to pass rearward of chest at any point during exercise.
3. With arms remaining rigid, bring hands *upward* in a clapping motion until they meet directly in front of head. Pause, then return to starting position.

Decline Cable Pec Fly

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Lower pectorals, anterior deltoids, triceps
At Risk: Shoulders, elbows, wrists
Equipment Required: Cable towers or exercise bands

1. Pull *upper* cables to sides of chest. Back should be straight.
2. Once in the lunge position, stretch arms out to sides with elbows bent slightly, not straight. Hands should not be allowed to pass rearward of chest at any point during exercise.
3. With arms remaining rigid, bring hands *downward* in a clapping motion until they meet directly in front of pelvis. Pause, then return to starting position.

Back



Bent Over Row

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Rhomboids, trapezius, posterior deltoids, biceps, forearms
At Risk: Lower back, shoulders, elbows
Equipment Required: Dumbbells or exercise bands

1. Bend knees and stick out butt to engage muscles of lower back. Bend forward at waist as far as possible without compromising curve in lower back. Allow arms to hang loosely from shoulders, then squeeze shoulder blades together.
2. Row dumbbells upward, trying to get elbows as far backwards as possible. Pause, then return to starting position.

Note: This exercise can also be performed by lying on a bench.

Bent Over Front Deltoid Raise

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Rhomboids, trapezius, deltoids, forearms
At Risk: Lower back, shoulders
Equipment Required: Dumbbells or exercise bands

1. Bend knees and stick out butt to engage muscles of lower back. Bend forward at waist as far as possible without compromising curve in lower back. Allow arms to hang loosely from shoulders, then squeeze shoulder blades together.
2. With straight and rigid arms, raise dumbbells *forward* as high as possible directly in line with shoulders. Pause when maximum height is achieved, then return to starting position.

Note: This exercise can also be performed by lying on a bench.

Bent Over Straight Arm Kickback

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Latisimus dorsi, triceps, posterior deltoids
At Risk: Lower back, shoulders
Equipment Required: Dumbbells or exercise bands

1. Bend knees and stick out butt to engage muscles of lower back. Bend forward at waist as far as possible without compromising curve in lower back. Allow arms to hang loosely from shoulders, then squeeze shoulder blades together.
2. With straight and rigid arms, push dumbbells *rearward* as high as possible directly in line with shoulders. Pause when maximum height is achieved, then return to starting position.

Note: This exercise can also be performed by lying on a bench.

Bent Over Rhomboid Fly

Variations: Overhand or parallel grips
Muscles Worked: Rhomboids, trapezius, deltoids, forearms
At Risk: Lower back, shoulders
Equipment Required: Dumbbells or exercise bands

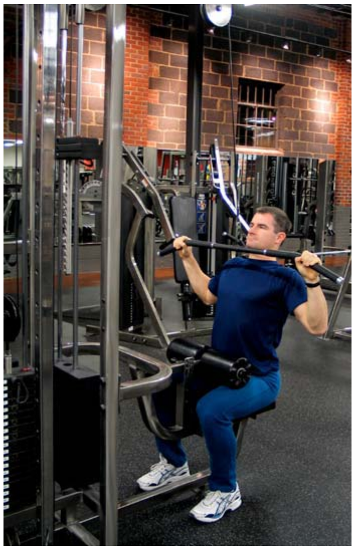
1. Bend knees and stick out butt to engage muscles of lower back. Bend forward at waist as far as possible without compromising curve in lower back. Allow arms to hang loosely from shoulders, then squeeze shoulder blades together.
2. With straight and rigid arms, raise dumbbells *sideward* as high as possible directly in line with shoulders. Pause when maximum height is achieved, then return to starting position.

Note: This exercise can also be performed by lying on a bench.

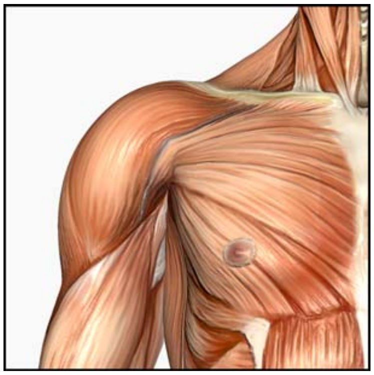
Lat Pulldown

Variations: Wide, close, or underhand grips
Muscles Worked: Latissimus dorsi, rhomboids, biceps, forearms
At Risk: Shoulders, elbows
Equipment Required: Cable and lat bar or exercise bands

1. Grasp lat bar and sit down with back straight. Squeeze shoulder blades together for duration of exercise. Arms should be extended with muscles under tension, not relaxed.
2. Pull bar in front of face to chin level. Pause, then return to starting position.



Shoulders



Shoulder Press

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Deltoids, trapezius, triceps
At Risk: Lower back, shoulders, elbows
Equipment Required: Dumbbells or exercise bands

1. Sit on bench or stand with feet shoulder width apart. Raise dumbbells to ear level. Squeeze shoulder blades together for duration of exercise.
2. Press dumbbells upward as high as possible. Pause, then return to starting position.

Shoulder Shrugs

Muscles Worked: Trapezius, deltoids
At Risk: Neck, shoulders
Equipment Required: Dumbbells or exercise bands

1. Stand with feet shoulder width apart. Allow arms to hang loosely from shoulders, then squeeze shoulder blades together.
2. Shrug shoulders towards ears as high as possible. Pause, then return to starting position.

Front Deltoid Raise

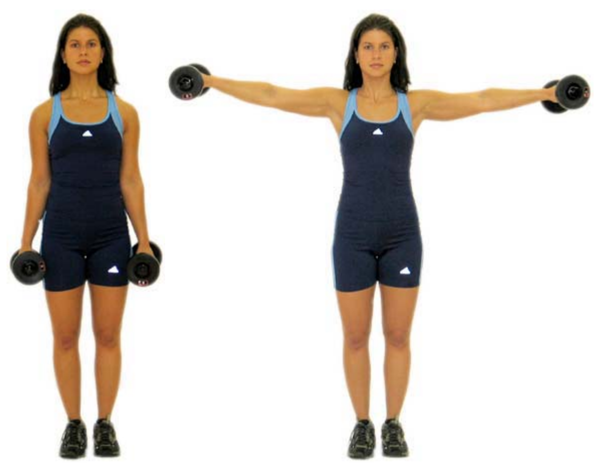
Variations: Overhand, parallel, or underhand grips
Muscles Worked: Deltoids, trapezius
At Risk: Neck, shoulders, lower back
Equipment Required: Dumbbells or exercise bands

1. Stand with feet shoulder width apart. Squeeze shoulder blades together for duration of exercise.
2. Raise dumbbells *forward* until arms are parallel to floor. Pause, then return to starting position.

Lateral Deltoid Raise

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Deltoids, trapezius
At Risk: Neck, shoulders
Equipment Required: Dumbbells or exercise bands

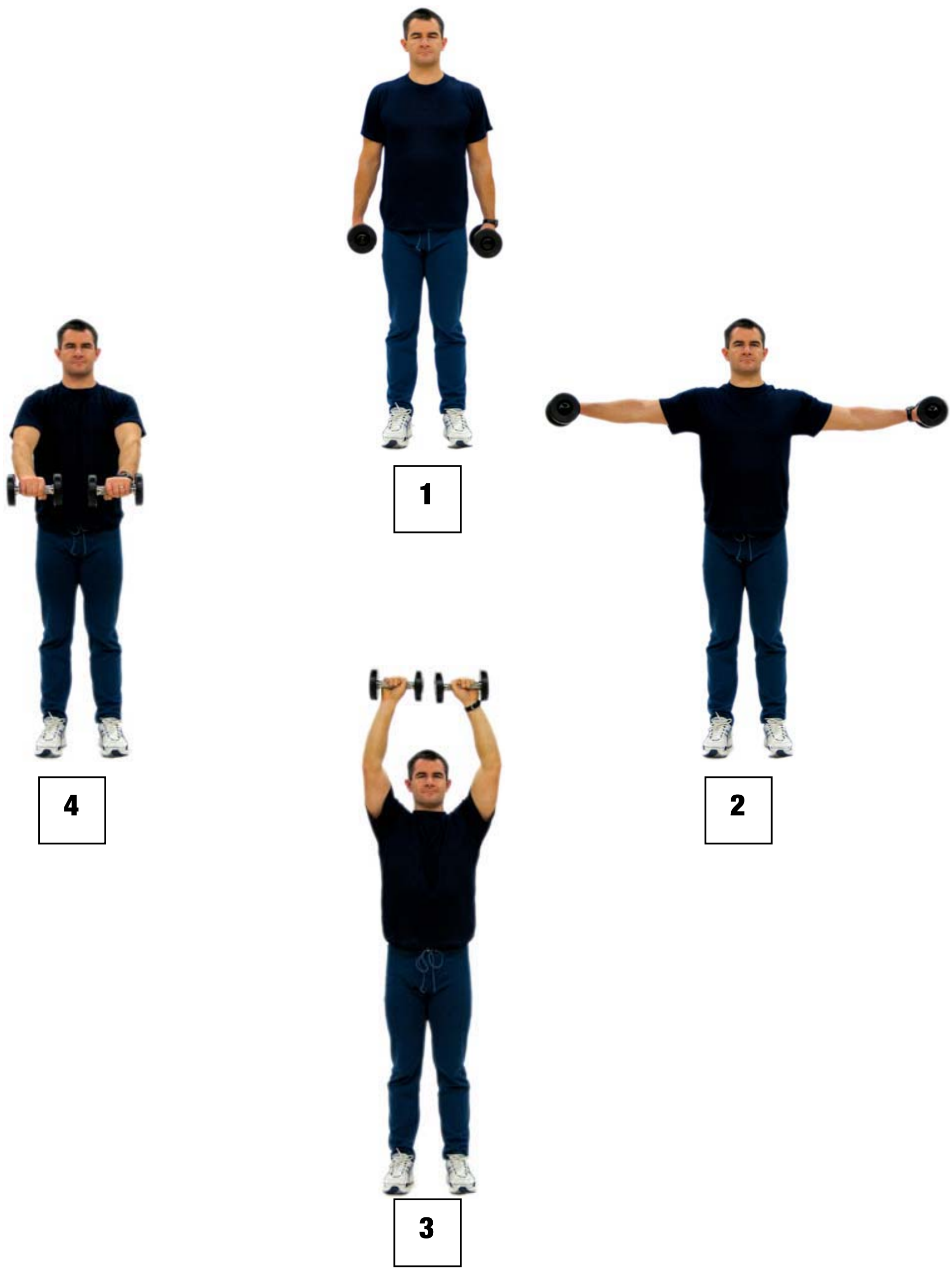
1. Stand with feet shoulder width apart. Squeeze shoulder blades together for duration of exercise.
2. Raise dumbbells *sideward* until arms are parallel to floor. Pause, then return to starting position.



Deltoid Around-the-Worlds

Variations: Forwards or backwards
Muscles Worked: Deltoids, trapezius
At Risk: Neck, shoulders, lower back
Equipment Required: Dumbbells or exercise bands

1. Stand with feet shoulder width apart. Squeeze shoulder blades together for duration of exercise.
2. Raise dumbbells *sideward* until arms meet above head, then lower dumbbells *forward* to front of thighs.



Biceps

Dumbbell Biceps Curl

Variations: Standard, hammer, or reverse grips
Muscles Worked: Biceps, forearms
At Risk: Neck, lower back, shoulders, elbows
Equipment Required: Dumbbells or exercise bands

1. Stand with feet shoulder width apart. Squeeze elbows tightly against sides of ribcage.
2. Curl dumbbells until elbows reach 45 degree bends. Pause, then lower dumbbells to starting position.

Concentration Curl

Variations: Standard or hammer grips
Muscles Worked: Biceps, forearms
At Risk: Neck, elbows
Equipment Required: Bench or chair, dumbbell

1. Sit with knees apart. Place back of upper arm against inside of thigh.
2. Curl dumbbell towards shoulder as far as possible. Pause, then lower dumbbell to starting position.

Monkey Curl

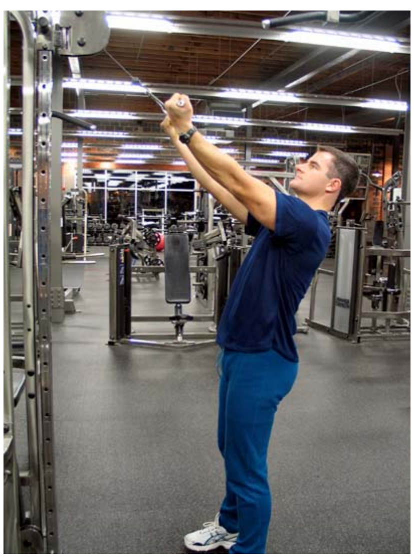
Muscles Worked: Biceps, forearms, deltoids, trapezius
At Risk: Neck, elbows, wrists
Equipment Required: Dumbbells

1. Stand with feet shoulder width apart. Squeeze shoulder blades together for duration of exercise.
2. Drag dumbbells upward along sides of ribcage towards armpits. Curl wrists upward to achieve maximum height. Pause, then return to starting position.

High Cable Biceps Curl

Variations: Standard, hammer, or reverse grips
Muscles Worked: Biceps, forearms, rhomboids
At Risk: Lower back, neck, elbows
Equipment Required: Cable with biceps bar or exercise bands

1. Grab bar and step away from pulley. Arms should be in line with cable, pointing directly at pulley.
2. Curl bar towards chin as far as possible without moving upper arms out of position. Pause, then return to starting position.



Triceps

Bench Dip

Variations: Bent or straight legs
Muscles Worked: Triceps, latissimus dorsi, deltoids
At Risk: Wrists, elbows, shoulders
Equipment Required: Bench or chair

1. Sit on the edge of a secure bench. Place hands on edge of bench immediately adjacent to hips. Lift body off bench and step forward with both feet.
2. Lower body towards floor until elbows are bent 45 degrees. Pause, then return to starting position.

Note: Beginners should perform exercise with knees bent and feet flat on floor.

Floor Dip

Muscles Worked: Triceps, latissimus dorsi, deltoids, glutes, hamstrings
At Risk: Wrists, elbows, shoulders, lower back
Equipment Required: Mat

1. Sit on mat with legs straight. Place hands on floor adjacent to hips. Lift body off floor with hands and feet flat on floor. Arms should be straight, and knees bent approximately 90 degrees.
2. Lower hips to floor by bending elbows only. Stop when elbows reach 90 degrees. Pause, then return to starting position.

Bent Over Triceps Kickback

Variations: Overhand, parallel, or underhand grips
Muscles Worked: Triceps, posterior deltoids
At Risk: Lower back, shoulders
Equipment Required: Dumbbells or exercise bands

1. Bend knees and stick out butt to engage muscles of lower back. Bend forward at waist as far as possible without compromising curve in lower back. Raise elbows as high as possible, then squeeze shoulder blades together. Forearms should hang loosely from elbows.
2. Push dumbbells *rearward* as high as possible. Pause when maximum height is achieved, then return to starting position.

Note: This exercise can also be performed by lying on a bench.

Overhead Triceps Press

Muscles Worked: Triceps, latissimus dorsi
At Risk: Elbows, shoulders, lower back
Equipment Required: Dumbbells or exercise band

1. Sit on bench or stand with feet shoulder width apart. Raise dumbbells straight above head. Biceps should be against ear.
2. Lower dumbbells behind head until elbow reaches 90 degrees. Pause, then return to starting position.

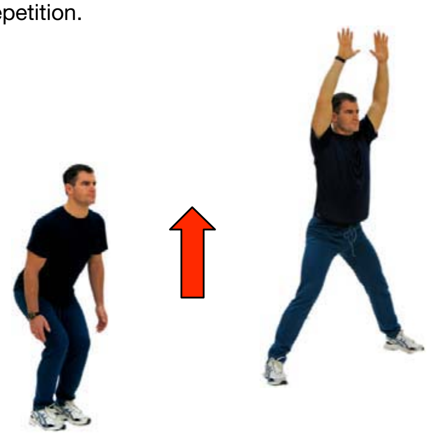
Note: Do not allow dumbbells to hit head or neck when lowered.

Calisthenics

Star Jumpers

Muscles Worked: Quadriceps, hamstrings, calves, abdominals, shoulders
At Risk: Ankles, knees, lower back

1. Stand with feet together and arms at sides.
2. Quickly squat down, then jump high into the air, raising arms overhead and spreading legs as wide as possible (as if doing a jumping jack in the air).
3. Bring legs and arms back together as you land. Squat to absorb the impact and prepare for the next repetition.



Lumberjacks

Muscles Worked: Hip flexors, abdominals
At Risk: Ankles, knees, lower back
Equipment Required: Bench

1. Stand with right foot on floor and left foot on bench. Right arm should be forward and the left rearward.
2. Jump to switch legs and arms, then repeat to complete one repetition.

Mountain Climbers

Muscles Worked: Hip flexors, abdominals, chest, shoulders
At Risk: Lower back

1. Start with hands on floor, left leg straight and the right leg bent, similar to a sprinter in the blocks.
2. Jump while keep your hands on the floor to switch legs, thrusting your left knee under your chest and straightening your right leg. Repeat to return to the starting position to complete one repetition.

Steam Engines

Muscles Worked: Hip flexors, abdominals
At Risk: Lower back

1. Start with feet shoulder width apart and arms out to the sides. Elbows should be bent 90 degrees with upper arms parallel to the floor.
2. Raise left knee towards right elbow as you twist your upper body to the left. Don’t bend forward or lower elbow towards knee. Instead, focus on raising knee as high as possible to meet the elbow.
3. Return to the starting position, then reverse to complete one repetition.

Jumping Lunges

Muscles Worked: Quadriceps, hamstrings, hip flexors, abdominals
At Risk: Ankles, knees, lower back

1. Start in lunge position, with right leg forward and left leg rearward.
2. Jump to switch legs, lowering yourself into the lunge position as you land. Repeat to complete one repetition.

High Stepping/Straight Leg High Stepping

Muscles Worked: Hip flexors, calves, abdominals
At Risk: Lower back

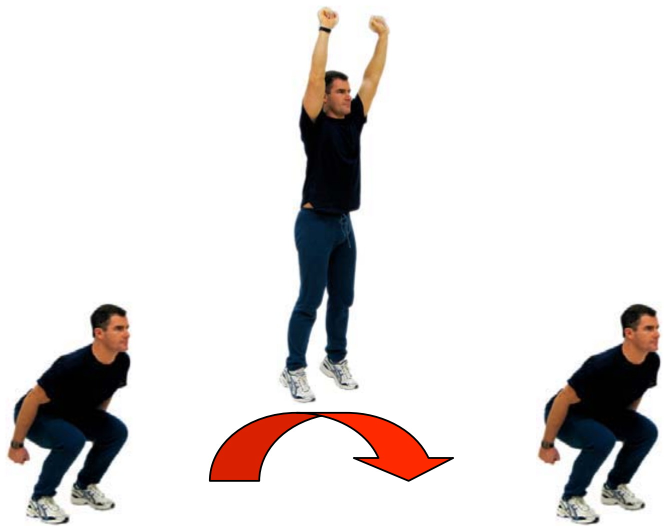
1. Stand with right knee in air and left leg straight. Left arm should be forward and right arm should be rearward.
2. Jump to switch legs and arms, then repeat to complete one repetition.

Note: For additional difficulty, perform this exercise with both legs straight.

Standing Broad Jump

Muscles Worked: Quadriceps, hamstrings, hip flexors, abdominals
At Risk: Ankles, knees, lower back

1. Start with feet shoulder width apart and arms at sides.
2. Squat low, then jump forward as far as possible.
3. Squat to absorb the impact and prepare for the next repetition.



Ski Jumpers

Muscles Worked: Quadriceps, calves, abdominals
At Risk: Ankles, knees, lower back

1. Stand with feet together, left hand up and right hand down.
2. Jump to right side, raising right hand and lowering left hand.
3. Jump to left side, raising left hand and lowering right hand to complete one repetition.

Unit 4
Stretching

Chapter 13
Principles of Stretching

Though research shows that stretching might not decrease our chances of injury during exercise (Black & Stevens 2001, Black et al 2002, Herbert & Gabriel 2002, Pope et al 2000, Shrier 1999, Thacker et al 2002, van Mechelen et al 1993, Weldon & Hill 2003), stretching does bestow two important benefits upon divers: increased range of motion and decreased cramping.

Increased Range of Motion

A program of regular stretching increases a joint's range of motion by lengthening the muscles and connective tissues that resist the movement of the joint.

Turning valve knobs behind your head is awkward at best, but stretching can make it easier. (Vadim Ternovski)

Reaching Valves

Whether you are diving an Al80 or a set of manifolded doubles, the ability to reach your tank valves behind your head is a fundamental safety skill. In addition to proper positioning of your equipment on your back, this requires flexibility of the shoulder. Tension in the triceps, pectorals, and rotator cuff can limit the ease with which you can get your hand on a valve with enough flexibility left over to turn it.

Finning

While there are many styles of finning, all require flexible ankles and hips for efficient power delivery and effective directional control. Ankles should be flexible in plantar flexion (downward), dorsiflexion (upward), and rotation.

Tight hamstrings, quadriceps, adductors and abductors contribute to stiffness in the hips and can prove especially limiting for techniques such as frog kick or shuffle kick. Tight muscles in the lower leg restrict ankle movement, making helicopter turns and backwards kicking slow and inefficient.

Decreased Cramping

Though the exact mechanism is still under study, research suggests that muscle fatigue and inflexibility lead to abnormalities in mechanisms that control muscle contraction (Schwellnus 1999, Schwellnus et al 1997). As a fatigued muscle's oxygen supply depletes, a spinal reflex stimulates the muscle to keep contracting.

By *strengthening* our muscles that are prone to cramping, we can delay the onset of fatigue. Likewise, by *stretching* our muscles that are prone to cramping, we reduce the amount of work required to contract them.

Stretching also changes the activity of the Golgi tendon organ (GTO), which is believed to provide signals to the spinal cord that trigger cramps (Bentley 1996). The GTO is a bundle of nerves in each skeletal muscle that senses tension.

In particular, muscles that span multiple joints are especially prone to cramping. In divers, cramps most frequently occur in the calves or feet, though hamstrings, adductors, and quadriceps cramps are also common.

When to Stretch

We can simplify things if we consider three different conditions under which we might stretch, especially in relation to our workouts:

Cold Muscle

This condition occurs when a muscle has not seen any appreciable activity. Muscular tension in a cold muscle is due to fluid viscosity, low circulation, and potentially a lack of proper joint alignment from disuse.

Stretching during this time is not normally associated with optimal gains in long-term flexibility. However, this does not make stretching of a cold muscle useless.

When a muscle is not warmed up, it usually does not have its entire range of motion available. Gentle stretching before use can make a muscle's full range available short-term. Think of waking up in the morning and stretching- this natural activity not only feels good, but it also helps our joints get their full ranges before use.

We can do the same thing before a workout where we do not have time for a proper warm up. This will prepare our joints for immediate use, though we should not expect to see the same increases in long-term flexibility as we would from post-warm-up stretching.

Muscle after a Warm-Up Period

"Warming up" is a literal term- our muscles increase in temperature from use, and this has a positive impact both on our stretching and our exercise. See **Chapter 3- Warming Up** for a more detailed explanation of this.

This is the condition considered most ideal for achieving lasting, long-term gains in flexibility. The muscle is at its most supple, is least likely to resist stretching, yet is not loaded with metabolic wastes from intense exercise. Also, muscular tension in a warm muscle is due mostly to its structure- i.e., the length of the fascia and tendons. When you stretch a warm muscle, you are actually stretching and lightly damaging the fascia and tendons, resulting in the long-term lengthening of these structures as they remodel.

Cardiovascular training, by its nature, can be considered one big warm up. Often, athletes doing intense training, like speed work, will stretch after a 10-minute easy warm up. Such an interruption of "mental momentum" is not always the best way to just get through a workout, so this is why many stretch after their cardiovascular activity is complete.

During a session dedicated to strength training, this means that the best time to stretch is after a 10-15 minute cardiovascular warm up. This both results in preparing the joints for their full ROMs and causes the muscles to lengthen over time.

Muscle Immediately after Strength Training (Pre-recovery)
A muscle used for high-intensity activity, such as strength training or sprinting, loads up with metabolic waste. Blood flows into the muscle faster than it leaves until the *fascia* wrapping the muscle bulges to its maximum volume. This is known as getting "pumped up."

When you "inflate" the fascia, it expands at the midpoint of the muscle, thus pulling on the tendonous ends and creating tension on the joint(s) involved. If the muscle was properly warmed up and stretched before use, there is not much stretching left to be done in the structure of the muscle itself. Nor will this type of muscle tightness result in long-term reductions in flexibility. This is only a short-term tension that will be relieved as the fluid pressure decreases.

So, why does a muscle tight from weight training feel better and "looser" after a big stretch? Because stretching "squishes" fluid out of the muscle by pulling on its tendonous ends, forcing the fascia to collapse. The problem is, this very pressure prevents fresh blood from entering the fascia to help clear away the toxins. Plus, if the pressure is high enough, it can even prevent the very fluid you're trying to clear from flowing out, *reducing* the rate of muscular recovery.

This is not the quickest way, nor the most effective way, of increasing the fluid exchange in a highly fatigued muscle. It is much better to "pump" the fluid out through gentle, repetitive contractions or stretches, and it just so happens that this occurs naturally as you use that muscle's antagonist (opposite).

For example, you were loading up the plates on a barbell for biceps curl when that girl/guy you've been trying to impress saunters up beside you. Naturally, you "biggie size" the plate you were just reaching for, making the bar as heavy as you've ever curled before.

Now, you know this guy/girl has their act together and won't be impressed by sloppy form, so you are careful to do every repetition picture perfect, and indeed, her/his proximity has its expected boost on your performance.

You finish the last repetition, put the weight down and, WHAMMM!!! Your biceps feel like they're going to bust out of your arm skin, and you don't know how you will ever straighten your elbows again. Do you stretch now? You certainly could, but you will achieve better results by taking advantage of the muscle pump.

It's much better to head on over to do some triceps extensions on the cables. Yes, the first two or three will feel like you're working against yourself, but very quickly, that repetitive contraction of the triceps will make those biceps fasciae pump all that pressure out. In the meantime, the brain is sending an inhibitory signal to the biceps muscles, helping them to "wind down" from the curls.

So, this is what you see in the exercise ordering of the programs in this guide. Most workouts alternate "pushes" and "pulls." One exercise helps you recover from another, and you can keep your heart rate cranking from the start to the end of your strength workout. If you still feel tight after a hard day of hitting the weights, it's better to hop back on the treadmill for a 10-minute walk than to stand around doing static stretching.

How to Stretch

Though there are at least a dozen different techniques for stretching muscles, the three most popular are described below.

Passive or Static Stretching (Stretch and Hold)
Passive stretching is the most commonly used method for increasing muscle flexibility. It is also referred to as *static stretching*.

Passive stretching involves gradually easing into a stretch and holding the position for 20-30 seconds. Holding a passive stretch for additional time has not been shown to increase flexibility. However, additional repetitions of a stretch separated by a short recovery period can be performed for especially tight muscles.

Passive stretching is the best technique to use when beginning a stretching program. It balances efficient gains in flexibility with little stress on the muscle system.

Beginners should start with passive stretching.

Ballistic Stretching (Stretch and Bounce)
Ballistic stretching involves using high velocity movements to force a muscle past the length achievable with a passive stretch. Because ballistic stretching does not allow your muscles to adjust to a stretched position, long term flexibility gains are reduced. Additionally, the muscles can even tighten up in reaction to the repetitive force. This extreme form of stretching can lead to muscle tears and is not recommended.

Proprioceptive Neuromuscular Facilitation
Proprioceptive neuromuscular facilitation, or PNF stretching, was developed by physical therapists to rehabilitate muscles that have become shortened due to paralysis or disuse. It has since become an effective technique to stretch muscles in healthy, conditioned individuals.

PNF stretching begins with a passive stretch as described above. Once the maximum passive stretch is achieved, the muscle is contracted isometrically against a partner or immovable object for 5-10 seconds. The muscle is then relaxed and immediately stretched again for 20-30 seconds. This cycle is then repeated until no additional stretch is achieved, which is commonly reached with 2-4 repetitions.

Contracting the stretched muscle against isometric resistance serves several purposes:

1. It fatigues the muscle, reducing its resistance to further stretching.
2. It adapts the muscle stretch receptors to a greater muscle length.
3. It activates the Golgi tendon organ (GTO), a sensory organ that measures tension in a muscle. When activated, the GTO inhibits the muscle's resistance to lengthening.

Stretch from Big to Small

Whichever stretching technique you choose (passive or PNF), you can maximize your gains in flexibility with some attention to order. Each joint in your body is surrounded by multiple muscles, some exerting more tension than others. These tight muscle systems can inhibit the amount of stretch you can achieve in other, looser muscle systems. So, it is best to begin by stretching the tightest muscles, then proceeding to the looser muscles around a joint.

Usually, the most tension comes from the largest muscle systems. Your chest and back, for example, likely exert more tension on the shoulder joint than your biceps and triceps. By stretching your chest and back first, you can then achieve a better stretch on your biceps and triceps. Quadriceps and hamstrings should be stretched before inner and outer thigh, and gastrocnemius (upper calf) should be stretched before soleus (lower calf).

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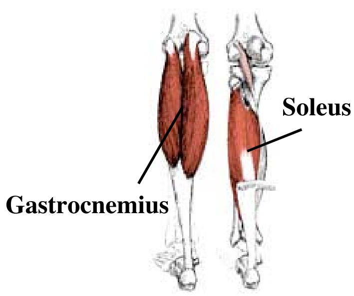
Chapter 14
Preventing Foot and Calf Cramps

Foot and calf cramps happen in even the fittest of divers after finning around for a dive. Most commonly a painful nuisance, these cramps can become a serious problem if currents change and you are working to get back to a mooring line or surface swimming to the boat.

Foot Anatomy

You can think of the foot as a "bag of bones." It is designed to flex throughout and must be allowed to do so for optimal strength and blood flow. The three-dimensional model to the right (courtesy William Ledoux, Ph.D., Dept. of Veterans Affairs) shows how the 28 bones of the foot form an arch supported by muscle and connective tissue underneath. Between every bone are flexible joints, giving the foot its many ranges of motion.



Calf Anatomy

The lower leg is devoted to flexing and extending the ankle via the most efficient skeletal muscles in your body. Typically, the muscles doing the most work while finning are the gastrocnemius (upper calf) and the soleus (lower calf), which runs behind and below it. They are responsible for pointing your toes, or the power stroke in most finning techniques, and are thus most likely to experience cramping during a dive.

Equipment

Before you blame your body for causing you pain, you need to eliminate your equipment as a trigger of cramps.

1. The foot pockets of your fins must be wide enough for the bones of your feet to be able to "splay," or spread apart, as you fin. Squish them together and the muscles in your feet can neither work nor circulate blood efficiently.
2. Your booties must be snug without restricting the bones of the foot for the same reason as above.
3. Your fin straps must not pull too deeply into your Achilles tendons, or this will cause extra tension on the muscles of the calves.
4. The legs of your wetsuit or drysuit should not be restrictive. As with your feet, if you can't move your legs through their natural ranges of motion, then they can't produce the power *you* need or get the blood supply *they* need.

Stretches

Muscle tightness is a well-known trigger of cramps. These stretches are easy to do and will make a real difference in calf flexibility.

Stretching should not hurt. Do not do any stretch to the point of pain. Move slowly through all movements described below, and hold each stretch for 20-30 seconds. Perform these stretches 4-5 times per week.

Toe Pull (Muscles of Feet)

1. Sit on the floor barefoot with one leg straight.
2. Loop a towel under your toes.
3. Pull until stretch is achieved.

Tip: As taught in most OW courses, this stretch can be done to relieve an active foot or calf cramp while diving. Just grab the blade of your fin, straighten your leg, and pull the blade back towards your knee.

Straight Leg Calf Stretch (Gastrocnemius)

1. Stand in a lunge position with hands on wall, keeping rear knee *straight* and both feet flat on the ground.
2. Lean your hips towards the wall until stretch is achieved. You should feel this in the *upper* calf area.

Bent Leg Calf Stretch (Soleus)

1. Stand in a lunge position with hands on wall, keeping rear knee *slightly bent* and both feet flat on the ground.
2. Lean your hips towards the wall until stretch is achieved. You should feel this in the *lower* calf area.

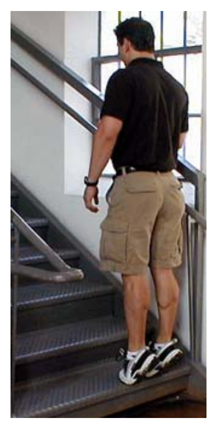
Exercises

Though this unit focuses on stretching, it is only natural to include the following exercises when you discuss cramping. The stronger your calves are, the easier finning will be and the less likely you will experience cramping. Also, fitter muscles have better circulation, further reducing their tendencies to cramp.

These exercises can be done immediately after performing the stretches above and should only take you a few minutes. Perform these exercises 2-3 times per week.

Sock Pickup (Muscles of Feet)

1. Remove your shoes and socks.
2. Grab a sock with the toes of one foot and lift it off the floor, holding for one second.
3. Release and repeat until fatigue achieved.



Standing Calf Raise (Gastrocnemius)

1. Stand with the balls of your feet firmly on the edge of a step and your heels suspended.
2. Stand as tall as you can, emphasizing a squeeze in your calves.
3. Slowly lower yourself until your heels are just below the edge of the step.
4. Repeat until fatigue achieved.

Tip: To increase difficulty, do one leg at a time.

Seated Calf Raise (Soleus)

1. Lean against the wall as if sitting in an invisible chair.
2. Rise slowly onto the balls of your feet.
3. Slowly lower yourself until your heels are just touching the floor, but not resting. Keep a contraction on the calf muscles from the first through the last repetition.
4. Repeat until fatigue is achieved.

Tip: To increase difficulty, do one leg at a time.

Chapter 15
Knees to Neck:
More stretches for diver flexibility

Increased flexibility can make certain aspects of your diving a lot easier, such as getting in and out of your gear, getting back on the boat, and maintaining proper trim while swimming. Hip and leg flexibility can also help you with more advanced finning techniques, such as backwards kicking and helicopter turns.

These stretches fill in the gap between those demonstrated in **Chapter 14 – Preventing Foot and Calf Cramps** and **Chapter 16 - Reaching Your Valves**. Perform the calf stretches first, followed by the stretches demonstrated below, and finish with the shoulder stretches. This toe-to-head order will help you to remember all of the stretches covered in these chapters.

Stretching should not hurt. Do not do any stretch to the point of pain. Move slowly through all movements described below, and hold each stretch for 20-30 seconds. Perform these stretches 4-5 times per week.

Quadriceps Stretch

This stretch can be performed either standing or lying on your side.

1. Grab the instep of your foot.
2. Pull foot towards your glutes until stretch is achieved, keeping thighs parallel.

Hamstring Stretch

1. Sitting on floor, fold one leg and straighten the other in front of your body.
2. Lean your chest towards your knee until stretch is achieved. Keep your back straight and your toes pointed *away* to isolate your hamstring.

Inner Thigh Stretch

1. While standing, spread your feet as far apart as possible *without* getting a stretch.
2. Squat over one foot as you stretch the inner thigh of the opposite leg. Keep toes pointed away to isolate the adductors.

Inner/Outer Hip Rotation

1. Sit on floor with one knee bent inward and the other bent outward.
2. Keep back straight as you lean over back ankle until a stretch is achieved, then lean over front ankle until a stretch is achieved.
3. Switch legs and repeat.

Hip Flexor Stretch

1. Kneel with one leg forward, keeping back upright.
2. Bend front knee until a stretch is achieved in hip of back leg.

Press Ups

1. Lie flat on your stomach.
2. Keep your body relaxed as you slowly press up off the floor until a stretch is achieved.

Hint: Let your stomach sag- if it's tight, it will interfere with the stretch.

Prayer Stretch

1. Start on all fours.
2. Sit back on your heels and crawl your hands out as far as you can. You should feel a stretch along the sides of your arms and ribcage.

Cat Stretch

1. Start on all fours.
2. Arch your mid back up towards the ceiling, using your muscles to achieve the stretch.

Camel Stretch

1. Start on all fours.
2. Sag your mid back down towards the floor, using your muscles to achieve the stretch.

Back Rotation

This stretch can be performed standing or kneeling.

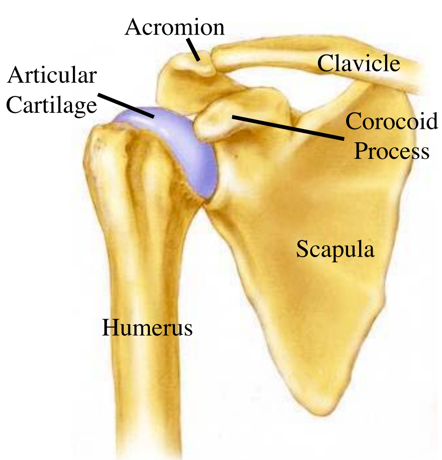
1. Straighten back, stick our your chest and lightly squeeze your shoulder blades together.
2. Slowly twist around as if to look behind you until stretch is achieved. You should feel a gentle stretch from the base of your skull to the top of your pelvis.

Chapter 16
Reaching Your Valves: Five Stretches for Shoulder Mobility

Jumping off a boat only to find that your tank is off should not be a life-threatening event. Likewise, diving double tanks with an isolation manifold adds a great margin of safety to deep or overhead diving, but only if you can reach your valves without assistance. By the time your buddy comes to your aid, a significant amount of gas may be lost that you could have otherwise preserved by shutting down your own valves. This increases the risk not only to yourself but also to your buddy, who may have to share gas with you as a result. Because of this, many experienced divers incorporate valve shut-off drills into their pre-dive buddy checks.

Shoulder Anatomy

The shoulder consists of not one but four joints and is connected to the trunk in only one place- the sternoclavicular joint. This is where the collarbone (clavicle) meets the upper ridge of the breastbone (sternum). The collarbone then continues outward to meet two finger-like projections of the shoulder blade (scapula), called the acromion and the coracoid process. The acromion is that boney lump you feel at the top of your shoulder, and the coracoid process can be felt below it covered in muscle.



Shoulder
(Anterior View)

The final joint of the shoulder connects the shoulder blade to the upper bone of the arm (humerus) at the glenoid capsule. This final joint is often referred to as a “ball and socket” joint, but it really fits together more like a cup and saucer. The ball on the humerus is very large, but the socket on the shoulder blade is quite shallow, allowing for a large range of motion.

So, most of the shoulder is left suspended from the back and neck via muscle connections, which is good news and bad news. The bad news is that if you allow your muscles to get tight, then your range of motion will decrease. The good news is that soft tissue responds to stretching, and over time you can gain very large increases in ranges of motion.

Most people think of the deltoid when they think of the shoulder muscles. In fact, all of the muscles in the chest and upper back are muscles with the sole purpose of moving and stabilizing the shoulder joint. These muscles contribute to tension around the joint and must be included in your shoulder stretching program.

Equipment

Your equipment must be properly adjusted before you have any chance of reaching your valves. One way of checking this is to have a buddy compare your shoulder mobility with and without your dive equipment on. If it is not *exactly* the same, you must identify the impediment and correct it. Common sources include:

Exposure Protection

1. Too tight a wetsuit or drysuit will obviously prevent you from bending your arms.
2. Drysuit insulation that is too *large* is just as bad as insulation that is too *small*. Overly bulky insulation can prevent you from bending in an otherwise properly fitted drysuit. The use of argon inflation and compressed thinsulate insulation can make up for much of the bulk some divers think they need. In any case, use only insulation specifically designed for wear under drysuits.

Backplate and Harness

1. Backplate should be positioned correctly on the harness.
2. Harness should be snug but not constricting.
3. Inflated wing should not get in the way.

Jacket-Style BCD

1. BCD should allow full range of motion in both arms, even when inflated.
2. Tank should be placed high enough so that the valve is within reach.

Other Gear

1. Gear such as lights, stage bottles, back-up regulators, etc., should be placed out of the way.
2. Wrists should be free from unnecessary clutter, such as extra gauges or writing slates.

The Stretches

Most of the time, the assistance of a qualified dive instructor is all you need to help you reach your valves. However, if your gear is squared away and you still have trouble reaching and turning your valves, then it’s time to adopt a stretching program. Give yourself 4-6 weeks to see an improvement in flexibility- you might even require several *months* of stretching to get to your valves with ease. So, patience and persistence are required.

Stretching should not hurt. Do not do any stretch to the point of pain. Move slowly through all movements described below, and hold each stretch for 20-30 seconds. Perform these stretches 4-5 times per week.

Hanging Shoulder Stretch

1. Place palms on a wall, shoulder width apart, keeping the elbows straight.
2. Walk your feet backward as you lean your chest towards the floor until stretch is achieved.

Hint: If you're tall enough, you can use a doorway.

Pectoral Stretch (High/Mid/Low)

1. Place palm on wall or doorway. To stretch the lower pec, the hand should be at head level. To stretch the mid pec, the hand should be at chest level. To stretch the upper pec, the hand should be at stomach level.
2. Rotate upper body away from the wall until stretch is achieved.
3. Repeat for other side.

Posterior Deltoid/Rhomboid Stretch

1. Reach your right hand over your left shoulder.
2. Place your left hand behind your right elbow.
3. With right arm relaxed, press on the elbow until stretch is achieved.
4. Repeat for other side.

Latissimus Dorsi/Triceps Stretch

1. Reach your right hand behind your neck.
2. Place your left hand behind your right elbow. You might have to reach around the back of your head to get the best stretch.
3. With right arm relaxed, press on the elbow until stretch is achieved.
4. Repeat for other side.

Swimmers Stretch

1. Reach both arms behind your back.
2. Clasp hands while keeping arms as straight as possible.
3. Press arms up as high as possible.

Unit 5
Dive Day

Chapter 17
Exercise on Dive Day

[Note: For purposes of the following discussion, "exercise" refers to any strenuous activity, including heavy lifting, extended walking, swimming, etc.]

No book on exercise for divers would be complete without discussing the issue of exercising on dive day. Many divers both exercise and dive with enough regularity that these interests are bound to conflict. Others enjoy strenuous activities on the surface when on vacations that include diving.

It's easy to see why a diver might want to exercise on dive day.

In discussing this issue, we must pay particular attention to timing. Exercise can have very different effects on a diver depending on whether it is done before, during, or after a dive. Each case is discussed below.

Exercise at Maximum Depth

From the beginning, divers and caisson workers have been used to perform physical labor under pressurization. Throughout the decades, researchers learned that those exerting themselves at depth were at greater risk for DCS upon surfacing. This includes professional divers working on oil rigs, emergency divers performing recoveries, and recreation divers swimming too hard against a current.

Small Bubbles Become Big Bubbles

Researchers have shown that exercise, whether performed at depth (Flook 1997) or on the surface (Conkin and Powell 2001), creates bubbles within the body. When bubbles are formed at depth, they can provide a way for additional dissolved gas to come out of solution during ascent. This liberated gas then adds to the size of the existing bubbles, potentially triggering DCS.

Increased Gas Loading

Exercise at depth can also increase the risk of DCS from an increase in gas absorbed by the diver (Dick et al 1984, Flook 1997, Buhlmann 1975, Shibli & Buhlmann 1972). The enhanced blood flow during exercise will accelerate the uptake of gas by tissues of the diver, a problem further compounded when that blood flow decreases during a slow, inactive ascent or staged decompression. This increased risk was demonstrated in several animal and human studies (Van der Aue et al 1951, 1949, 1945).

As a result, recreational divers should plan every dive to reduce the amount of exertion required at depth. This includes drifting or using diver propulsion vehicles (a.k.a. "scooters") when diving strong currents, perfecting buoyancy techniques to reduce finning, and even reducing the amount of acreage a diver intends to cover at depth. A slow, meditative dive ensures that gas loading occurs at the slowest possible rate.

Studying exercise at depth. (NASA)

Exercise While Decompressing

Most divers chose to stay within the no-decompression limits of their tables. Others, often referred to as "technical" divers, chose to dive deep and long enough to require in-water decompression.

Our current understanding of decompression suggests that off-gassing is largely *perfusion limited*. That is to say that a tissue's ability to decompress is directly correlated to the amount of circulation it receives.

One surefire way to increase perfusion is to increase muscular activity. Working muscles require more oxygen and produce a greater amount of carbon dioxide. This triggers an increase in blood flow through the opening of capillaries throughout the tissue. The additional buildup of carbon dioxide results in an increase in blood flow to the lungs, which increases gas exchange between our blood and the gas we breathe.

Increased Perfusion Means Increased Gas Exchange
In performing a study for space flight (see "*Altitude vs. Depth*" below), Conkin and Powell (2001) found that incidence of DCS and venous gas embolism was reduced with an increase in activity of subjects preparing for decompression to altitude. Subjects breathed 100% oxygen at the surface to *denitrogenate* their tissues prior to decompression. Those that restricted lower body movement but performed upper body exercise reduced their denitrogenation time relative to subjects who did *not* perform upper body exercise.

Another altitude study (Loftin, et al 1997) found that exercise during *oxygen prebreathe* doubled tissue perfusion and nitrogen elimination in subjects.

Note that denitrogenation, while a period of inert gas elimination, is not a period of decompression. However, this illustrates the acceleration that exercise can have on gas exchange.

The most compelling study supporting exercise during decompression was published in June 2004 (Jankowski et al 2004). Researchers simulated a dive to 45 msw in a water-filled hyperbaric chamber. Subjects that performed several intervals of moderate exercise during decompression showed less bubbling after returning to surface pressure than subjects inactive during decompression.

Earlier studies on divers found that mild exercise accelerates decompression and reduces post-dive bubbling (Flook 1997, Jankowski et al 1997). This is believed to be due to the increase in peripheral perfusion.

Yet another study examined the effect of *inactivity* during deco. Guilliod, et al, (1996) found that restricting subjects during decompression increase their incidence of DCS compared to unrestricted subjects.

Cavitation

Similar research examining divers seem contradictory. Several animal and human studies demonstrated an increase in DCS risk due to exercise during decompression (Van der Aue et al 1945, 1949, 1951). The risk to divers comes from their heightened tissue gas tensions compared to ambient pressure, making *cavitation* a possible consequence of repetitive joint movement. In other words, a diver performing in-water decompression might cause dissolved gas to form bubbles from the very activity intended to increase off-gassing.

The same phenomenon has been observed in subjects exercising at altitude (Conkin et al 2003, Webb et al 2001, Pilmanis et al 1999, Krutz & Dixon 1987). In all cases studied, exercise while decompressing at altitude produced a greater incidence of DCS. Conkin and Powell (2001) demonstrated that restricting lower body movement at altitude reduces DCS and VGE compared to walking.

Foster, et al, (2002) presented a model of the way exercise affects bubble formation and growth during decompression. They describe competing influences, whereby an exercising subject's elevated oxygen consumption increases bubble persistence in tissues, though increased perfusion suppresses bubble growth. Exercise as a whole would lead to a net reduction of bubble volume without the additional influence of cavitation.

Treading Lightly

Overall, divers are generally encouraged to limit exertion during decompression, but not eliminate activity altogether. Some light movement, such as slow arm pumping or cycling of the legs, might encourage tissue perfusion without causing undue bubbling.

Post-Dive Exercise

Strenuous activity immediately following a dive has been implicated in a number of DCS cases, and clinical research mirrors this experience (Pollard et al 1995, Van der Aue et al 1949). From a difficult climb onto a dive boat to carrying gear back to the shop, physical exertion while tissue tensions remain high has been shown to cause bubble formation and growth, leading to DCS.

One study seems to contradict what we see in accident reports. Muth, et al, (1994) found that post-dive nitrogen eliminated was tripled in subjects exercising upon surfacing from simulated dives. The researchers concluded that if tissue tensions could be kept at a safe level, such exercise could reduce surface decompression time without increasing risk of DCS.

Finding the Knife's Edge
The challenge, obviously, is in knowing where to draw the line. How do divers know when their tissue tensions are getting too high without already getting bent? In light of the real-world experience of divers taking trips to decompression chambers, it is best to avoid any strenuous activity immediately following a dive.

Of course, at some point, exercise must become safe again. While research has not been performed to quantify this issue, several experts on decompression have theorized that a diver should wait a total of 6 half-times of the compartment limiting decompression before exercising. This compartment is typically the 60 minute compartment in NDL diving, meaning that divers limiting themselves to NDL depths and times can safely exercise 6 hours after surfacing.

This assumes that the diver is not experiencing DCS, which can be difficult to ascertain at a sub-clinical level. Realizing that divers can surface with bubbles that cause no outward symptoms of DCS, we have no easy way to determine when we are *cleared*. Should a diver end up with enough *silent bubbles*, exercise might be enough to cause these bubbles to grow and elicit DCS.

Am I bent or just sore?
Additionally, the symptoms we normally associate with a good workout, namely fatigue and muscle soreness, mimic early symptoms of DCS. A post-dive workout could thus result in a false diagnosis of DCS or confound discovery of a real case of DCS. Obviously, the longer a diver waits to exercise after diving, the less this could be an issue.

Pre-Dive Exercise

The area of greatest controversy surrounds exercise done *prior* to diving. One German study published in 1994 (Dietzel, et al 1994) examined a single case of DCS attributed to dehydration caused by a pre-dive run. However, many divers regularly exercise the morning before diving without consequence. While DAN members perform roughly 12 million dives annually, it remains difficult to find additional cases of DCS in recreational divers directly attributed to this practice.

In spite of the evidence that many divers are exercising before diving, very little research has been done to ensure that those divers aren't accumulating injury from low-level DCS. Several recent studies, however, have examined the possibility that pre-dive exercise provides a protective effect by stimulating the release of certain beneficial *biochemicals*.

Norwegian researchers recently published three studies suggesting that exercise done a day before diving reduces a diver's risk of DCS. In one study done with human subjects (Dujic et al 2004), a single bout of interval training performed 24 hours prior to a simulated dive significantly reduced bubble formation, both in numbers and size. This study mirrored the results of an earlier study examining the same effect in rats (Wisloff and Brubakk 2001).

In a second study (Wisloff et al 2004), exercise performed by rats 20 hours prior to a simulated dive reduced bubble formation and allowed them to survive the protocol. Exercise performed 48, 10, 5, and 0.5 hours before a dive produced no effect, positive or negative, on bubbling or mortality.

In the third study (Wisloff et al 2003), rats were treated with an NOS inhibitor that was believed to increase the risk of DCS. Rats treated with the NOS inhibitor had a greater incidence of DCS than controls. Smaller rats that exercised 20 hours before the simulated dive showed no such effect from the administration of the NOS inhibitor, and even heavier, normally sedentary rats were significantly more likely to survive the protocol if it included a single bout of pre-dive exercise.

Altitude vs. Depth

Most of the remaining research on pre-decompression exercise completed in the past decade has examined its effect on astronauts preparing for spacewalks. While an astronaut wears a pressurized suit as protection from the vacuum of space, a suit pressurized to 14.7psi (surface pressure) would be too difficult to bend. For this reason, astronauts are decompressed over the course of several hours to 4.3psi to enable a more pliable suit.

These studies are known as “altitude” studies because 4.3psi represents the pressure of the Earth’s atmosphere at very high altitude. While these studies have shown that pre-decompression exercise increases DCS in astronauts (Dervay 2002, Powell et al 1995, Powell et al 1992), the results do not necessarily translate to conclusions applicable to diving.

In the altitude studies, subjects perform exercise(s) at or near one atmosphere of pressure, producing bubbles measurable by Doppler. The subjects are then decompressed to as little as 4.3psi, at which pressure any remaining bubbles will grow to more than three times their original size.

The surrounding tissues, previously saturated at surface pressure, become *super*-saturated at this lesser pressure. The partial pressures in the gas bubbles are thus lower than the tissue pressures, causing gas to leave the tissues and enter the bubbles. The bubbles must then grow in volume to maintain their pressure, per Boyle’s Law, compounding the potential for injury.

In diving, however, any bubbles formed at the surface are compressed at depth. On a recreational dive to 70 feet, for example, these bubbles would be less than one-third their size at the surface. Since these bubbles do not cause a problem on the surface, their influence on DCS risk can only come from their potential to act as seeds for creating larger bubbles upon surfacing.

Additionally, the tissues surrounding these bubbles are *under*-saturated, drawing gas from areas of higher partial pressure, including bubbles. Without other outside influences, the bubbles with therefore continue to shrink throughout the entire dive. This is one of the ways that decompression chambers treat DCS.

On dives using hyperoxic gasses, the additional percentage of oxygen will work to further reduce the size of the bubbles through a widening of the *oxygen window*.

Begging the Question

Ultimately, it remains entirely possible that exercise-induced bubbles formed at the surface have no influence on decompression sickness in a diver. However, as previously mentioned, no research has examined this possibility, leaving our best knowledge dictated by what conclusions we may draw from the altitude studies. With the pace of research in this area accelerating, we will likely have more specific information in the near future.

Other Risk Factors

Exercise not only creates bubbles, but it also results in several other important risk factors for divers.

Dehydration

During cardiovascular exercise, we can lose up to 1-2 liters of water per hour. Even when we think we are replenishing these lost fluids, most people can only tolerate drinking about 300-500mL per hour while exercising (Noakes 1993).

Protection from the sun can help you stay hydrated and ready to dive. (Ken Rutt)

Several studies have linked dehydration to an increased risk of DCS. A 1993 Israeli study on sport divers found a higher incidence of spinal DCS in divers exhibiting signs of dehydration (Aharon-Peretz et al 1993). As previously mentioned, a 1994 German study linked exercise-induced dehydration to a single case of DCS in a sport diver (Dietzel et al 1994).

Dehydration reduces the volume of blood in our bodies, which results in decreased tissue perfusion. Additionally, the *hematocrit*, or number of blood cells per volume of fluid, increases with dehydration. This increases the resistance of blood flowing into capillaries. Both of these effects reduce our capacities to remove gas dissolved in our tissues during decompression.

Hyponatremia

Hyponatremia exists when blood levels of sodium drop below a critical level. This is not normally a concern until someone has been sweating for several hours without replenishing the lost sodium. However, if you spend your post-exercise interval in the hot sun, the total sweat lost might become a problem.

Dilutional hyponatremia can occur when water is absorbed by the intestine at a rate faster than can be eliminated by the kidneys. Such extra water can dilute sodium levels enough to be a danger. This type of hyponatremia is extremely rare except in mental patients or athletes participating in ultra-endurance events, such as an Ironman triathlon. Even in events as strenuous as a marathon, dilutional hyponatremia occurs in less than 0.5% of participants (Hew et al 2003, Hsieh et al 2002, Speedy et al 2000). Most healthy divers should not worry about overhydrating as long as they are drinking less than 1 liter per hour (Noakes et al 2001).

In response to hyponatremia, our kidneys eliminate water to bring sodium concentrations back into the safe zone. We can drink all the water we want and not rehydrate until our sodium levels increase. Hyponatremia also causes cramping, impairs mental capacity, and reduces peripheral perfusion.

While some think of sport drinks as "electrolyte replacement" drinks, this is a misconception. The electrolytes included in sport drinks, such as sodium and potassium, are only enough to speed the absorption of the water and carbohydrates they contain. Since our sweat contains 2-3 grams of sodium per liter, we would need to drink *two gallons* of the most popular sport drink to replace the sodium lost from one hour of sweating. A better way to replenish lost sodium is through eating salty foods, such as pretzels, salted popcorn, or potato chips.

In any event, if environmental conditions or your pre-dive effort is enough to raise a credible concern of hyponatremia, then you are likely accumulating other sources of risk for DCS and should not dive.

Fatigue

Fatigue can be dealt with easily enough on the surface. However, fatigue can slow our reaction times, increase the chance that our muscles will cramp, and reduce the energy we have in reserve for dealing with physical problems while diving. Aharon-Peretz, et al, (1993) also determined that fatigue predisposed divers to DCS.

The level of post-exercise fatigue we experience is certainly a function of exercise intensity and our levels of fitness. We can also replenish our energy stores through eating and drinking the appropriate levels of calories. However, a diver must consider the physical capacity required of a dive gone wrong when deciding when and how much to exercise beforehand.

Increased Rate of Respiration

Exercise before a dive might also affect gas planning. Your metabolism rises during exercise and remains elevated for hours afterward. During this time, you continue to require a greater amount of oxygen and breathe at a higher rate. If you dive during this state, your gas supply will be depleted more quickly than if your metabolism were slower.

Increased Perfusion

Increased perfusion, or tissue blood flow, is not ordinarily a bad thing for divers. However, a high level of perfusion not only speeds off-gassing, but it also increases the rate of gas *absorption* by the tissues. If your perfusion is relatively even throughout your dive, this generally would not be a problem. However, if you start your dive with an elevated metabolism and dive long enough, your perfusion while you are on-gassing might be significantly greater than when you're off-gassing. The equations used to create dive tables do not use such a high level of tissue perfusion when estimating gas loading, and as a result, your tables might allow you to stay at depth longer than is safe.

How Long to Wait

One altitude study attempted to quantify the safe rest interval required between exercise and decompression (Dervay 2002). As a result of these findings, researchers (Powell 2003) and DAN (2004) recommend that NDL divers wait at least 4 hours before diving after exercise. By this time, any bubbles formed from exercising should be dissolved and metabolic levels should be near resting levels. Of course, this does not reflect the influence of additional activity, as would be expected by someone preparing for a dive.

Bubbles aside, such a rest interval will also give you time to eat, rehydrate, replenish lost sodium, and otherwise recover for the dive ahead. During this time, particular attention should be given to your overall physical readiness to dive that day. When in doubt, sit it out.

Divers planning more involved dives should consider taking a break from exercise on dive day. This would include dives requiring extended exposure and/or depth, dives involving greater physical demands, such as strong currents, or any dive at the limit of a diver's experience level.

Exercise on the days leading up to a big dive has not been shown to negatively impact DCS risk (Kumar et al 1992). Though more research is needed, exercise 24 hours before a big dive might actually be beneficial (Dujic et al 2004, Wisloff et al 2003, 2004).

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Chapter 18
Dealing with Heavy Gear

Over 70% of the population will experience lower back strain in his or her lifetime. In the best cases, the strain can be treated with over the counter anti-inflammatories (such as aspirin or ibuprofen) and rest. The worst result in bulging discs, which rarely can be fully repaired. Keep in mind that this is not as much an issue of fitness as it is one of repetitive stress combined with improper technique.

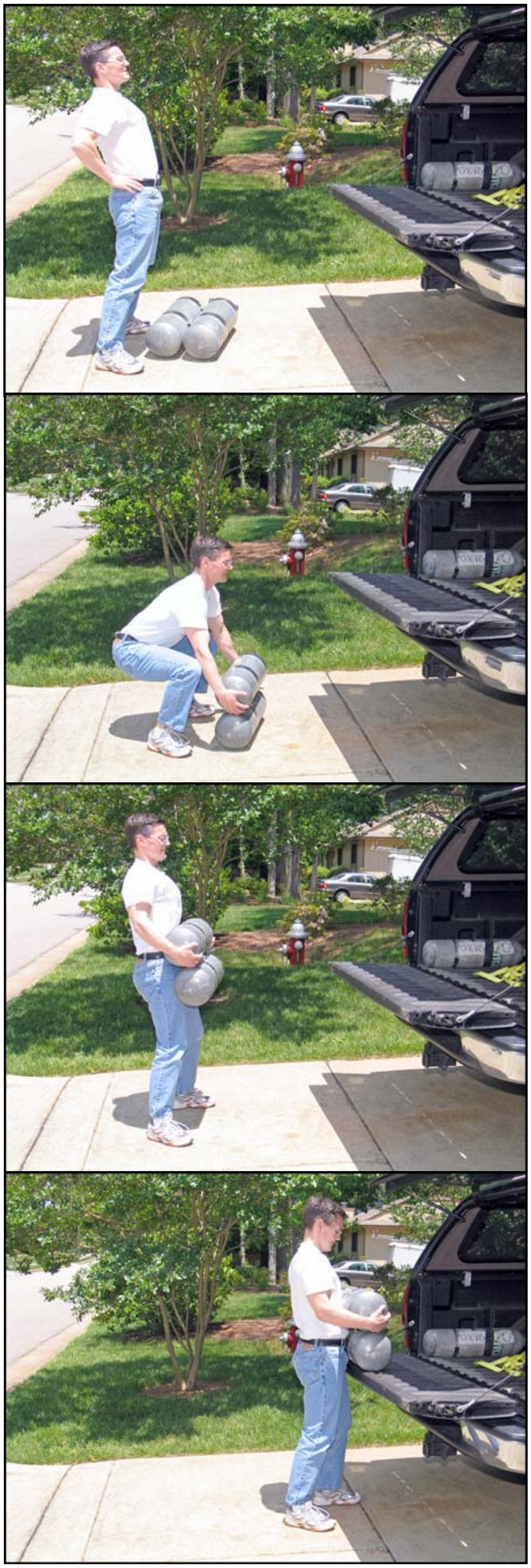
Dive equipment, with its cumbersome bulk, lends itself to create the exact type of stress that puts the lower back at risk. A day of picking up tanks and gear bags places a heavy strain on the connective tissues that hold your vertebrae and discs in place. You might not feel your back hurt with any given lift, but the strain will still take place. If the ligaments get stretched enough, they can no longer support your spine and you can end up with irreparable disc damage. This damage may then happen simply sitting in the car on the way home or bending over to tie your shoe.

Proper Lifting Technique

The ground is the worst place to find anything heavy that you want to lift. In fact, lifting anything lower than your knees will subject your spine to a high level of stress, even when everything is done right.

In order to reduce the risks involved with lifting heavy gear off the ground, you should familiarize yourself with proper lifting technique. According to Robin McKenzie, author of “Treat Your Own Back” (Orthopedic Physical Therapy Products 1993), you should prepare by bending backwards five or six times immediately prior to lifting. This helps to minimize any injury-inducing distortion present in your lumbar spine before you begin your lift. Keep in mind that this is especially important after extended periods of sitting, such as when driving a car or riding in a boat.

Exercises like the bench squat can be considered practice for lifting heavy gear.



In general, proper lifting technique requires the following steps:

1. Stand close to the load with a wide stance. Bend backwards to prepare your lumbar spine for lifting.
2. Squat down by bending your knees, not just your waist. Arch your lower back to pre-engage the muscles protecting the spine. You should look like you're sticking your butt out- though this may attract comments from onlookers, this is the same technique used to set powerlifting records and can make the difference between a successful lift and an injured back. Keep your upper back flat and your chin up as you reach for the load. *Lean one or both elbows on your knees to provide forward support and leverage for your spine*. Be certain to tighten the abdominal muscles, which support the spine from the front.
3. Straighten your knees to lift the load, leaning back and keeping the load as close to your body as possible.
4. Keep back straight when placing the load. When moving multiple heavy objects, intersperse backward bending between periods of lifting. Always use a cart for long distances whenever feasible.

A portable workbench is the perfect height for gearing up.
(Vadim Ternovski)

Gearing Up

To reduce the potential for back strain, gear should be positioned as close to hip height as possible. Picnic tables and truck tailgates are designed with this in mind and are great places to set up, when available. This height will allow you to piece your equipment together without too much forward bending. Then, when you are ready to don your gear, you can remain relatively upright, where your spine is at its strongest.

Organizing Gear for Easier Lifting

Likewise, gear should be placed as high as possible for storage. Racks can be easily made out of plywood that securely organize tanks and scooters at a more back-friendly height.

For boat diving, mesh gear bags are a popular choice for transporting regulators, fins, and other equipment. Bags that can be worn like a backpack are better than those with only a single strap. Whether you wear a single strap on your shoulder or across your body, you place uneven stress on the spine with this type of load. Backpack straps more evenly distributed the load from side to side, reducing strain on the neck and upper back.

While mesh gear bags are a common way of transporting dive gear, many prefer the protection and organization of plastic bins whenever possible. Bins are more easily transported via carts or even luggage dollies, though they can be more difficult to carry by hand than gear bags. This is certainly less of a concern when diving from the back of your car.

Protect Your Gear

Certain dive gear requires additional care when lifting to avoid damaging the equipment.

Single Tanks
Tanks should ***never*** be lifted by their valve knobs alone. Though the knob may feel like a great handle, it is a very fragile component of the valve and is easily bent or damaged. Be mindful not to roll on the valve when lifting or carrying single tanks.

Whether lifting single or double tanks, this grip can be used to protect the valve from damage.

Manifolded Doubles
Manifolded doubles should ***never*** be lifted by the manifold crossbar. This could cause the crossbar to bend or break at the threads. Like with single tanks, be mindful not to roll on the valves when lifting or

carrying doubles.

Diver Propulsion Vehicles (a.k.a. "Scooters")
Some scooters are sensitive to orientation to keep their batteries and trim weights in place. Familiarize yourself with the transportation precautions as directed by the manufacturer and incorporate them into your lifting technique.

Carts should be used to transport heavy gear whenever feasible. (Vadim Ternovski)

Important Note on Back Injuries

There is no 100% safe way of lifting anything. You can only reduce your risk and be mindful of the onset of injury. If you feel any pain when lifting, stop what you're doing and let someone else take over. Seek the attention of a physical therapist or an orthopedic or spine specialist to properly diagnose any injury that might have occurred.

If you already suffer from a back injury, you probably already know how important the above guidelines are to your daily life. That said, the possibility for further injury increases in any lifting-intensive activity. Always follow the advice of your physician or physical therapist, know your limits, and think before you lift.

Robin McKenzie, PT, has authored several books on the prevention and treatment of back injuries, and his methods have become the standard treatment for many physical therapists and doctors. His books "Treat Your Own Back" and "Treat Your Own Neck" are available from most online retailers and have demonstrated an 80% success rate for the most common injuries. I highly recommend that you read these books and talk to your healthcare professional about using his methods in your treatment plan.

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Chapter 19
Dive Day Nutrition

Proper nutrition for healthy living is a source of constant debate. High carb/low fat diets, low carb/high fat diets, vegetarian diets, Mediterranean diets, and more compete to be the best way to lose weight and improve health. In reality, however, most of us can thrive on a variety of diets, and no diet is a panacea for all of our ailments.

Rather than attempt to summarize the various healthy options for day-to-day menu planning that exist, I will leave it to you to research and chose which diet fits your lifestyle best. Instead, I will focus on the short-term effects of diet that can have a direct impact on your safety on dive day.

In particular, we have four areas of interest on dive day: triglycerides, hypoglycemia, dehydration, and hypothermia.

Triglycerides

Triglycerides are fat molecules used by our bodies to transport excess energy to our fat stores. Triglyceride levels in our blood are easily and immediately manipulated by the food we eat.

Of course, meals high in fats increase blood triglyceride levels during digestion. About an hour after a high fat meal, triglycerides can make up as much as 2% of our blood volume, making our normally clear plasma look cloudy and yellow (Guyton 1991).

Probably not the best place to eat on dive day.

What is not so intuitive is the fact that sugary meals *also* increase blood triglyceride levels. This happens as the liver converts excess blood sugar to triglycerides for transport to fat cells. In fact, *all* excess calories eventually become converted to triglycerides, which float in our circulation until deposited in fat tissue.

Triglycerides are especially sensitive to the sugars contained in alcohol. Even small amounts of alcohol can significantly elevate blood triglyceride levels.

Triglycerides are also *released* from our fat tissues to serve as fuel between meals. So, a good strategy for limiting triglyceride levels involves eating frequent, small meals throughout the day.

Though the relationship between triglycerides and DCS is not well-examined, several studies suggest that diving with a high level increases DCS risk:

- One reported study found a direct correlation between pre-dive triglycerides and bubble formation during decompression (*Coastliness* 2001).

- Triglycerides reduce blood surface tension, potentially increasing bubble formation during decompression (Hjelde et al 2000).

- Triglycerides increase blood viscosity, leading to an increase in capillary resistance (Rosenson et al 2002, Rim et al 2001). This can result in reduced tissue perfusion as well increased cardiovascular risk.

- Triglycerides increase the aggregation of red blood cells (Cicha et al 2001). While the association between aggregation and DCS is not well understood, platelet aggregation is often found in association with DCS injury (Francis & Mitchell 2003).

While these studies alone might not compel many divers to change their eating habits, the other well-known benefits of reduced triglyceride levels make it worth the effort.

Hypoglycemia

Most of us can relate to the experience of getting cranky and losing mental focus when it's been too long since we've last eaten. The symptoms we experience at these times are generally minor inconveniences that dissipate quickly with a good snack.

Hypoglycemia occurs when the level of sugar in your blood drops below a healthy level. For most people, hypoglycemia is a rare condition accompanied by a feeling of weakness, headache, and a short temper. If the level drops far enough, confusion, inability to focus, coma, and even death can occur, though symptoms this serious generally require extended periods of exercise or a metabolic disease.

Hypoglycemia causes several changes in the body that can increase our risk of DCS. Primarily, hypoglycemia triggers what's known as the sympathetic nervous system, which is a survival mechanism. This sympathetic response decreases blood flow to many internal organs and the skin, which helps to conserve blood sugar for the heart, lungs and brain.

Unfortunately, this reduction in peripheral blood flow might also decrease off-gassing of the affected tissues. If you ascend in this condition, then these tissues do not have the blood flow needed to eliminate dissolved nitrogen and/or helium before it turns into a gas from decompression.

Hypoglycemia also increases risk of hypothermia, as it impairs thermoregulation and the shivering response (Mekjavic et al 2003). This hypothermia causes a further reduction in peripheral blood flow, compounding the DCS risk from hypoglycemia (Mekjavic et al 2003).

Hypothermia

Food is the fuel that stokes the body's furnace. When we are exposed to a cold environment, either on the surface or in the water, our bodies need more energy to maintain proper body temperature. In fact, hypothermia can occur in water only a few degrees below body temperature if the exposure is long enough, making this a risk even in tropical dive locations.

This means that just as you should avoid *over*eating, you must also avoid *under*eating on dive day. Skipping meals or otherwise restricting calories can rob your body of fuel needed for heat production. This can be especially important when performing multiple dives or extended exposures. In fact, lengthy decompression schedules could require you to develop a strategy for getting calories underwater.

Dehydration

As mentioned in **Chapter 17 – Exercise on Dive Day**, dehydration is a known precipitator of DCS. Drink enough water throughout the day to stay hydrated.

Sport Drinks are Meant for Sport
While a popular source of hydration for many divers, most sport drinks contain enough sugar to potentially trigger the *insulin reflex*. When blood sugar rises above metabolic needs, the body releases insulin to bring levels back under control. If blood sugar rises rapidly enough, the body can overreact, pumping enough insulin into the blood to cause rebound hypoglycemia.

This reflex is not a concern during or immediately after exercise, as your metabolism is high enough to inhibit this response. However, during periods of inactivity, such as during a surface interval on a boat, your metabolism might not be high enough to handle a sugar spike. The prudent way to hydrate is to stick to plain water, leaving food to provide the calories and sodium you might require.

Can you find the healthy option?

The Cost of High Fat Meals

Your risk of heart attack in the hours following a large, fatty meal is *quadrupled* in comparison to eating moderately sized, low fat portions (Francisco Lopez-Jimenez, MD, Brigham and Women's Hospital in Boston or the American Heart Association). This alone might influence the meal choices of some divers. However, the mechanism by which this risk manifests itself is of importance to all divers, regardless of their baseline risk of heart attack.

Your clotting factors are activated for up to six hours after a high fat meal. This heightened state of clotting could also increase the effect that free phase gas bubbles have on your circulation.

Large meals require the stomach to divert blood flow from other areas of the body, including the heart and peripheral tissues. This seems to peak two hours post eating. Such a reduction in perfusion could complicate off-gassing from a dive, whether it's a dive you are about to do or one you've just completed.

Dive Day Eating Guidelines

Eating for a day of diving does not need to be complicated, nor does it require you to avoid the hotel breakfast buffet altogether. However, following a few guidelines might make a difference in how you feel during and after your dives:

Sushi strikes a good balance between fats, carbohydrates, and protein.

1. Beginning with a balanced breakfast, eat 5-6 small meals containing complex carbohydrates, lean proteins, and low levels of saturated fats. This will moderate your blood sugar, insulin, and triglyceride levels throughout the day.

2. Eat slowly. Eating too quickly increases effort of digestion, reducing the blood available to the rest of your body.

3. Consider your pre-dive and post-dive meals to have the same effect on your diving safety. Until your body has completed the process of off-gassing on the surface, you can still affect your risk of DCS with your meal choices.

4. Drink water for hydration and avoid alcohol or drinks containing simple sugars. On days where you will be sweating, a little extra salt with your meals will help you stay hydrated.

Sample Menus

Diving is pursued the world around by people of many different cultures and many different diets. Thus, there is no one “ideal menu” to eat on dive day. The following menus consist of typical American fare and serve only as examples of what a diver might consider eating on dive day.

Breakfast
1 egg, scrambled
1 cup oatmeal or porridge
1 cup fruit juice

1 cup low-sugar cereal
1 cup lowfat milk
1 serving fruit

2 pieces whole grain toast
2 Tbsp peanut butter
1 sliced banana

Meals and Snacks for the Road
Sliced fruit with peanut butter or humus
Ginger cookies
Tomato juice
Whole grain crackers and bean dip
Popcorn sprinkled with grated cheese
Sandwich on whole grain bread with cheese, lowfat deli meat, lettuce, and tomato
Applesauce foil cups or homemade fruit salad frozen for travel

Après Dive Dinner
Any moderate meal prepared without excess fat. Many restaurants will prepare reduced fat versions of menu items upon request.

A Note on Cholesterol

While *cholesterol* is not as easily manipulated over the short term, it deserves special mention in a discussion on nutrition for divers.

Cholesterol is fat-based molecule used in the construction of cell membranes, sex hormones, bile, and vitamin D. It has a waxy consistency at body temperature, which is why excess cholesterol can cause problems for our hearts.

Our bodies produce all of the cholesterol we need, though about 15% of the cholesterol found in our blood is actually from animal products in our diets. While vegetables and grains contain no cholesterol, every animal product, including dairy, contains some amount of cholesterol.

Though age and genetics have a great influence on our blood cholesterol levels, these levels are influenced by many factors under our control:

- *Body Fat*- people who are overweight tend to have higher levels of cholesterol, though this can be reduced with weight loss.
- *Exercise*- people who are inactive tend to have higher levels of cholesterol, while exercise tends to lower cholesterol levels.
- *Tobacco Use*- chemicals in tobacco stimulate the body to produce excess cholesterol.
- *Diabetes* and *Hypertension*- these two diseases lead to increased cholesterol when left unchecked, though most treatments reverse the trend if consistently followed.
- *Stress*- the body produces additional cholesterol when under chronic stress.
- *Diet*- while reducing dietary cholesterol usually reduces blood cholesterol levels, reducing dietary sugars can have a similar effect.

Cholesterol exists in two forms in our blood: high-density lipoprotein (HDL), or the *good cholesterol*, and low-density lipoprotein (LDL), known as the *bad cholesterol*. Excess LDLs accumulate on arterial walls, forming plaques which restrict arterial flexibility and blood flow. HDLs help to scrub down these plaques and transport excess LDLs to the liver, where they are eliminated.

While the well-known cardiovascular risks are certainly a good enough reason for divers to watch their cholesterol, the possible interaction between blood cholesterol and dissolved gas poses another reason. Several studies have demonstrated a link between pre-decompression cholesterol levels and risk of DCS.

A 1988 study in Texas (Webb et al) found that higher levels of cholesterol resulted in increased bubbling when decompressing to altitude. Another altitude study (Jauchem et al 1986) found higher incidence of venous gas emboli in subjects with greater levels of total cholesterol and HDL cholesterol (ironically, the “good cholesterol”). In 2004, researchers (Tripodi et al) found a correlation between brain lesions and cholesterol in asymptomatic professional divers.

So, reducing your cholesterol levels may reduce your chance of suffering a heart attack getting back on the boat, and it may reduce your chance of DCS, as well.

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Chapter 20
Nutritional Supplements and Diving

[*Note: Endnotes are used in this chapter due to the preponderance of product and internet references.*]

The appeal of nutritional supplements is hard to deny. With claims ranging from "supports fat loss"[i] to "increases energy"[ii] to "stimulates muscle synthesis,"[iii] the promises of improved fitness and performance seem to be only a wrapper or bottle away.

Do you know what's in these pills?

Ironically, we wouldn't dare take one breath from a bottle of mixed gas we haven't analyzed ourselves, yet we rarely think twice about the contents of a bar, powder, or pill. The problem is that the contents of nutritional products are rarely analyzed by anyone other than their manufacturers. This makes swallowing a matter of faith.

Additionally, the effects of these products have never been tested at depth, making this a serious matter for divers. For example, pseudoephedrine has arguably been implicated in several diving deaths, and there is nothing to distinguish this synthetic drug from its natural counterpart, ephedra, or other ingredients commonly found in nutritional supplements.

If it's natural, then it's safe.

This is the biggest myth associated with nutritional supplements. Certainly, it would comfort us to think that Mother Nature looks after her children, but toxic compounds abound in nature. Cocaine, cyanide, and strychnine are all 100% natural substances. This makes such an assumption pure bunk from the start, but there are yet other reasons to be suspicious of natural ingredients.

Drug Interactions

Even otherwise benign substances can have dangerous interactions with common pharmaceuticals. **Table 1** lists only a few examples of common supplements that can have dangerous consequences when taken with certain prescription medications. Interactions like these are usually learned from the experience of consumers long after such products are on the market, and there is no requirement for supplement manufacturers to include warnings on product labels or marketing materials once interactions are identified.

Table 1 Drug Interactions of Four Common Herbs

Supplement	Common Use	Drug Interactions
St. John's Wort	Anti-depressant.	May reduce effectiveness of contraceptives, heart medications, anti-depressants, and Tamoxifen (a cancer drug).
Ginko	Memory, balance booster.	May cause serious bleeding disorder when taken with anti-coagulants, such as Aspirin, Coumadin, heparin, and warfarin.
Ginseng	Stress reducer.	Decreases effectiveness of warfarin. May cause headache, hallucination, and manic episodes if taken with MAO inhibitors.
Kava-Kava	Sleep aid, anti-anxiety.	Increases effect of alcohol. Additive effect with prescription sleep and anxiety medications.

Source: University of Michigan Health System[iv]

No Standard Dosages

Many natural compounds have the same pharmacological effects as medications that require a prescription. However, no standard for dosage or efficacy exists for any nutritional supplement. Some supplements vary in recommended dosage by ninety fold from manufacturer to manufacturer.[v]

Inconsistent Potency

Plant sources of compounds are not consistent in concentration. Soil, climate, rainfall, plant variety and the like all contribute to great variations in potency. This variability is often passed directly to the product, with potency often changing from bottle to bottle.

Lack of Regulation

The most important cause for safety concerns lies in the fact that nutritional supplements are almost entirely unregulated. Supplement manufacturers are not required to provide safety information or report adverse reactions to anyone, and rarely is this information volunteered.

Dietary Supplement Health and Education Act

In 1994, the US Congress passed the Dietary Supplement Health and Education Act, or the DSHEA. This act placed limits on the role the FDA could take in regulating nutritional supplements and their ingredients.

In effect, the FDA must learn about safety issues from consumers who have already taken a given supplement, experienced a problem, then chosen to formally notify the government. Only then can the FDA begin a lengthy process to change or take a product off the market.

The DSHEA places full responsibility for product safety with the manufacturers. They do not need FDA approval before releasing a new product, and the FDA cannot, by law, attempt to regulate a nutritional product before it appears in the hands of consumers.

Health clubs sell supplements just as pharmacies sell cigarettes- this doesn't mean they're good for us.

While the DSHEA requires all product ingredients to be listed on the label, it is not a rare occurrence to find additional ingredients or levels of ingredients not found on the label.[vi] For example, lead, pesticides, cadmium, and banned artificial sweeteners have all been identified in laboratory tests of various nutritional supplements. Some supplements have even been found to be spiked with prescription medication.[vii][viii]

United States Pharmacopeia

The United States Pharmacopeia, or the USP, is a nonprofit, nongovernmental organization that sets standards for the quality and consistency of medications and nutritional supplements. Made up of representatives from pharmacy, medicine, academia, the U.S. government, and consumer organizations, the USP devotes its resources to improving patient and consumer safety.

Through its verification program, the USP monitors compliance to standards of manufacturing, content, and marketing for nutritional supplements voluntarily submitted by manufacturers. Those products that pass verification can place the "USP-Verified Dietary Supplement" logo on their labels and promotional materials.

ConsumerLabs.org

ConsumerLabs.org (CL) picks up where the USP leaves off by independently testing various nutritional supplements without manufacturer consent. The "Consumer Reports" of nutritional supplements, CL attempts to help consumers make informed decisions. As an aside, CL's reports might also pressure manufacturers to become more consistent and accurate with content and labels.

CL found that all products it tested with the USP label met accepted standards. This could not be said for many supplements without USP verification. **Table 2** lists a sample of laboratory findings from more than 30 different types of supplements tested by CL.

Table 2 Sample of Supplements Tested by ConsumerLabs.org

Supplement	# Tested	# Passed	# Failed	Comments
B Vitamins	21	11	10	9 contained doses above and up to 10x Tolerable Intake Levels for adults; 1 contained amounts below those claimed.[ix]
Cholesterol-Lowering	16	7	9	9 contained as little as 4% of claimed amount, two of which required a hammer to release their contents.[x]
Nutrition Bars	30	12	18	15 contained carbs in amounts far exceeding claims; 1 "low carb" bar had 11x the carbs claimed on label; 7 contained up to 3x more sodium than claimed; 2 product contained more fat than claimed; 4 products contained more saturated fat than claimed.[xi]
Probiotics	25	17	8	8 contained less than 1% of claimed amount, 6 of which contained less than .0001% of claimed amount.[xii]
Multivitamins	27	18	9	1 contained 150% labeled amount of Vitamin A, putting it far above acceptable levels; 2 contained less than 40% claimed beta-carotene; 1 failed to disintegrate; 2 contained less-than-claimed amounts of folic acid; 1 contained 165% claimed folic acid, which is above acceptable amounts; 4 contained 4-8x acceptable amounts of Niacin.[xiii]

Source: ConsumerLabs.org

Natural Compounds at Depth

As previously discussed, many natural compounds have the same or similar effects as their synthesized counterparts. Most divers realize that we know little about the effects of FDA-regulated pharmaceuticals at depth. We know almost *nothing* about the depth effects presented by the myriad of nutritional supplements taken by many divers. The most well known example of this risk is found in a class of compounds known as *central nervous system (CNS)-exciters.*

The effect of CNS-exciters on tolerance to oxygen toxicity is certainly a matter for debate. The only research on this was performed in 1974 by Dr. Peter Bennett, which suggested that sympathomimetics, like pseudoephedrine and ephedra, seemed increase susceptibility to oxygen toxicity in rats.[xiv] Expert conjecture and opinion attempt to link anecdotal accounts of diver death with use of pseudoephedrine, though no scientific confirmation is possible until more research is done.

Even powdered shakes can contain herbal ingredients that are potentially dangerous at depth.

While the late Dr. E.D. Thalmann, formerly DAN Assistant Medical Director, felt that the occasional use of pseudoephedrine on recreational air dives is probably safe[xv], divers taking supplements containing ephedra could easily exceed the recommended dosage.

On April 11, 2004, the FDA successfully banned the marketing of ephedra in the United States as a dietary supplement. However, a court later limited the ban to products containing more than ten milligrams of ephedra per serving. It has also been replaced in many products with compounds that have similar effects on the central nervous system. Bitter orange, listed as a supplement to avoid by Consumer Reports[xvi], carries with it the same risks of heart attack, stroke, and high blood pressure as does ephedra. It is also a CNS exciter, giving it the potential to increase risk of oxygen toxicity if taken before diving.

In fact, most products labeled “thermogenic” contain one or more ingredients that stimulate the central nervous system in an effort to increase metabolism. This includes many prescription weight loss medications, as well.

Summary

There is no easy way to get fit. While some over-the-counter products are promoted as solutions to diet and exercise woes, the safest way to fitness is through the only way that has been proven to work every time- increased activity supported by a nutritious diet.

Divers who chose to take nutritional supplements should do their homework. Check with the FDA for recall and safety information, review the side effects and drug interactions, and avoid using any supplement on the days leading up to your dives.

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Unit 6
The Programs

Chapter 21
Program Design

"One size fits all" fitness programs do not exist. In truth, there are many different paths that will take you to better fitness. The programs in this guide represent only examples of how a diver can improve his or her fitness. Use them "as is," and you will certainly achieve an enviable level of fitness geared specifically to help you enjoy your diving. You can also use them as templates, changing out exercises and even whole workouts for those you might find in other, less specialized fitness guides.

These programs are designed to balance the cardiovascular conditioning you need to endure a day of diving with the strength you need to deal with your gear. The exercises were chosen because they are easy to learn and can be done anywhere with very little equipment. In fact, many of the exercises can be performed with no equipment at all.

The Levels

All of the programs share the same basic schedule of strength and cardiovascular training days. This makes it very easy for divers of different fitness levels to be training partners.

In fact, the strength training schedules of both the *Intermediate* and *Advanced* programs are exactly the same. This is due to the likelihood that, beyond a certain level, additional strength gains will not be as valuable to a diver as additional cardiovascular gains.

The shared structure also makes it easy for you to mix and match the components of these programs to fit your specific fitness needs. For example, if you are experienced with strength training but need a start to your cardiovascular conditioning, you can merge the strength training workouts from the Advanced program with the cardiovascular training workouts from the Beginner program. Any such combination will still provide the right pattern of intensity and recovery as long as the levels you choose are appropriate to your current fitness.

General descriptions of each level can be found below. Whichever level you choose to start with, you must make adjustments to the suggested workouts based upon your experience. If the progression of cardiovascular training feels too easy or too hard, then modify the time and/or intensity of the workouts accordingly. As noted above, strength training can be easily adjusted by selecting a combination of workouts from the Beginner and Advanced programs. When in doubt, consult a fitness professional to ensure that your program is appropriate to your fitness needs.

Beginner

This program is intended for divers who are new to exercise or who do not exercise consistently. Most workouts can be completed in approximately 30 minutes or less, making this the easiest program to fit into a busy schedule. In fact, even advanced exercisers with demanding lifestyles can use this program by increasing the intensity of the cardiovascular workouts listed. If you cannot carve the time required by this program out of your daily life, then you might need to reevaluate your priorities.

Intermediate
This program was designed for divers who already participate in regular exercise. While some workouts will take 60 minutes or more to complete, most workouts can be completed in approximately 45 minutes or less. Training with this program will give a diver all of the strength and cardiovascular conditioning needed to get the most out of their diving. It will also result in a very high quality of life on the surface.

Advanced
This program takes the *Intermediate* program and increases the volume of cardiovascular training. Some days will require one hour dedicated to strength training and another dedicated to cardiovascular training. Training with this program would be comparable to preparing for a marathon or international distance triathlon and is intended only for those divers interested in achieving an elite level of cardiovascular fitness.

The Phases
As discussed in **Chapter 3- Principles of Physical Conditioning**, good programs are organized into microcycles and macrocycles.

Microcycles
You will see that no two resistance training workouts are exactly alike. By varying the exercises performed from workout to workout, these programs will keep your body in a mode of adaptation while reducing your chances of developing overuse injuries.

Macrocycles
The programs are also organized into four phases, with each emphasizing a different aspect of fitness necessary to accumulating long term gains.

Acclimation Phase
Goal- to acclimate the body to regular exercise.

While we are certainly capable of performing at a very high level for a short period of time, we must prepare our bodies to undergo the repeated stress of a progressive exercise program. During the **Acclimation Phase**, workouts are designed to nudge your body into a state of constant adaptation without overwhelming your ability to recover.

The **Acclimation Phase** appears in all three programs because even experienced exercisers need a period of conservative exercise to adjust to a new training schedule. Completing this phase is critical to getting the most out of the more intense phases that follow.

Build Phase
Goal- to strengthen muscles and bones, increase flexibility.

This phase gradually increases strength training volume and intensity while maintaining your base of cardiovascular fitness developed in the **Acclimation Phase**. It is during this phase that you should experience the most rapid changes in your physical strength.

Conditioning your muscles at this phase will also reduce your chance for injury during the endurance phase.

Endurance Phase

Goal- to turn muscle strength into endurance gains.

The schedules in the **Endurance Phase** place emphasis on cardiovascular conditioning while maintaining strength gained during the build phase. The volume and intensity of your cardiovascular training is increased throughout this phase, while techniques are introduced into strength training that will further improve your muscular endurance.

Recovery Phase

Goal- to promote recuperation for both the body and mind.

Over time, the body accumulates stress from regular exercise. Though recovery days are found throughout the previous phases, our bodies often require more to fully adapt to the physical strain of a lifelong exercise program.

The **Recovery Phase** reduces training volume enough to provide your body with extra rest. Resources that were once needed to adapt to exercise can now be devoted to healing. While the average intensity of the workouts is lower than in previous phases, peak intensity remains high. This, in essence, "reminds" your body that it must maintain a high level of fitness. Very little detraining should occur.

After completion of the **Recovery Phase**, you should return to the **Build Phase** and start a new cycle. While this might seem like a step backward, you will actually be adding to the strength and endurance you have already developed.

Fitting the Schedules to Real Life

The amount of time dedicated to exercise varies from day to day throughout each week's schedule, alternating periods of intensity with periods of recovery. Of course, these variations might not match the time you have available.

The best way to fit any workout program to your time constraints is to begin with the days off. Place them on days that you are least likely to find the time to exercise. From there, you must decide where to place the other workouts so that you do not get more than two hard days in a row, if at all possible.

Of course, if you can fit the existing schedules into your life as they are, then there is no additional planning required on your part. All of your cardiovascular and strength training is already mapped out for you for the next six months or more.

Cardio before Strength

Whenever possible, we would like to separate our cardiovascular exercise from our strength training so that we have maximum energy on reserve for the work at hand. In this case, it doesn't matter much whether you do your cardio in the morning and your strength training in the evening or vice versa.

On occasions where cardio workouts must be combined with strength workouts, it is best to begin with the cardio. Overall, our cardiovascular fitness matters more to diving than our strength, so we want to make sure not to shortchange our cardio workouts with fatigue from strength training. Besides, a good cardio workout will mean that your body is warmed up for your strength workout, anyway.

"Sets" vs. "Repetitions"

These two terms are often a source of confusion when discussing strength training. A *repetition* of an exercise, or a "rep," consists of a single, complete movement of an exercise. A *set* of an exercise includes performance of a series of repetitions without stopping.

The three programs in this guide will have you perform two sets of 12-15 repetitions of each exercise. However, just because you have hit the number "15" doesn't mean you should stop. If you can continue, keep performing repetitions until you achieve failure, then make a note to increase the weight next time.

Warm Up and Stretch

Spend 5 to 10 minutes before each strength training workout warming up. This could be as easy as a fast walk on a treadmill or a few minutes of jumping jacks.

Stretch *after* your warm up but *before* strength training to ensure your muscles are ready for exercise. Stretch *after* cardiovascular training while your muscles are at the most supple. A basic stretching routine for divers can include the following:

1. straight leg calf stretch
2. bent leg calf stretch
3. quadriceps stretch
4. hamstring stretch
5. inner thigh stretch
6. press ups
7. prayer stretch
8. cat and camel stretches
9. posterior deltoid/rhomboid stretch
10. latissimus dorsi/triceps stretch
11. swimmers stretch

See **Unit 4- Stretching** for more specific instructions on performing these stretches. The additional stretches contained in this guide should be added to those listed above if you have specific issues of flexibility.

The Ordinal Effect

We start each strength workout with the most energy that we will have. Each exercise we perform drains our energy reserves, leaving less for the next exercise. This means that the muscles that we exercise first tend to get better work than those that we exercise last.

In the programs that follow, every resistance workout begins with leg exercises. The legs contain our largest muscles and require the most energy to work them to failure. Additionally, leg training is too often neglected because it can be so difficult.

As you will see, the order of body parts for upper body exercises changes with every workout. This helps us to balance our upper body strength, rather than emphasizing whatever body part we would otherwise prefer to begin with.

Choosing the Appropriate Weight

When you attempt any exercise for the first time, you should do so without any added resistance. Many of the exercises in this guide will fatigue your muscles adequately without the need for weights. If you can complete more than fifteen repetitions without fatigue, then it is time to increase the resistance.

Table 1

Push Ups
Crunches
Flutter Kicks
Bicycles
Adductor/Abductor Scissors
Bridges
Toe Lift
External/Internal Ankle Rotation
Sock Pickup
Bench Dip
Floor Dip

Always start with a weight lighter than you think you'll need. Focus on completing the exercise with perfect form. Change weights as necessary until you can only perform 12-15 repetitions without cheating.

Several of the exercises in this guide are always to be performed without additional weight (see **Table 1**). As your performance improves for these movements, you should continue to increase the number of repetitions until you achieve momentary failure.

Supersets, Drop Sets, and Timed Rest

The **Build Phase** of each program will introduce you to several advanced ways to increase the intensity of your strength training without the need to increase weights.

Supersets

Supersets link two or more exercises in a row performed with as little rest as possible between. Half of the supersets in this guide pair opposing muscle groups, allowing you to greatly accelerate you workout. While one muscle group is working, the other is resting.

The remaining supersets pair exercises that work the same muscle groups in different ways. This allows you to really fatigue all of the components to a muscle group in a brief period of time.

Drop Sets

Drop sets involve performing a set of an exercise to failure using your usual resistance, then immediately dropping the resistance by 20-30%, performing as many repeititions as possible at that resistance, then again, dropping the resistance by another 20-30% and performing as many repetitions as possible.

By the end of the set, the muscles worked will be fully exhausted. This increases the stimulation that causes the muscles to get stronger without increasing the risk.

Timed Rest Interval

During these workouts, you must keep your rest between sets to 30 seconds. This includes not only sets of the same exercise but also moving from exercise to exercise. The entire workout is thus a combination of strength and endurance training.

Keeping Track

One of the many advantages of electronic books is that the number of pages they contain has little effect on their portability. That is why this guide has pre-printed record sheets for every week of exercise in each of the three programs. This would not be possible in a conventional, bound paper book.

You can print these record sheets week by week and take them with you to your workouts. When you have completed your training for the week, store your record sheets in a three-ring binder. This will allow you to measure your gains in fitness over time, including weights used, repetitions completed, as well as details of your cardiovascular training.

What to Do after Time Off

Inevitably, illness or the demands of life will cause an interruption in your training schedule. This does not need to be seen as a major setback in fitness. However, adjustments should be made to your training in consideration of your time away from training.

If you are off for only one or two days, then you can usually pick up with the schedule where you left off. Beyond that, a good rule of thumb is to double the amount of time you took off and subtract that from where you are in the schedule.

For example, you were about to begin Week 4 of the **Build Phase** when you took a week off due to illness. You would then start back at the beginning of Week 2 and continue the program from there.

Sometimes, an especially hard illness might require you to go back to the **Acclimation Phase** and start again. You must listen to what your body tells you, and continue to allow it to heal as you gradually increase your activity to pre-illness levels. As always, consult your physician to be sure that this or any fitness program meets your unique health needs.

Chapter 22
Physical Assessment

Looser clothes, increased muscular definition, and greater energy are all signs that your fitness is improving. You can get a more impartial gauge of your changing fitness by measuring your performance with an objective physical assessment.

There are three stages to a safe and thorough physical assessment for fitness. The first stage involves a medical checkup, including measurements of heart rate, blood pressure, and cholesterol. It is during this step that you should discuss with your doctor any special needs to consider when starting or advancing your exercise program.

The second stage involves a monitored cardiovascular screening, such as a 3-minute step test, that confirms your body's preparedness for more intense measurements of fitness. This stage should be supervised by your physician or a qualified exercise physiologist.

The third stage includes a series of tests designed to measure your physical limits, including cardiovascular endurance, flexibility, and strength. This stage is designed to be physically demanding. Therefore, it should only be performed upon completion of the first two stages and your physician's approval.

The first two days of every program phase are devoted to the third stage of physical assessments. Record your results in the training logs provided and discuss them with your physician or fitness professional to ensure that you are on the right track.

Note: The following tests will push you to your limits and should be performed only upon approval by your physician.

Day 1

Cardiovascular
Equipment Required- cardio machine (e.g., treadmill, rowing machine) or outdoor track
Perform *one* of the following:

Speed, Incline/Resistance for 15 minutes at 80% HRM

1. Warm up for 5 minutes.
2. Reset cardio machine so that time and distance read "0."
3. Select a combination of speed, incline, and or resistance that gets your heart rate to 80% HRM. Adjust your speed throughout the assessment as necessary to keep that value as constant as possible.
4. Stop after 15 minutes or when you feel the need, whichever comes first.
5. Record the parameters used and the distance traveled.
6. Cool down for 5-10 minutes.

1.5-mile Walk/Run

1. Warm up for 5 minutes on a measured course or track.
2. Walk/Run 1.5 miles at 80% HRM and record time.
3. Cool down for 5-10 minutes.

Day 2

Note: Flexibility and muscular assessments should be completed only after a 10 minute cardiovascular warm up.

Flexibility
Equipment Required- tape measure and partner
All flexibility tests should be performed three times with the average value recorded.

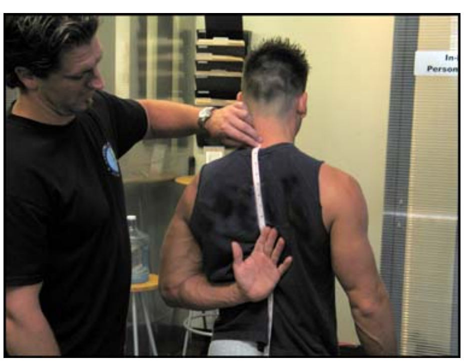
Modified Sit and Reach Test (measures flexibility of hamstrings, calf, and lower back)

1. Sit on floor with both legs extended straight and feet flat on a wall in front of you.
2. Place a tape measure along your right leg, against and perpendicular to the wall. The wall should be the "zero" end of the measuring device.
3. With both hands flat on the floor, reach as close to the wall as possible and record the value achieved. Note that the lower the value, the greater your flexibility.

Apley Scratch Test Right/Left (measures flexibility of shoulders and triceps)

Down the Back

1. Stand with back straight.
2. Place one arm behind your head, reaching as far down your spine as possible.
3. Have a partner measure the distance between the tip of your index finger and the highest boney protuberance on your spine (this is the spinous process of the seventh cervical vertebra).
4. Repeat test for other arm.



Up the Back

1. Stand with back straight.
2. Place one arm behind your lower back, reaching as far up your spine as possible.
3. Have a partner measure the distance between the tip of your index finger and the highest boney protuberance on your spine (this is the spinous process of the seventh cervical vertebra).
4. Repeat test for other arm.

Muscular Strength
Equipment Required- flat bench, dumbbells, step

Bench Squat
1. Choose a weight, if any, that generally leads you to failure in 12-15 repetitions.
2. Perform as many bench squats as possible *without rest*. No time limit applies.

Standing Lunges
1. Choose a weight, if any, that generally leads you to failure in 12-15 repetitions.
2. Perform as many standing lunges as possible *without rest*. No time limit applies.
3. Record performance for each leg.

Bridges
1. Perform as many bridges as possible *without rest*. No time limit applies.

Calf Raises
1. Choose a weight, if any, that generally leads you to failure in 12-15 repetitions.
2. Perform as many calf raises as possible *without rest*. No time limit applies.

Dumbbell Chest Press
1. Choose a weight that generally leads you to failure in 12-15 repetitions.
2. Perform as many dumbbell chest presses as possible *without rest*. No time limit applies.

Bent-Over Dumbbell Row
1. Choose a weight that generally leads you to failure in 12-15 repetitions.
2. Perform as many bent-over dumbbell rows as possible *without rest*. No time limit applies.

Dumbbell Shoulder Press
1. Choose a weight that generally leads you to failure in 12-15 repetitions.
2. Perform as many dumbbell shoulder presses as possible *without rest*. No time limit applies.

Dumbbell Biceps Curl
1. Choose a weight that generally leads you to failure in 12-15 repetitions.
2. Perform as many dumbbell biceps curls as possible *without rest*. No time limit applies.

Overhead Triceps Press
1. Choose a weight that generally leads you to failure in 12-15 repetitions.
2. Perform as many overhead triceps presses as possible *without rest*. No time limit applies.

Muscular Endurance
Equipment Required- stopwatch

Push Ups in One Minute (2 minutes for Advanced programs)

Perform as many push ups as possible in specified time. All rest should be done in the down position.

Crunches in One Minute (2 minutes for Advanced programs)

Perform as many crunches as possible in specified time. All rest should be done in the down position.

Wave-Offs in One Minute (2 minutes for Advanced programs)

Perform as many wave-offs as possible in specified time. All rest should be done in the down position.

Bent Leg Stand (maximum time)

Stand on one leg, bent to 90 degrees. Hold for as long as possible. Repeat for other leg.

Chapter 23
The Beginner Program

If you are new to exercise or have experienced an extended period away from a regular workout program, this is the chapter for you. This program can take you from couch potato to someone who is comfortable exercising for more than thirty minutes every day.

This program can also be used by more advanced exercisers by increasing the intensity of the cardiovascular workouts listed. As long as you perform the strength training exercises to failure, these workouts will provide your body with all you will need to maintain your overall health as well as improve your function as a diver on thirty minutes a day or less.

Cardiovascular Training

The purpose of the cardiovascular training in the **Beginner Program** is to gradually progress you from only ten minutes of exercise to a maximum of forty-five minutes. This might sound like a big change, and it is, but you have nearly five months to get there.

Zone 1 workouts can be performed as brisk walking, easy swimming, or casual bike rides. These workouts should not make you winded, but should elevate your respiration and heart rate for the time indicated. This intensity will also be used as a warm up for more difficult training.

Zone 2 workouts are where you begin to step up the intensity. Your pace should be faster, though you should still be able to hold a brief conversation with a workout partner without struggling for breath. If you are a walker interested in running for fitness, these workouts would be where you can introduce running intervals of 2-3 minutes into your walking. You should spend the first 5-10 minutes of these workouts in Zone 1 to prepare you for the faster pace.

Zone 3 workouts will bring you beyond the point you would feel comfortable speaking, but only for short periods of time. You should spend the first 5 minutes of these workouts in Zone 1 and another 5 minutes in Zone 2 to prepare you for the intervals of higher intensity.

Strength Training

The strength workouts in this program will introduce you to new exercises and ways of working out while allowing your body to adapt to the new activity this presents. Some workouts will include exercises for your entire body, while others will focus on two or three body parts at a time. Supersets, drop sets, and forced rest intervals are found in the **Build Phase** to increase the cardiovascular effort of your strength training. While two days each week will involve training with weights or exercise bands, up to three days each week will be devoted to strengthening your abdominal and back muscles (a.k.a. “the core”).

You might find that many exercises are challenging enough without weights or exercise bands. Be sure that you can comfortably perform 12-15 repetitions of these exercises before adding the resistance of a dumbbell or band (see **Chapter 10- Strength Training for Diving** for more information).

Beginner- Acclimation Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio** **Strength**	Physical Assesment	REST Physical Assesment	Zone 1- 10 minutes REST	Zone 1- 12 minutes REST	REST Standing Leg Extension Standing Leg Curl Bench Dip Monkey Curl Shoulder Press (Overhand)	REST REST	Zone 1- 12 minutes REST
Week 2	**Cardio** **Strength**	Zone 1- 10 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST Step Ups Hip Flexion Hip Extension Cable Chest Press (Standard/Overhand) Bent-Over Straight Arm Kickback (Overhand)	Zone 1- 12 minutes REST	Zone 1- 15 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST Standing Lunge Bridges Shoulder Press (Parallel) Biceps Curl (Overhand) Overhead Triceps Press (Single Arm)	REST REST	Zone 1- 15 minutes REST
Week 3	**Cardio** **Strength**	Zone 1- 12 minutes Push Ups Flutter Kicks Saxon Side Bends	REST Bench Squat Hip Adduction Hip Abduction Dumbbell Chest Press (Flat/Parallel) Lat Pulldown (Wide)	Zone 1- 15 minutes REST	Zone 1- 18 minutes Push Ups Flutter Kicks Saxon Side Bends	REST Quadriceps Cycling Hamstring Cycling Standing Calf Raise Bench Dip Concentration Curl (Underhand) Lateral Deltoid Raise	REST REST	Zone 1- 18 minutes Push Ups Flutter Kicks Saxon Side Bends
Week 4	**Cardio** **Strength**	Zone 1- 15 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST Step Ups Hip Flexion Hip Extension Cable Chest Press (Decline/Underhand) Lat Pulldown (Underhand)	Zone 2- 18 minutes REST	Zone 1- 20 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST Standing Lunge Bridges Seated Calf Raise Shoulder Press (Single Arm/Overhand) Monkey Curl Overhead Triceps Press	REST REST	Zone 1- 20 minutes Push Ups Crunches (Straight) Crunches (Side) Superman
Week 5	**Cardio** **Strength**	Zone 1- 15 minutes Push Ups Flutter Kicks Saxon Side Bends	REST Bench Squat Hip Adduction Hip Abduction Dumbbell Chest Press (Flat/Underhand) Bent-Over Row (Parallel)	Zone 2- 20 minutes REST	Zone 1- 25 minutes Push Ups Flutter Kicks Saxon Side Bends	REST Quadriceps Cycling Hamstring Cycling Standing Calf Raise Bench Dip Biceps Curl (Overhand) Shoulder Shrugs	REST REST	Zone 1- 25 minutes Push Ups Flutter Kicks Saxon Side Bends
Week 6	**Cardio** **Strength**	Zone 1- 20 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST Step Ups Hip Flexion Hip Extension Cable Chest Press (Incline/Parallel) Bent-Over Rhomboid Fly (Parallel)	Zone 2- 25 minutes REST	Zone 1- 30 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST Standing Lunge Bridges Seated Calf Raise Deltoid Around-the-Worlds Concentration Curl (Hammer) Bent-Over Triceps Kickback (Parallel)	REST REST	Zone 1- 30 minutes Push Ups Crunches (Straight) Crunches (Side) Superman

Beginner- Build Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio** **Strength**	Physical Assessment	REST Physical Assessment	Zone 2- 20 minutes REST	Zone 1- 25 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST Dumbbell Chest Press (Incline/Overhand) Bent Over Row (Parallel) Bench Dip Overhead Triceps Press Monkey Curl Biceps Curl (Parallel) Shoulder Press (Overhand) Front Deltoid Raise (Overhand)	REST REST	Zone 1- 30 minutes REST
Week 2	**Cardio** **Strength**	Zone 1- 20 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST ***30 seconds rest*** Step Ups Standing Lunge Bridges Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation	Zone 2- 20 minutes REST	Zone 1- 30 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST ***30 seconds rest*** Shoulder Shrugs High Cable Biceps Curl (Underhand) Bench Dip Bent Over Triceps Kickback (Overhand) Lat Pulldown (Wide) Bent Over Front Deltoid Raise (Overhand) Dumbbell Pec Fly (Flat/Overhand) Cable Chest Press (Standard/Parallel)	REST REST	Zone 1- 30 minutes Push Ups Straight Crunches Swimmers Standing Calf Raise Seated Calf Raise
Week 3	**Cardio** **Strength**	Zone 1- 20 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST Bench Squat Quadriceps Cycling Hamstring Cycling Standing Calf Raise Seated Calf Raise Sock Grab Flutter Kicks	Zone 2- 25 minutes REST	Zone 1- 30 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST ***Drop Sets*** Bench Dip Bent Over Row (Overhand) Dumbbell Chest Press (Incline/Underhand) Cable Pec Fly (Decline/Overhand) Monkey Curl Biceps Curl (Overhand) Shoulder Press (Parallel) Deltoid Around-the-Worlds	REST REST	Zone 1- 30 minutes REST
Week 4	**Cardio** **Strength**	Zone 1- 20 minutes REST Push Ups Crunches (Straight) Crunches (Side) Superman	REST ***Supersets*** Step Ups Walking Lunge Mule Kick Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation	Zone 2- 20 minutes REST	Zone 1- 30 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST ***Supersets*** Cable Chest Press (Standard/Parallel) Lat Pulldown (Underhand) Shrugs Front Deltoid Raise High Cable Biceps Curl Concentration Curl (Underhand) Floor Dip Bent Over Triceps Kickback (Parallel)	REST REST	Zone 1- 30 minutes Push Ups Superman Saxon Side Bends Standing Calf Raise Seated Calf Raise
Week 5	**Cardio** **Strength**	Zone 1- 20 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST ***30 seconds rest*** Single Leg Squat Standing Leg Extension Standing Leg Curl Hip Adduction Hip Abduction Standing Calf Raise Seated Calf Raise	Zone 2- 25 minutes REST	Zone 1- 30 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST ***30 seconds rest*** Shoulder Press (Underhand) Monkey Curl Bench Dip Overhead Triceps Press Bent Over Row (Underhand) Bent Over Front Deltoid Raise (Parallel) Dumbbell Chest Press (Incline/Parallel) Cable Pec Fly (Decline/Underhand)	REST REST	Zone 1- 30 minutes REST
Week 6	**Cardio** **Strength**	Zone 1- 20 minutes REST Push Ups Crunches (Straight) Crunches (Side) Superman	REST Step Ups Standing Lunge Bridges Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation	Zone 2- 25 minutes REST	Zone 1- 30 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST ***Drop Sets*** Floor Dip High Cable Bices Curl (Single Arm) Cable Chest Press (Standard/Overhand) Dumbbell Pec Fly (Flat/Parallel) Lat Pulldown (Single Arm) Bent Over Straight Arm Kickback (Parallel) Shoulder Shrugs Deltoid Around-the-Worlds	REST REST	Zone 1- 30 minutes Push Ups Side Crunches Swimmers Standing Calf Raise Seated Calf Raise

Beginner- Endurance Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio** **Strength**	Physical Assessment	REST Physical Assessment	Zone 2- 20 minutes REST	Zone 1- 30 minutes Push Ups Wave Offs Saxon Side Bends Standing Calf Raise Seated Calf Raise	REST Bench Squat Hip Adduction Hip Abduction Cable Chest Press (Standard/Overhand) Bent Over Row (Overhand)	REST REST	Zone 1- 30 minutes REST
Week 2	**Cardio** **Strength**	Zone 1- 20 minutes REST	REST Walking Lunges Hamstring Cycling Standing Calf Raise Bent Over Triceps Kickback (Overhand) Biceps Curl (Parallel) Front Deltoid Raise (Overhand)	Zone 2- 20 minutes REST	Zone 1- 30 minutes Push Ups Straight Crunches Swimmers Internal/External Ankle Rotation Toe Lift	REST Step Ups Hip Extension Hip Flexion Dumbbell Chest Press (Incline/Overhand) Lat Pulldown (Standard)	REST REST	Zone 1- 35 minutes REST
Week 3	**Cardio** **Strength**	Zone 1- 20 minutes REST	REST Standing Leg Extension Standing Leg Curl Seated Calf Raise Bench Dip High Cable Biceps Curl (Overhand) Single Arm Lateral Deltoid Raise (Overhand)	Zone 3- 20 minutes REST	Zone 1- 30 minutes Push Ups Side Crunches Bicycles Standing Calf Raise Seated Calf Raise	REST Single Leg Squat Hip Adduction Hip Abduction Bent Over Front Delt Raise (Parallel)) Cable Chest Press (Decline/Overhand)	REST REST	Zone 1- 40 minutes REST
Week 4	**Cardio** **Strength**	Zone 1- 20 minutes REST	REST Quadriceps Cycling Hamstring Cycling Standing Calf Raise Deltoid Around-the-Worlds Biceps Curl (Overhand) Overhead French Press	Zone 2- 20 minutes REST	Zone 1- 30 minutes Push Ups Superman Saxon Side Bends Internal/External Ankle Rotation Toe Lift	REST Bench Squat Hip Extension Hip Flexion Single Arm Bent Over Rhomboid Fly Dumbbell Chest Press (Flat/Overhand)	REST REST	Zone 1- 30 minutes REST
Week 5	**Cardio** **Strength**	Zone 1- 20 minutes REST	REST Walking Lunges Standing Leg Curl Seated Calf Raise Bent Over Triceps Extension (Overhand) Single Arm Monkey Curl Lateral Deltoid Raise	Zone 3- 20 minutes REST	Zone 1- 30 minutes Push Ups Bicycles (Backwards & Forwards) Wave Offs Standing Calf Raise Seated Calf Raise	REST Step Ups Hip Adduction Hip Abduction Single Arm Cable Chest Press (Standard/Overhand) Bent Over Front Deltoid Raise (Overhand)	REST REST	Zone 1- 40 minutes REST
Week 6	**Cardio** **Strength**	Zone 1- 20 minutes REST	REST Standing Leg Extension Standing Leg Curl Standing Calf Raise Overhead French Press Biceps Curl (Overhand) Front Deltoid Raise (Parallel)	Zone 3- 20 minutes REST	Zone 1- 30 minutes Push Ups Side Crunches Swimmers Internal/External Ankle Rotation Toe Lift	REST Single Leg Squat Hip Flexion Hip Extension Single Arm Lat Pulldown Dumbbell Chest Press (Incline/Overhand)	REST REST	Zone 1- 45 minutes REST

Beginner- Recovery Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio**	Physical Assesment	REST	Zone 1- 20 minutes	Zone 1- 20 minutes	REST	REST	Zone 1- 30 minutes
	Strength		Physical Assessment	REST	REST	Standing Leg Extension Standing Leg Curl Standing Calf Raise External Ankle Rotation Bench Dip Monkey Curl Shoulder Press (Overhand)	REST	REST
Week 2	**Cardio**	Zone 1- 20 minutes	REST	Zone 1- 20 minutes	Zone 1- 20 minutes	REST	REST	Zone 1- 35 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman	REST	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Bent Over Front Deltoid Raise (Overhand) Dumbbell Pec Fly (Flat/Overhand)	REST	REST
Week 3	**Cardio**	Zone 1- 20 minutes	REST	Zone 1- 20 minutes	Zone 1- 20 minutes	REST	REST	Zone 1- 30 minutes
	Strength	Push Ups Saxon Side Bends Swimmers	Bench Squat Hip Adduction Hip Abduction Toe Raise Bent Over Triceps Kickback (Overhand) Monkey Curl Front Deltoid Raise (Overhand)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST	REST	Push Ups Saxon Side Bends Swimmers
Week 4	**Cardio**	Zone 1- 20 minutes	REST	Zone 2- 20 minutes	Zone 1- 20 minutes	REST	REST	Zone 1- 30 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Decline/Underhand) Lat Pulldown (Underhand)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Single Arm/Overhand) Monkey Curl Overhead Triceps Press	REST	Push Ups Crunches (Straight) Crunches (Side) Superman
Week 5	**Cardio**	Zone 1- 20 minutes	REST	Zone 2- 20 minutes	Zone 1- 20 minutes	REST	REST	Zone 1- 30 minutes
	Strength	Push Ups Saxon Side Bends Swimmers	REST	REST	Push Ups Saxon Side Bends Swimmers	Quadriceps Cycling Hamstring Cycling Standing Calf Raise External Ankle Rotation Bent Over Straight Arm Kickback (Parallel) Cable Pec Fly (Incline/Parallel)	REST	Push Ups Saxon Side Bends Swimmers
Week 6	**Cardio**	Zone 1- 20 minutes	REST	Zone 2- 20 minutes	Zone 1- 20 minutes	REST	REST	Zone 1- 35 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman	Step Ups Hip Flexion Hip Extension Sock Grab Shoulder Press (Underhand) Monkey Curl Overhead Triceps Press	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	REST	REST	Push Ups Crunches (Straight) Crunches (Side) Superman

Beginner
Acclimation Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 1 10 minutes	Zone 1 12 minutes	REST	REST	Zone 1 12 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	REST	Workout A	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent-Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Beginner Acclimation Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Bench Dip			
Monkey Curl			
Shoulder Press (Overhand)			

Beginner
Acclimation Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 10 minutes	REST	Zone 1 12 minutes	Zone 1 12 minutes	Zone 2 15 minutes	REST	Zone 1 15 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	REST
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Cable Chest Press (Standard, Overhand)			
Bent-Over Straight Arm Kickback (Overhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner Acclimation Phase: Week 2 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Shoulder Press (Parallel)			
Biceps Curl (Overhand)			
Overhead Triceps Press (Single Arm)			

Beginner
Acclimation Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 12 minutes	REST	Zone 1 15 minutes	Zone 1 15 minutes	REST	REST	Zone 1 18 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Toe Raise			
Dumbbell Chest Press (Flat, Parallel)			
Lat Pulldown (Wide)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			

Beginner Acclimation Phase: Week 3 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
Bench Dip			
Concentration Curl (Underhand)			
Lateral Deltoid Raise			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			

Beginner
Acclimation Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 15 minutes	REST	Zone 2 18 minutes	Zone 1 20 minutes	REST	REST	Zone 1 20 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Cable Chest Press (Decline, Underhand)			
Lat Pulldown (Underhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner Acclimation Phase: Week 4 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Shoulder Press (Single Arm, Overhand)			
Monkey Curl			
Overhead Triceps Press			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner
Acclimation Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 15 minutes	REST	Zone 2 20 minutes	Zone 1 25 minutes	REST	REST	Zone 1 25 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Dumbbell Chest Press (Flat, Underhand)			
Bent Over Row (Parallel)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			

Beginner Acclimation Phase: Week 5 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
Bench Dip			
Biceps Curl (Overhand)			
Shrugs			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			

Beginner
Acclimation Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 25 minutes	Zone 1 30 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Cable Chest Press (Incline, Parallel)			
Bent-Over Rhomboid Fly (Parallel)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner Acclimation Phase: Week 6 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Deltoid Around-the-Worlds			
Concentration Curl (Parallel)			
Bent-Over Triceps Kickback (Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner
Build Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 2 20 minutes	Zone 1 25 minutes	REST	REST	Zone 1 30 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	Workout A	Workout B	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent-Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Beginner Build Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Dumbbell Chest Press (Incline, Overhand)			
Bent Over Row (Parallel)			
Bench Dip			
Monkey Curl			
Biceps Curl (Parallel)			
Shoulder Press (Overhand)			
Front Deltoid Raise (Overhand)			

Beginner
Build Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 20 minutes	Zone 1 30 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	Workout B (30 seconds rest between sets)	REST	Workout C	Workout D (30 seconds rest between sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B (30 sec rest between sets)	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Standing Lunge			
Bridges			
Hip Flexion			
Hip Extension			
Internal/External Ankle Rotation			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Beginner Build Phase: Week 2 (cont.)

Workout D (30 sec rest between sets)	**Set 1** Weight/Reps	**Set 2** Weight/Reps	**Notes**
Shoulder Shrugs			
High Cable Biceps Curl (Underhand)			
Bench Dip			
Bent Over Triceps Kickback (Overhand)			
Lat Pulldown (Wide)			
Bent Over Front Deltoid Raise (Overhand)			
Dumbbell Pec Fly (Flat, Overhand)			
Cable Chest Press (Standard, Parallel)			

Workout E	**Set 1** Reps	**Set 2** Reps	**Notes**
Push Ups			
Straight Crunches			
Swimmers			
Standing Calf Raise			
Seated Calf Raise			

Beginner
Build Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 25 minutes	Zone 1 30 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D (Drop Sets)	REST	REST
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
Seated Calf Raise			
Sock Grab			
Flutter Kicks			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner Build Phase: Week 3 (cont.)

Workout D (Drop Sets)	Set 1 Weight/Reps Weight/Reps Weight/Reps	Set 2 Weight/Reps Weight/Reps Weight/Reps	Notes
Bench Dip			
Bent Over Row (Overhand)			
Dumbbell Chest Press (Incline, Underhand)			
Cable Pec Fly (Decline, Overhand)			
Monkey Curl			
Biceps Curl (Overhand)			
Shoulder Press (Parallel)			
Deltoid Around-the-Worlds			

Beginner
Build Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 20 minutes	Zone 1 30 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	Workout B (Supersets)	REST	Workout C	Workout D (Supersets)	REST	Workout E
Notes							

Workout A	**Set 1 Reps**	**Set 2 Reps**	**Notes**
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	**Set 1 Weight/Reps**	**Set 2 Weight/Reps**	**Notes**
Superset 1: Step Ups Walking Lunge Mule Kick			
Superset 2: Hip Flexion Hip Extension			
Superset 3: External Ankle Rotation Internal Ankle Rotation			

Workout C	**Set 1 Reps**	**Set 2 Reps**	**Notes**
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Beginner Build Phase: Week 4 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Superset 1: Cable Chest Press (Standard, Parallel) Lat Pulldown (Underhand)			
Superset 2: Shoulder Shrugs Front Deltoid Raise			
Superset 3: High Cable Biceps Curl Concentration Curl (Underhand)			
Superset 4: Bench Dip Bent Over Triceps Kickback (Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Superman			
Saxon Side Bends			
Standing Calf Raise			
Seated Calf Raise			

Beginner
Build Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 20 minutes	REST	Zone 2 25 minutes	Zone 1 30 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	Workout B (30 seconds rest between sets)	REST	Workout C	Workout D (30 seconds rest between sets)	REST	REST
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B (30 sec rest between sets)	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Standing Leg Extension			
Standing Leg Curl			
Hip Adduction			
Hip Abduction			
Standing Calf Raise			
Seated Calf Raise			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner Build Phase: Week 5 (cont.)

Workout D (30 sec rest between sets)	**Set 1 Weight/Reps**	**Set 2 Weight/Reps**	**Notes**
Shoulder Press (Underhand)			
Monkey Curl			
Bench Dip			
Overhead Triceps Press			
Bent Over Row (Underhand)			
Bent Over Front Deltoid Raise (Parallel)			
Dumbbell Chest Press (Incline, Parallel)			
Cable Pec Fly (Decline, Underhand)			

Beginner
Build Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 25 minutes	Zone 1 30 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D (Drop Sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Standing Lunge			
Bridges			
Hip Flexion			
Hip Extension			
External Ankle Rotation			
Internal Ankle Rotation			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Beginner Build Phase: Week 6 (cont.)

Workout D **(Drop Sets)**	**Set 1** **Weight/Reps** **Weight/Reps** **Weight/Reps**	**Set 2** **Weight/Reps** **Weight/Reps** **Weight/Reps**	**Notes**
Bench Dip			
High Cable Biceps Curl (Single Arm, Underhand)			
Cable Chest Press (Standard, Overhand)			
Dumbbell Pec Fly (Flat, Parallel)			
Lat Pulldown (Single Arm)			
Bent Over Straight Arm Kickback (Parallel)			
Shoulder Shrugs			
Deltoid Around-the-Worlds			

Workout E	**Set 1** **Reps**	**Set 2** **Reps**	**Notes**
Push Ups			
Side Crunches			
Swimmers			
Standing Calf Raise			
Seated Calf Raise			

Beginner
Endurance Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 2 20 minutes	Zone 1 30 minutes	REST	REST	Zone 1 30 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	Workout A	Workout B	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent-Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Beginner Endurance Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Wave Offs			
Saxon Side Bends			
Standing Calf Raise			
Seated Calf Raise			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Cable Chest Press (Standard, Overhand)			
Bent Over Row (Overhand)			

Beginner
Endurance Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 20 minutes	Zone 1 30 minutes	REST	REST	Zone 1 35 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Walking Lunges			
Hamstring Cycling			
Standing Calf Raise			
Bent-Over Triceps Kickback (Overhand)			
Biceps Curl (Parallel)			
Front Deltoid Raise (Overhand)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Swimmers			
Internal/External Ankle Rotation			
Toe Lift			

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Extension			
Hip Flexion			
Dumbbell Chest Press (Incline, Overhand)			
Lat Pulldown (Standard)			

Beginner
Endurance Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 3 20 minutes	Zone 1 30 minutes	REST	REST	Zone 1 40 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Seated Calf Raise			
Bench Dip			
High Cable Biceps Curl (Overhand)			
Single Arm Lateral Raise (Overhand)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Side Crunches			
Bicycles			
Standing Calf Raise			
Seated Calf Raise			

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Hip Adduction			
Hip Abduction			
Bent Over Front Delt Raise (Parallel)			
Cable Chest Press (Decline, Overhand)			

Beginner
Endurance Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 20 minutes	Zone 1 30 minutes	REST	REST	Zone 1 30 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
Deltoid Around-the-Worlds			
Biceps Curl (Overhand)			
Overhead Triceps Extension			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Superman			
Saxon Side Bends			
Internal/External Ankle Rotation			
Toe Lift			

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Extension			
Hip Flexion			
Single Arm Bent Over Rhomboid Fly			
Dumbbell Chest Press (Flat, Overhand)			

Beginner
Endurance Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 3 20 minutes	Zone 2 30 minutes	REST	REST	Zone 1 40 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Walking Lunges			
Standing Leg Curl			
Seated Calf Raise			
Bent Over Triceps Extension (Overhand)			
Single Arm Monkey Curl			
Lateral Deltoid Raise			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Bicycles (Backwards & Forwards)			
Wave Offs			
Standing Calf Raise			
Seated Calf Raise			

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Adduction			
Hip Abduction			
Single Arm Cable Chest Press (Standard/Overhand)			
Bent Over Front Deltoid Raise (Overhand)			

Beginner
Endurance Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 3 20 minutes	Zone 1 30 minutes	REST	REST	Zone 1 45 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Standing Calf Raise			
Overhead Triceps Extension			
Biceps Curl (Overhand)			
Front Deltoid Raise (Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Side Crunches			
Swimmers			
Internal/External Ankle Rotation			
Toe Lift			

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Hip Flexion			
Hip Extension			
Single Arm Lat Pulldown			
Dumbbell Chest Press (Incline, Overhand)			

Beginner
Recovery Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 1 20 minutes	Zone 1 20 minutes	REST	REST	Zone 1 30 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	REST	Workout A	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent-Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Beginner Recovery Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Monkey Curl			
Shoulder Press (Overhand)			

Beginner
Recovery Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 1 20 minutes	Zone 1 20 minutes	REST	REST	Zone 1 35 minutes
Strength	Workout A	REST	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Bent-Over Front Deltoid Raise (Overhand)			
Dumbbell Pec Fly (Flat, Overhand)			

Beginner
Recovery Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 1 20 minutes	Zone 1 20 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	Workout B	REST	Workout C	REST	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Toe Raise			
Bent-Over Triceps Kickback (Overhand)			
Monkey Curl			
Front Deltoid Raise (Overhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Beginner Recovery Phase: Week 3 (cont.)

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Beginner
Recovery Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 20 minutes	Zone 1 20 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Decline, Underhand)			
Lat Pulldown (Underhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner Recovery Phase: Week 4 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
External Ankle Rotation			
Shoulder Press (Single Arm, Overhand)			
Monkey Curl			
Overhead Triceps Press			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner
Recovery Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 20 minutes	Zone 1 20 minutes	REST	REST	Zone 1 30 minutes
Strength	Workout A	REST	REST	Workout B	Workout C	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Beginner Recovery Phase: Week 5 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
External Ankle Rotation			
Bent-Over Straight Arm Kickback (Parallel)			
Cable Pec Fly (Incline. Parallel)			

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Beginner
Recovery Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 1 20 minutes	REST	Zone 2 20 minutes	Zone 1 20 minutes	REST	REST	Zone 1 35 minutes
Strength	Workout A	Workout B	REST	Workout C	REST	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Shoulder Press (Underhand)			
Monkey Curl			
Overhead Triceps Press			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Beginner Recovery Phase: Week 6 (cont.)

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Chapter 24
The Intermediate Program

Whether you prefer recreational dives or perform extended decompression, the **Intermediate Program** will greatly enhance the enjoyment of your diving while having a dramatic impact on your health. Though this program is labeled "intermediate," it is still a very challenging program to complete.

The workouts in this program are designed to replace the activity that we have given up in favor of convenient lifestyles, taking you well beyond the fitness level easily achieved on only 30 minutes of exercise a day. If you have been exercising regularly for 3-5 hours per week, you should be able to start here.

As with the **Beginner Program**, this program can also be used by the most advanced exercisers by increasing the intensity of the cardiovascular workouts listed. In fact, the weight training workouts are exactly the same as in the **Advanced Program**, as additional time spent here will have rapidly diminishing returns to your overall health and function as a diver.

Cardiovascular Training

The cardiovascular training in the **Intermediate Program** will introduce you to a balance of interval training and long, slow distance training up to 90 minutes long.

Zone 1 workouts can be performed as brisk walking or jogging, easy swimming, or low-intensity bike rides. These workouts should not make you winded, but should elevate your respiration and heart rate for the time indicated. This intensity will also be used as a warm up for more difficult training.

Zone 2 workouts are where you begin to step up the intensity. Your pace should be faster, though you should still be able to hold a brief conversation with a workout partner without struggling for breath. If you are a walker interested in running for fitness, these workouts would be where you can introduce running intervals of 2-3 minutes into your walking. You should spend the first 5-10 minutes of these workouts in Zone 1 to prepare you for the faster pace.

Zone 3 workouts will bring you beyond the point you would feel comfortable speaking, but only for short periods of time. You should spend the first 5 minutes of these workouts in Zone 1 and another 5 minutes in Zone 2 to prepare you for the intervals of higher intensity.

Zone 4 workouts involve periods of maximum effort, whether those periods are short bursts of speed (1-2 minutes) or longer intervals of fast endurance training (5-10 minutes). Intervals of intensity will be hard enough to leave you winded and appreciative of subsequent intervals of recovery.

Strength Training

The strength workouts in this program will increase both muscular strength and muscular endurance. Some workouts will include exercises for your entire body, while others will focus on two or three body parts at a time. Supersets, drop sets, and forced rest intervals are found in the **Build Phase** to increase the cardiovascular effort of your strength training. While two days each week will involve training with weights or exercise bands, up to three days each week will be devoted to strengthening your abdominal and back muscles (a.k.a. "the core").

You might find that some exercises are challenging enough without weights or exercise bands. Be sure that you can comfortably perform 12-15 repetitions of these exercises before adding the resistance of a dumbbell or band (see **Chapter 10- Strength Training for Diving** for more information).

Intermediate- Acclimation Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio**	Physical Assesment	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 40 minutes
	Strength		Physical Assesment	REST	REST	Standing Leg Extension Standing Leg Curl Standing Calf Raise External Ankle Rotation Bench Dip Monkey Curl Shoulder Press (Overhand) Bent-Over Rhomboid Fly (Parallel) Cable Pec Fly (Parallel)	REST	REST
Week 2	**Cardio**	Zone 2- 30 minutes	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 40 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Standard/Overhand) Bent-Over Straight Arm Kickback (Overhand) Shoulder Shrugs Concentration Curl (Parallel) Bent-Over Triceps Kickback (Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Parallel) Biceps Curl (Overhand) Overhead Triceps Press (Single Arm) Bent-Over Front Deltoid Raise (Overhand) Dumbbell Pec Fly (Flat/Overhand)	REST	REST
Week 3	**Cardio**	Zone 2- 30 minutes	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 40 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers	Bench Squat Hip Adduction Hip Abduction Toe Raise Dumbbell Chest Press (Flat/Parallel) Lat Pulldown (Wide) Bent-Over Triceps Kickback (Overhand) Monkey Curl Front Deltoid Raise (Overhand)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers	Quadriceps Cycling Hamstring Cycling Standing Calf Raise External Ankle Rotation Bench Dip Concentration Curl (Underhand) Lateral Deltoid Raise Bent-Over Row (Parallel) Cable Pec Fly (Decline/Parallel)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers
Week 4	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 40 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Decline/Underhand) Lat Pulldown (Underhand) Shoulder Shrugs High Cable Biceps Curl (Underhand) Bent-Over Triceps Kickback (Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Single Arm/Overhand) Monkey Curl Overhead Triceps Press Bent-Over Rhomboid Fly (Overhand) Dumbbell Pec Fly (Flat/Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping
Week 5	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines	Bench Squat Hip Adduction Hip Abduction Toe Raise Dumbbell Chest Press (Flat/Underhand) Bent-Over Row (Parallel) Bent-Over Triceps Kickback (Underhand) High Cable Biceps Curl (Parallel) Lateral Deltoid Raise	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines	Quadriceps Cycling Hamstring Cycling Standing Calf Raise External Ankle Rotation Bench Dip Biceps Curl (Overhand) Shoulder Shrugs Bent-Over Straight Arm Kickback (Parallel) Cable Pec Fly (Incline/Parallel)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines
Week 6	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 40 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Incline/Parallel) Bent-Over Rhomboid Fly (Parallel) Shoulder Press (Underhand) Monkey Curl Overhead Triceps Press	REST	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Deltoid Around-the-Worlds Concentration Curl (Parallel) Bent-Over Triceps Kickback (Parallel) Lat Pulldown (Close) Dumbbell Pec Fly (Flat/Underhand)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers

Intermediate- Build Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio**	Physical Assessment	REST	Zone 3- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength		Physical Assessment	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	Dumbbell Chest Press (Incline/Overhand) Cable Pec Fly (Decline/Parallel) Bent Over Row (Parallel) Bent Over Rhomboid Fly (Overhand) Bench Dip Overhead Triceps Press Monkey Curl Biceps Curl (Parallel) Shoulder Press (Overhand) Front Deltoid Raise (Overhand)	REST	REST
Week 2	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 35 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman	***30 seconds rest*** Step Ups Standing Lunge Bridges Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation Standing Calf Raise Bicycles (Backward)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers	***30 seconds rest*** Shoulder Shrugs Lateral Deltoid Raise High Cable Biceps Curl (Underhand) Concentration Curl (Parallel) Floor Dip Bent Over Triceps Kickback (Overhand) Lat Pulldown (Wide) Bent Over Front Deltoid Raise (Overhand) Dumbbell Pec Fly (Flat/Overhand) Cable Chest Press (Standard/Parallel)	REST	Push Ups Mountain Climbers Straight Crunches High Stepping Swimmers Jumping Lunges Standing Calf Raise Seated Calf Raise
Week 3	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 35 minutes	Zone 2- 35 minutes	REST	REST	Zone 2- 60 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers	Bench Squat Quadriceps Cycling Hamstring Cycling Hip Adduction Hip Abduction Standing Calf Raise Seated Calf Raise Sock Grab Flutter Kicks	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	***Drop Sets*** Bench Dip Overhead Triceps Press Bent Over Row (Overhand) Bent Over Straight Arm Kickback (Parallel) Dumbbell Chest Press (Incline/Underhand) Cable Pec Fly (Decline/Overhand) Monkey Curl Biceps Curl (Overhand) Shoulder Press (Parallel) Deltoid Around-the-Worlds	REST	REST
Week 4	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength	REST Push Ups Crunches (Straight) Crunches (Side) Superman	***Supersets*** Step Ups Walking Lunge Mule Kick Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation Standing Calf Raise Abductor/Adductor Scissors	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers	***Supersets*** Cable Chest Press (Standard/Parallel) Dumbbell Pec Fly (Flat/Overhand) Lat Pulldown (Underhand) Bent Over Rhomboid Fly (Parallel) Shrugs Front Deltoid Raise High Cable Biceps Curl Concentration Curl (Underhand) Floor Dip Bent Over Triceps Kickback (Parallel)	REST	Push Ups Flutter Kicks Superman Standing Broad Jump Saxon Side Bends Ski Jumpers Standing Calf Raise Seated Calf Raise
Week 5	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 40 minutes	Zone 2- 35 minutes	REST	REST	Zone 2- 60 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers	***30 seconds rest*** Single Leg Squat Standing Leg Extension Standing Leg Curl Hip Adduction Hip Abduction Standing Calf Raise Seated Calf Raise Sock Grab Flutter Kicks	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	***30 seconds rest*** Shoulder Press (Underhand) Lateral Deltoid Raise Monkey Curl Biceps Curl (Underhand) Bench Dip Overhead Triceps Press Bent Over Row (Underhand) Bent Over Front Deltoid Raise (Parallel) Dumbbell Chest Press (Incline/Parallel) Cable Pec Fly (Decline/Underhand)	REST	REST
Week 6	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 40 minutes	Zone 2- 40 minutes	REST	REST	Zone 2- 60 minutes
	Strength	REST Push Ups Crunches (Straight) Crunches (Side) Superman	Step Ups Standing Lunge Bridges Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation Standing Calf Raise Abductor/Adducttor Scissors	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers	***Drop Sets*** Floor Dip Bent Over Triceps Kickback (Underhand) High Cable Bices Curl (Single Arm) Concentration Curl (Parallel) Cable Chest Press (Standard/Overhand) Dumbbell Pec Fly (Flat/Parallel) Lat Pulldown (Single Arm) Bent Over Straight Arm Kickback (Parallel) Shoulder Shrugs Deltoid Around-the-Worlds	REST	Push Ups Mountain Climbers Side Crunches High Steping Swimmers Ski Jumpers Standing Calf Raise Seated Calf Raise

Intermediate- Endurance Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio**	Physical Assessment	REST	Zone 3- 40 minutes	Zone 2- 40 minutes	REST	REST	Zone 2- 60 minutes
	Strength		Physical Assessment	REST	Push Ups Lumberjacks Wave Offs Steam Engines Ski Jumpers Saxon Side Bends Standing Calf Raise Seated Calf Raise	Bench Squat Hip Adduction Hip Abduction Cable Chest Press (Standard/Overhand) Bent Over Row (Overhand) Bent Over Triceps Kickback (Parallel) Monkey Curl Shoulder Shrugs	REST	REST
Week 2	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 40 minutes	Zone 2- 40 minutes	REST	REST	Zone 2- 70 minutes
	Strength	REST	Walking Lunges Hamstring Cycling Standing Calf Raise Bent Over Triceps Kickback (Underhand) Hammer Curl Front Deltoid Raise (Overhand) Bent Over Straight Arm Kickback (Overhand) Dumbbell Pec Fly (Incline/Parallel)	REST	Push Ups Mountain Climbers Straight Crunches High Stepping Swimmers Jumping Lunges Internal/External Ankle Rotation Toe Lift	Step Ups Hip Extension Hip Flexion Dumbbell Chest Press (Incline/Overhand) Lat Pulldown (Standard) Single Arm Shoulder Press (Parallel) High Cable Biceps Curl (Underhand) Overhead Triceps Extension	REST	REST
Week 3	**Cardio**	Zone 2- 30 minutes	REST	Zone 4- 30 minutes	Zone 2- 40 minutes	REST	REST	Zone 2- 80 minutes
	Strength	REST	Standing Leg Extension Standing Leg Curl Seated Calf Raise Cable Pec Fly (Incline/Overhand) Bent Over Row (Underhand) Bench Dip High Cable Biceps Curl (Overhand) Single Arm Lateral Deltoid Raise (Overhand)	REST	Push Ups Lumberjacks Side Crunches Bicycles Frog Pull Straight Leg High Stepping Standing Calf Raise Seated Calf Raise	Single Leg Squat Hip Adduction Hip Abduction Arnold Press Monkey Curl Overhead Triceps Extension Bent Over Front Delt Raise (Parallel) Cable Chest Press (Decline/Overhand)	REST	REST
Week 4	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 40 minutes	Zone 2- 40 minutes	REST	REST	Zone 2- 60 minutes
	Strength	REST	Quadriceps Cycling Hamstring Cycling Standing Calf Raise Deltoid Around-the-Worlds Biceps Curl (Overhand) Overhead Triceps Extension Lat Pulldown (Underhand) Dumbbell Pec Fly (Incline/Parallel)	REST	Push Ups Flutter Kicks Superman Standing Broad Jump Saxon Side Bends Ski Jumpers Internal/External Ankle Rotation Toe Lift	Bench Squat Hip Extension Hip Flexion Single Arm Bent Over Triceps Extension (Parallel) Concentration Curl (Parallel) Shoulder Press (Overhand) Single Arm Bent Over Rhomboid Fly Dumbbell Chest Press (Flat/Overhand)	REST	REST
Week 5	**Cardio**	Zone 2- 30 minutes	REST	Zone 4- 30 minutes	Zone 2- 40 minutes	REST	REST	Zone 2- 80 minutes
	Strength	REST	Walking Lunges Standing Leg Curl Seated Calf Raise Bent Over Triceps Extension (Overhand) Single Arm Monkey Curl Lateral Deltoid Raise Bent Over Row (Overhand) Single Arm Cable Pec Fly (Standard/Parallel)	REST	Push Ups High Stepping Bicycles (Backwards & Forwards) Steam Engings Wave Offs Star Jumpers Standing Calf Raise Seated Calf Raise	Step Ups Hip Adduction Hip Abduction Single Arm Cable Chest Press (Standard/Overhand) Bent Over Front Deltoid Raise (Overhand) Shoulder Shrugs Single Arm High Cable Biceps Curl (Underhand) Bench Dip	REST	REST
Week 6	**Cardio**	Zone 2- 30 minutes	REST	Zone 4- 30 minutes	Zone 2- 40 minutes	REST	REST	Zone 2- 90 minutes
	Strength	REST	Standing Leg Extension Standing Leg Curl Standing Calf Raise Single Arm Dumbbell Pec Fly (Standard/Parallel) Bent Over Rhomboid Fly Overhead Triceps Extension Biceps Curl (Overhand) Front Deltoid Raise (Parallel)	REST	Push Ups Mountain Climbers Side Crunches High Steping Swimmers Ski Jumpers Internal/External Ankle Rotation Toe Lift	Single Leg Squat Hip Flexion Hip Extension Singel Arm Shoulder Press (Overhand) Concentration Curl (Underhand) Bench Dip Single Arm Lat Pulldown Dumbbell Chest Press (Incline/Overhand)	REST	REST

Intermediate- Recovery Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio**	Physical Assesment	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 60 minutes
	Strength		Physical Assesment	REST	REST	Standing Leg Extension Standing Leg Curl Standing Calf Raise External Ankle Rotation Bench Dip Monkey Curl Shoulder Press (Overhand) Bent Over Rhomboid Fly (Parallel) Cable Pec Fly (Parallel)	REST	REST
Week 2	**Cardio**	Zone 2- 30 minutes	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 70 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman	REST	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Parallel) Biceps Curl (Overhand) Overhead Triceps Press (Single Arm) Bent Over Front Deltoid Raise (Overhand) Dumbbell Pec Fly (Flat/Overhand)	REST	REST
Week 3	**Cardio**	Zone 2- 30 minutes	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 40 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers	Bench Squat Hip Adduction Hip Abduction Toe Raise Dumbbell Chest Press (Flat/Parallel) Lat Pulldown (Wide) Bent Over Triceps Kickback (Overhand) Monkey Curl Front Deltoid Raise (Overhand)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers
Week 4	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 40 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Decline/Underhand) Lat Pulldown (Underhand) Shoulder Shrugs High Cable Biceps Curl (Underhand) Bent Over Triceps Kickback (Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Single Arm/Overhand) Monkey Curl Overhead Triceps Press Bent Over Rhomboid Fly (Overhand) Dumbbell Pec Fly (Flat/Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping
Week 5	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines	REST	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines	Quadriceps Cycling Hamstring Cycling Standing Calf Raise External Ankle Rotation Bench Dip Biceps Curl (Overhand) Shoulder Shrugs Bent Over Straight Arm Kickback (Parallel) Cable Pec Fly (Incline/Parallel)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines
Week 6	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 40 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Incline/Parallel) Bent Over Rhomboid Fly (Parallel) Shoulder Press (Underhand) Monkey Curl Overhead Triceps Press	REST	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers	REST	REST	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers

Intermediate
Acclimation Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 40 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	REST	Workout A	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Intermediate Acclimation Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Monkey Curl			
Shoulder Press (Overhand)			
Bent Over Rhomboid Fly (Parallel)			
Cable Pec Fly (Standard, Parallel)			

Intermediate
Acclimation Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 40 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	REST
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Overhand)			
Bent-Over Straight Arm Kickback (Overhand)			
Shoulder Shrugs			
Concentration Curl (Parallel)			
Bent-Over Triceps Kickback (Parallel)			

Intermediate Acclimation Phase: Week 2 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Internal Ankle Rotation			
Shoulder Press (Parallel)			
Biceps Curl (Overhand)			
Overhead Triceps Press (Single Arm)			
Bent-Over Front Deltoid Raise (Overhand)			
Dumbbell Pec Fly (Flat, Overhand)			

Intermediate
Acclimation Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 40 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Toe Raise			
Dumbbell Chest Press (Flat, Parallel)			
Lat Pulldown (Wide)			
Bent Over Triceps Kickback (Overhand)			
Monkey Curl			
Front Deltoid Raise (Overhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate Acclimation Phase: Week 3 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Concentration Curl (Underhand)			
Lateral Deltoid Raise			
Bent Over Row (Parallel)			
Cable Pec Fly (Decline, Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate
Acclimation Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 40 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Decline, Underhand)			
Lat Pulldown (Underhand)			
Shoulder Shrugs			
High Cable Biceps Curl (Underhand)			
Bent Over Triceps Kickback (Parallel)			

Intermediate Acclimation Phase: Week 4 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
External Ankle Rotation			
Shoulder Press (Single Arm, Overhand)			
Monkey Curl			
Overhead Triceps Press			
Bent Over Rhomboid Fly (Overhand)			
Dumbbell Pec Fly (Flat, Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Intermediate
Acclimation Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Toe Raise			
Dumbbell Chest Press (Flat, Underhand)			
Bent Over Row (Parallel)			
Bent Over Triceps Kickback (Underhand)			
High Cable Biceps Curl (Parallel)			
Lateral Deltoid Raise			

Intermediate Acclimation Phase: Week 5 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Biceps Curl (Overhand)			
Shoulder Shrugs			
Bent Over Straight Arm Kickback (Parallel)			
Cable Pec Fly (Incline, Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Intermediate
Acclimation Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 40 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Incline, Parallel)			
Bent Over Rhomboid Fly (Parallel)			
Shoulder Press (Underhand)			
Monkey Curl			
Overhead Triceps Press			

Intermediate Acclimation Phase: Week 6 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Internal Ankle Rotation			
Deltoid Around-the-Worlds			
Concentration Curl (Parallel)			
Bent Over Triceps Kickback (Parallel)			
Lat Pulldown (Close Grip)			
Dumbbell Pec Fly (Flat, Underhand)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Intermediate
Build Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 3 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	Workout A	Workout B	REST	Workout C
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Intermediate Build Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Dumbbell Chest Press (Incline, Overhand)			
Cable Pec Fly (Decline, Parallel)			
Bent Over Row (Parallel)			
Bent Over Rhomboid Fly (Overhand)			
Bench Dip			
Overhead Triceps Press			
Monkey Curl			
Biceps Curl (Hammer)			
Shoulder Press (Overhand)			
Front Deltoid Raise (Overhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate
Build Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 35 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	Workout A	Workout B (30 seconds rest between sets)	REST	Workout C	Workout D (30 seconds rest between sets)	REST	Workout E
Notes							

Workout A	**Set 1 Reps**	**Set 2 Reps**	**Notes**
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B (30 sec rest between sets)	**Set 1 Weight/Reps**	**Set 2 Weight/Reps**	**Notes**
Step Ups			
Standing Lunge			
Bridges			
Hip Flexion			
Hip Extension			
Internal/External Ankle Rotation			
Standing Calf Raise			
Bicycles (Backward)			

Workout C	**Set 1 Reps**	**Set 2 Reps**	**Notes**
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate Build Phase: Week 2 (cont.)

Workout D (30 sec rest between sets)	**Set 1 Weight/Reps**	**Set 2 Weight/Reps**	**Notes**
Shoulder Shrugs			
Lateral Deltoid Raise			
High Cable Biceps Curl			
Concentration Curl (Parallel)			
Floor Dip			
Bent Over Triceps Kickback (Overhand)			
Lat Pulldown (Wide)			
Bent Over Front Deltoid Raise (Overhand)			
Dumbbell Pec Fly (Flat, Overhand)			
Cable Chest Press (Standard, Parallel)			

Workout E	**Set 1 Reps**	**Set 2 Reps**	**Notes**
Push Ups			
Mountain Climbers			
Straight Crunches			
High Stepping			
Swimmers			
Jumping Lunges			
Standing Calf Raise			
Seated Calf Raise			

Intermediate
Build Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 35 minutes	Zone 2 35 minutes	REST	REST	Zone 2 60 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D (Drop Sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Quadriceps Cycling			
Hamstring Cycling			
Hip Adduction			
Hip Abduction			
Standing Calf Raise			
Seated Calf Raise			
Sock Grab			
Flutter Kicks			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Intermediate Build Phase: Week 3 (cont.)

Workout D (Drop Sets)	Set 1 Weight/Reps Weight/Reps Weight/Reps	Set 2 Weight/Reps Weight/Reps Weight/Reps	Notes
Bench Dip			
Overhead Triceps Press			
Bent Over Row (Overhand)			
Bent Over Straight Arm Kickback (Parallel)			
Dumbbell Chest Press (Incline/Underhand)			
Cable Pec Fly (Decline/Overhand)			
Monkey Curl			
Biceps Curl (Overhand)			
Shoulder Press (Parallel)			
Deltoid Around-the-Worlds			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate
Build Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	Workout A	Workout B (Supersets)	REST	Workout C	Workout D (Supersets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Superset 1: Step Ups Walking Lunge Mule Kick			
Superset 2: Hip Flexion Hip Extension			
Superset 3: External Ankle Rotation Internal Ankle Rotation Standing Calf Raise			
Abductor/Adductor Scissors			

Intermediate Build Phase: Week 4 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Superset 1: Cable Chest Press (Standard/Parallel) Dumbbell Pec Fly (Flat/Overhand)			
Superset 2: Lat Pulldown (Underhand) Bent Over Rhomboid Fly (Parallel)			
Superset 3: Shrugs Front Deltoid Raise			
Superset 4: High Cable Biceps Curl Concentration Curl (Underhand)			
Superset 5: Floor Dip Bent Over Triceps Kickback (Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Superman			
Standing Broad Jump			
Saxon Side Bends			
Ski Jumpers			
Standing Calf Raise			
Seated Calf Raise			

Intermediate
Build Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 40 minutes	Zone 2 35 minutes	REST	REST	Zone 2 60 minutes
Strength	Workout A	Workout B (30 seconds rest between sets)	REST	Workout C	Workout D (30 seconds rest between sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B (30 sec rest between sets)	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Standing Leg Extension			
Standing Leg Curl			
Hip Adduction			
Hip Abduction			
Standing Calf Raise			
Seated Calf Raise			
Sock Grab			
Flutter Kicks			

Intermediate Build Phase: Week 5 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout D (30 sec rest between sets)	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Shoulder Press (Underhand)			
Lateral Deltoid Raise			
Monkey Curl			
Biceps Curl (Underhand)			
Bench Dip			
Overhead Triceps Press			
Bent Over Row (Underhand)			
Bent Over Front Deltoid Raise (Parallel)			
Dumbbell Chest Press (Incline, Parallel)			
Cable Pec Fly (Decline, Underhand)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate
Build Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 40 minutes	Zone 2 40 minutes	REST	REST	Zone 2 60 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D (Drop Sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Standing Lunge			
Bridges			
Hip Flexion			
Hip Extension			
External Ankle Rotation			
Internal Ankle Rotation			
Standing Calf Raise			
Scissors Kick			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate Build Phase: Week 6 (cont.)

Workout D (Drop Sets)	Set 1 Weight/Reps Weight/Reps Weight/Reps	Set 2 Weight/Reps Weight/Reps Weight/Reps	Notes
Floor Dip			
Bent Over Triceps Kickback (Underhand)			
High Cable Biceps Curl (Single Arm)			
Concentration Curl (Parallel)			
Cable Chest Press (Standard, Overhand)			
Dumbbell Pec Fly (Flat, Parallel)			
Lat Pulldown (Single Arm)			
Bent Over Straight Arm Kickback (Parallel)			
Shoulder Shrugs			
Deltoid Around-the-Worlds			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Mountain Climbers			
Side Crunches			
High Stepping			
Swimmers			
Ski Jumpers			
Standing Calf Raise			
Seated Calf Raise			

Intermediate
Endurance Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 3 40 minutes	Zone 2 40 minutes	REST	REST	Zone 2 60 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	Workout A	Workout B	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time ________ or

Cardio Machine (15 min) ___________ Speed _____ Incline _____ Resistance _____

Flexibility:

Sit and Reach Test _____

Apley Scratch Test (Down the Back) Right Side _____ Left Side _____

Apley Scratch Test (Up the Back) Right Side _____ Left Side _____

Muscular Strength:

Bench Squat _____

Standing Lunges _____

Bridges _____

Calf Raises _____

Dumbbell Chest Press _____

Bent Over Dumbbell Row _____

Dumbbell Shoulder Press _____

Dumbbell Biceps Curl _____

Overhead Triceps Press _____

Muscular Endurance:

Push Ups _____

Crunches _____

Wave-Offs _____

Bent Leg Stand _____

Intermediate Endurance Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Lumberjacks			
Wave Offs			
Steam Engines			
Ski Jumpers			
Saxon Side Bends			
Standing Calf Raise			
Seated Calf Raise			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Cable Chest Press			
Bent Over Row			
Bent Over Triceps Kickback			
Monkey Curl			
Shrugs			

Intermediate
Endurance Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 40 minutes	Zone 2 40 minutes	REST	REST	Zone 2 70 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Walking Lunges			
Hamstring Cycling			
Standing Calf Raise			
Bent Over Triceps Kickback (Overhand)			
Hammer Curl (Underhand)			
Front Deltoid Raise (Overhand)			
Bent Over Straight Arm Kickback (Parallel)			
Dumbbell Pec Fly (Incline, Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Mountain Climbers			
Straight Crunches			
High Stepping			
Swimmers			
Jumping Lunges			
Internal/External Ankle Rotation			
Toe Lift			

Intermediate Endurance Phase: Week 2 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Extension			
Hip Flexion			
Dumbbell Chest Press (Incline, Overhand)			
Lat Pulldown (Standard)			
Single Arm Shoulder Press (Parallel)			
High Cable Biceps Curl (Underhand)			
Overhead Triceps Extension			

Intermediate
Endurance Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 4 30 minutes	Zone 2 40 minutes	REST	REST	Zone 2 80 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Seated Calf Raise			
Cable Pec Fly (Incline, Overhand)			
Bent Over Row (Underhand)			
Bench Dip			
High Cable Biceps Curl (Overhand)			
Single Arm Lateral Deltoid Raise (Overhand)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Lumberjacks			
Side Crunches			
Bicycles			
Frog Pull			
Straight Leg High Stepping			
Standing Calf Raise			
Seated Calf Raise			

Intermediate Endurance Phase: Week 3 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Hip Adduction			
Hip Abduction			
Arnold Press			
Monkey Curl			
Overhead Triceps Extension			
Bent Over Front Delt Raise (Parallel)			
Cable Chest Press (Decline, Overhand)			

Intermediate
Endurance Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 40 minutes	Zone 2 40 minutes	REST	REST	Zone 2 60 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
Deltoid Around-the-Worlds			
Biceps Curl (Overhand)			
Overhead Triceps Extension			
Lat Pulldown (Underhand)			
Dumbbell Pec Fly (Incline, Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Superman			
Standing Broad Jump			
Saxon Side Bends			
Ski Jumpers			
Internal/External Ankle Rotation			
Toe Lift			

Intermediate Endurance Phase: Week 4 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Extension			
Hip Flexion			
Single Arm Bent Over Triceps Extension			
Concentration Curl (Parallel)			
Shoulder Press (Overhand)			
Single Arm Bent Over Rhomboid Fly			
Dumbbell Chest Press (Flat, Overhand)			

Intermediate
Endurance Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 4 30 minutes	Zone 2 40 minutes	REST	REST	Zone 2 80 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Walking Lunges			
Standing Leg Curl			
Seated Calf Raise			
Bent Over Triceps Extension (Overhand)			
Single Arm Monkey Curl			
Lateral Deltoid Raise			
Bent Over Row (Overhand)			
Single Arm Cable Pec Fly (Standard, Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
High Stepping			
Bicycles (Backwards & Forwards)			
Steam Engines			
Wave Offs			
Star Jumpers			
Standing Calf Raise			
Seated Calf Raise			

Intermediate Endurance Phase: Week 5 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Adduction			
Hip Abduction			
Single Arm Cable Chest Press (Standard, Overhand)			
Bent Over Front Deltoid Raise (Overhand)			
Shoulder Shrugs			
Single Arm High Cable Biceps Curl (Underhand)			
Bench Dip			

Intermediate
Endurance Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 4 30 minutes	Zone 2 40 minutes	REST	REST	Zone 2 90 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Standing Calf Raise			
Single Arm Dumbbell Pec Fly (Standard, Parallel)			
Bent Over Rhomboid Fly			
Overhead Triceps Extension			
Biceps Curl (Overhand)			
Front Deltoid Raise (Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Mountain Climbers			
Side Crunches			
High Stepping			
Swimmers			
Ski Jumpers			
Internal/External Ankle Rotation			
Toe Lift			

Intermediate Endurance Phase: Week 6 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Hip Flexion			
Hip Extension			
Single Arm Shoulder Press (Overhand)			
Concentration Curl (Underhand)			
Bench Dip			
Single Arm Lat Pulldown			
Dumbbell Incline Chest Press (Parallel)			

Intermediate
Recovery Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 60 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	REST	Workout A	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Intermediate Recovery Phase: Week 1 (cont.)

Workout B	Set 1 Reps	Set 2 Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Monkey Curl			
Shoulder Press (Overhand)			
Bent Over Rhomboid Fly (Parallel)			
Cable Pec Fly (Parallel)			

Intermediate
Recovery Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 70 minutes
Strength	Workout A	REST	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Intermediate Recovery Phase: Week 2 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Internal Ankle Rotation			
Shoulder Press (Parallel)			
Biceps Curl (Overhand)			
Overhead Triceps Press (Single Arm)			
Bent Over Front Deltoid Raise (Overhand)			
Dumbbell Pec Fly (Flat, Overhand)			

Intermediate
Recovery Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 40 minutes
Strength	Workout A	Workout B	REST	Workout C	REST	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Toe Raise			
Dumbbell Chest Press (Flat/Parllel)			
Lat Pulldown (Wide)			
Bent Over Triceps Kickback (Overhand)			
Monkey Curl			
Front Deltoid Raise (Overhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate Recovery Phase: Week 3 (cont.)

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Intermediate
Recovery Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 40 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Decline/Underhand)			
Lat Pulldown (Underhand)			
Shoulder Shrugs			
High Cable Biceps Curl (Underhand)			
Bent Over Triceps Kickback (Parallel)			

Intermediate Recovery Phase: Week 4 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
External Ankle Rotation			
Shoulder Press (Single Arm)			
Monkey Curl			
Overhead Triceps Press			
Bent Over Rhomboid Fly (Overhand)			
Dumbbell Pec Fly (Flat, Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Intermediate
Recovery Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	Workout A	REST	REST	Workout B	Workout C	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Intermediate Recovery Phase: Week 5 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Biceps Curl (Overhand)			
Shoulder Shrugs			
Bent Over Straight Arm Kickback (Parallel)			
Cable Pec Fly (Incline, Parallel)			

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Intermediate
Recovery Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 40 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	Workout A	Workout B	REST	Workout C	REST	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Incline, Parallel)			
Bent Over Rhomboid Fly (Parallel)			
Shoulder Press (Underhand)			
Monkey Curl			
Overhead Triceps Press			

Intermediate Recovery Phase: Week 6 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Chapter 25
The Advanced Program

If you enjoy running marathons, riding centuries (100-mile bike rides), or competing in triathlons, you should consider following the **Advanced Program**. This program is designed to combine the training typical to an endurance athlete with a strength training program functionally specific to diving. With this program, these goals can complement rather than compete with each other.

As previously mentioned, the weight training workouts are exactly the same as in the **Intermediate Program**, as additional time spent here will have rapidly diminishing returns to your overall health and function as a diver. Several days per week will involve both cardiovascular and strength training, challenging and conditioning your ability to recover from exercise.

Cardiovascular Training

If you already have the interest in fitness required for this program, then you probably already have a good cardiovascular program going. If that is the case, then there is no need to change other than to incorporate the diver-specific strength training.

If you are looking for additional guidance, you can still find it in this program. The cardiovascular training in the **Advanced Program** will introduce you to a balance of interval training and long, slow distance training up to two hours long.

Zone 1 workouts can be performed as brisk walking or easy running, easy swimming, or low-intensity bike rides. These workouts should not make you winded, but should elevate your respiration and heart rate for the time indicated. This intensity will also be used as a warm up for more difficult training.

Zone 2 workouts are where you begin to step up the intensity. Your pace should be faster, though you should still be able to hold a brief conversation with a workout partner without struggling for breath. If you are a walker interested in running for fitness, these workouts would be where you can introduce running intervals of 2-3 minutes into your walking. You should spend the first 5-10 minutes of these workouts in Zone 1 to prepare you for the faster pace.

Zone 3 workouts will bring you beyond the point you would feel comfortable speaking, but only for short periods of time. You should spend the first 5 minutes of these workouts in Zone 1 and another 5 minutes in Zone 2 to prepare you for the intervals of higher intensity.

Zone 4 workouts involve periods of maximum effort, whether those periods are short bursts of speed (1-2 minutes) or longer intervals of fast endurance training (5-10 minutes). Intervals of intensity will be hard enough to leave you winded and appreciative of subsequent intervals of recovery.

Strength Training

The strength workouts in this program will increase both muscular strength and muscular endurance. Some workouts will include exercises for your entire body, while others will focus on two or three body parts at a time. Supersets, drop sets, and forced rest intervals are found in the **Build Phase** to increase the cardiovascular effort of your strength training. While two days each week will involve training with weights or exercise bands, up to three days each week will be devoted to strengthening your abdominal and back muscles (a.k.a. “the core”).

You might find that some exercises are challenging enough without weights or exercise bands. Be sure that you can comfortably perform 12-15 repetitions of these exercises before adding the resistance of a dumbbell or band (see **Chapter 10- Strength Training for Diving** for more information).

Advanced- Acclimation Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio**	Physical Assesment	REST	Zone 2- 40 minutes	Zone 2- 40 minutes	Zone 2- 20 minutes	REST	Zone 2- 45 minutes
	Strength		Physical Assesment	REST	REST	Standing Leg Extension Standing Leg Curl Standing Calf Raise External Ankle Rotation Bench Dip Monkey Curl Shoulder Press (Overhand) Bent-Over Rhomboid Fly (Parallel) Cable Pec Fly (Parallel)	REST	REST
Week 2	**Cardio**	Zone 2- 40 minutes	REST	Zone 2- 40 minutes	Zone 2- 40 minutes	Zone 2- 20 minutes	REST	Zone 2- 45 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Overhand) Bent-Over Straight Arm Kickback (Overhand) Shoulder Shrugs Concentration Curl (Parallel) Bent-Over Triceps Kickback (Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Parallel) Biceps Curl (Overhand) Overhead Triceps Press (Single Arm) Bent-Over Front Deltoid Raise (Overhand) Dumbbell Pec Fly (Flat/Overhand)	REST	REST
Week 3	**Cardio**	Zone 2- 40 minutes	REST	Zone 2- 40 minutes	Zone 2- 40 minutes	Zone 2- 20 minutes	REST	Zone 2- 45 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers	Bench Squat Hip Adduction Hip Abduction Toe Raise Dumbbell Chest Press (Flat/Parallel) Lat Pulldown (Wide) Bent-Over Triceps Kickback (Overhand) Monkey Curl Front Deltoid Raise (Overhand)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers	Quadriceps Cycling Hamstring Cycling Standing Calf Raise External Ankle Rotation Bench Dip Concentration Curl (Underhand) Lateral Deltoid Raise Bent-Over Row (Parallel) Cable Pec Fly (Decline/Parallel)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers
Week 4	**Cardio**	Zone 2- 40 minutes	REST	Zone 3- 40 minutes	Zone 2- 40 minutes	Zone 2- 30 minutes	REST	Zone 2- 45 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Decline/Underhand) Lat Pulldown (Underhand) Shoulder Shrugs High Cable Biceps Curl (Underhand) Bent-Over Triceps Kickback (Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Single Arm/Overhand) Monkey Curl Overhead Triceps Press Bent-Over Rhomboid Fly (Overhand) Dumbbell Pec Fly (Flat/Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping
Week 5	**Cardio**	Zone 2- 40 minutes	REST	Zone 3- 40 minutes	Zone 2- 40 minutes	Zone 2- 30 minutes	REST	Zone 2- 60 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines	Bench Squat Hip Adduction Hip Abduction Toe Raise Dumbbell Chest Press (Flat/Underhand) Bent-Over Row (Parallel) Bent-Over Triceps Kickback (Underhand) High Cable Biceps Curl (Parallel) Lateral Deltoid Raise	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines	Quadriceps Cycling Hamstring Cycling Standing Calf Raise External Ankle Rotation Bench Dip Biceps Curl (Overhand) Shoulder Shrugs Bent-Over Straight Arm Kickback (Parallel) Cable Pec Fly (Incline/Parallel)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines
Week 6	**Cardio**	Zone 2- 40 minutes	REST	Zone 3- 45 minutes	Zone 2- 40 minutes	Zone 2- 30 minutes	REST	Zone 2- 60 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Incline/Parallel) Bent-Over Rhomboid Fly (Parallel) Shoulder Press (Underhand) Monkey Curl Overhead Triceps Press	REST	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Deltoid Around-the-Worlds Concentration Curl (Parallel) Bent-Over Triceps Kickback (Parallel) Lat Pulldown (Close) Dumbbell Pec Fly (Flat/Underhand)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers

Advanced- Build Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio** **Strength**	Physical Assessment	REST Physical Assessment	Zone 3- 40 minutes REST	Zone 2- 40 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	Zone 2- 30 minutes Dumbbell Chest Press (Incline/Overhand) Cable Pec Fly (Decline/Parallel) Bent Over Row (Parallel) Bent Over Rhomboid Fly (Overhand) Bench Dip Overhead Triceps Press Monkey Curl Biceps Curl (Parallel) Shoulder Press (Overhand) Front Deltoid Raise (Overhand)	REST REST	Zone 2- 60 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers
Week 2	**Cardio** **Strength**	Zone 2- 40 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	REST ***30 seconds rest*** Step Ups Standing Lunge Bridges Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation Standing Calf Raise Bicycles (Backward)	Zone 3- 35 minutes REST	Zone 2- 40 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	Zone 2- 30 minutes ***30 seconds rest*** Shoulder Shrugs Lateral Deltoid Raise High Cable Biceps Curl (Underhand) Concentration Curl (Parallel) Floor Dip Bent Over Triceps Kickback (Overhand) Lat Pulldown (Wide) Bent Over Front Deltoid Raise (Overhand) Dumbbell Pec Fly (Flat/Overhand) Cable Chest Press (Standard/Parallel)	REST REST	Zone 2- 60 minutes Push Ups Mountain Climbers Straight Crunches High Stepping Swimmers Jumping Lunges Standing Calf Raise Seated Calf Raise
Week 3	**Cardio** **Strength**	Zone 2- 40 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST Bench Squat Quadriceps Cycling Hamstring Cycling Hip Adduction Hip Abduction Standing Calf Raise Seated Calf Raise Sock Grab Flutter Kicks	Zone 3- 35 minutes REST	Zone 2- 35 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	Zone 2- 30 minutes ***Drop Sets*** Bench Dip Overhead Triceps Press Bent Over Row (Overhand) Bent Over Straight Arm Kickback (Parallel) Dumbbell Chest Press (Incline/Underhand) Cable Pec Fly (Decline/Overhand) Monkey Curl Biceps Curl (Overhand) Shoulder Press (Parallel) Deltoid Around-the-Worlds	REST REST	Zone 2- 75 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers
Week 4	**Cardio** **Strength**	Zone 2- 40 minutes REST Push Ups Crunches (Straight) Crunches (Side) Superman	REST ***Supersets*** Step Ups Walking Lunge Mule Kick Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation Standing Calf Raise Abductor/Adductor Scissors	Zone 3- 40 minutes REST	Zone 2- 40 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	Zone 2- 30 minutes ***Supersets*** Cable Chest Press (Standard/Parallel) Dumbbell Pec Fly (Flat/Overhand) Lat Pulldown (Underhand) Bent Over Rhomboid Fly (Parallel) Shrugs Front Deltoid Raise High Cable Biceps Curl Concentration Curl (Underhand) Floor Dip Bent Over Triceps Kickback (Parallel)	REST REST	Zone 2- 60 minutes Push Ups Flutter Kicks Superman Standing Broad Jump Saxon Side Bends Ski Jumpers Standing Calf Raise Seated Calf Raise
Week 5	**Cardio** **Strength**	Zone 2- 40 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST ***30 seconds rest*** Single Leg Squat Standing Leg Extension Standing Leg Curl Hip Adduction Hip Abduction Standing Calf Raise Seated Calf Raise Sock Grab Flutter Kicks	Zone 3- 45 minutes REST	Zone 2- 35 minutes Push Ups Crunches (Straight) Crunches (Side) Superman	Zone 2- 30 minutes ***30 seconds rest*** Shoulder Press (Underhand) Lateral Deltoid Raise Monkey Curl Biceps Curl (Underhand) Bench Dip Overhead Triceps Press Bent Over Row (Underhand) Bent Over Front Deltoid Raise (Parallel) Dumbbell Chest Press (Incline/Parallel) Cable Pec Fly (Decline/Underhand)	REST REST	Zone 2- 75 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers
Week 6	**Cardio** **Strength**	Zone 2- 40 minutes REST Push Ups Crunches (Straight) Crunches (Side) Superman	REST Step Ups Standing Lunge Bridges Hip Flexion Hip Extension External Ankle Rotation Internal Ankle Rotation Standing Calf Raise Abductor/Adducttor Scissors	Zone 3- 45 minutes REST	Zone 2- 45 minutes Push Ups Flutter Kicks Saxon Side Bends Swimmers	Zone 2- 30 minutes ***Drop Sets*** Floor Dip Bent Over Triceps Kickback (Underhand) High Cable Bices Curl (Single Arm) Concentration Curl (Parallel) Cable Chest Press (Standard/Overhand) Dumbbell Pec Fly (Flat/Parallel) Lat Pulldown (Single Arm) Bent Over Straight Arm Kickback (Parallel) Shoulder Shrugs Deltoid Around-the-Worlds	REST REST	Zone 2- 75 minutes Push Ups Mountain Climbers Side Crunches High Steping Swimmers Ski Jumpers Standing Calf Raise Seated Calf Raise

Advanced- Endurance Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio**	Physical Assessment	REST	Zone 3- 50 minutes	Zone 2- 50 minutes	Zone 2- 30 minutes	REST	Zone 2- 75 minutes
	Strength		Physical Assessment	REST	Push Ups Lumberjacks Wave Offs Steam Engines Ski Jumpers Saxon Side Bends Standing Calf Raise Seated Calf Raise	Bench Squat Hip Adduction Hip Abduction Cable Chest Press (Standard/Overhand) Bent Over Row (Overhand) Bent Over Triceps Kickback (Parallel) Monkey Curl Shoulder Shrugs	REST	REST
Week 2	**Cardio**	Zone 2- 45 minutes	REST	Zone 3- 50 minutes	Zone 2- 50 minutes	Zone 2- 30 minutes	REST	Zone 2- 90 minutes
	Strength	REST	Walking Lunges Hamstring Cycling Standing Calf Raise Bent Over Triceps Kickback (Underhand) Hammer Curl Front Deltoid Raise (Overhand) Bent Over Straight Arm Kickback (Overhand) Dumbbell Pec Fly (Incline/Parallel)	REST	Push Ups Mountain Climbers Straight Crunches High Stepping Swimmers Jumping Lunges Internal/External Ankle Rotation Toe Lift	Step Ups Hip Extension Hip Flexion Dumbbell Chest Press (Incline/Overhand) Lat Pulldown (Standard) Single Arm Shoulder Press (Parallel) High Cable Biceps Curl (Underhand) Overhead Triceps Extension	REST	REST
Week 3	**Cardio**	Zone 2- 45 minutes	REST	Zone 4- 45 minutes	Zone 2- 50 minutes	Zone 2- 30 minutes	REST	Zone 2- 105 minutes
	Strength	REST	Standing Leg Extension Standing Leg Curl Seated Calf Raise Cable Pec Fly (Incline/Overhand) Bent Over Row (Underhand) Bench Dip High Cable Biceps Curl (Overhand) Single Arm Lateral Deltoid Raise (Overhand)	REST	Push Ups Lumberjacks Side Crunches Bicycles Frog Pull Straight Leg High Stepping Standing Calf Raise Seated Calf Raise	Single Leg Squat Hip Adduction Hip Abduction Arnold Press Monkey Curl Overhead Triceps Extension Bent Over Front Delt Raise (Parallel) Cable Chest Press (Decline/Overhand)	REST	REST
Week 4	**Cardio**	Zone 2- 45 minutes	REST	Zone 3- 50 minutes	Zone 2- 50 minutes	Zone 2- 30 minutes	REST	Zone 2- 75 minutes
	Strength	REST	Quadriceps Cycling Hamstring Cycling Standing Calf Raise Deltoid Around-the-Worlds Biceps Curl (Overhand) Overhead Triceps Extension Lat Pulldown (Underhand) Dumbbell Pec Fly (Incline/Parallel)	REST	Push Ups Flutter Kicks Superman Standing Broad Jump Saxon Side Bends Ski Jumpers Internal/External Ankle Rotation Toe Lift	Bench Squat Hip Extension Hip Flexion Single Arm Bent Over Triceps Extension (Parallel) Concentration Curl (Parallel) Shoulder Press (Overhand) Single Arm Bent Over Rhomboid Fly Dumbbell Chest Press (Flat/Overhand)	REST	REST
Week 5	**Cardio**	Zone 2- 45 minutes	REST	Zone 4- 45 minutes	Zone 2- 50 minutes	Zone 2- 30 minutes	REST	Zone 2- 105 minutes
	Strength	REST	Walking Lunges Standing Leg Curl Seated Calf Raise Bent Over Triceps Extension (Overhand) Single Arm Monkey Curl Lateral Deltoid Raise Bent Over Row (Overhand) Single Arm Cable Pec Fly (Standard/Parallel)	REST	Push Ups High Stepping Bicycles (Backwards & Forwards) Steam Engings Wave Offs Star Jumpers Standing Calf Raise Seated Calf Raise	Step Ups Hip Adduction Hip Abduction Single Arm Cable Chest Press (Standard/Overhand) Bent Over Front Deltoid Raise (Overhand) Shoulder Shrugs Single Arm High Cable Biceps Curl (Underhand) Bench Dip	REST	REST
Week 6	**Cardio**	Zone 2- 45 minutes	REST	Zone 4- 45 minutes	Zone 2- 50 minutes	Zone 2- 30 minutes	REST	Zone 2- 120 minutes
	Strength	REST	Standing Leg Extension Standing Leg Curl Standing Calf Raise Single Arm Dumbbell Pec Fly (Standard/Parallel) Bent Over Rhomboid Fly Overhead Triceps Extension Biceps Curl (Overhand) Front Deltoid Raise (Parallel)	REST	Push Ups Mountain Climbers Side Crunches High Steping Swimmers Ski Jumpers Internal/External Ankle Rotation Toe Lift	Single Leg Squat Hip Flexion Hip Extension Singel Arm Shoulder Press (Overhand) Concentration Curl (Underhand) Bench Dip Single Arm Lat Pulldown Dumbbell Chest Press (Incline/Overhand)	REST	REST

Advanced- Recovery Phase

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Week 1	**Cardio**	Physical Assesment	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 60 minutes
	Strength		Physical Assesment	REST	REST	Standing Leg Extension Standing Leg Curl Standing Calf Raise External Ankle Rotation Bench Dip Monkey Curl Shoulder Press (Overhand) Bent Over Rhomboid Fly (Parallel) Cable Pec Fly (Parallel)	REST	REST
Week 2	**Cardio**	Zone 2- 30 minutes	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 70 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman	REST	REST	Push Ups Crunches (Straight) Crunches (Side) Superman	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Parallel) Biceps Curl (Overhand) Overhead Triceps Press (Single Arm) Bent Over Front Deltoid Raise (Overhand) Dumbbell Pec Fly (Flat/Overhand)	REST	REST
Week 3	**Cardio**	Zone 2- 30 minutes	REST	Zone 2- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 40 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers	Bench Squat Hip Adduction Hip Abduction Toe Raise Dumbbell Chest Press (Flat/Parallel) Lat Pulldown (Wide) Bent Over Triceps Kickback (Overhand) Monkey Curl Front Deltoid Raise (Overhand)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers	REST	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers
Week 4	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 40 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Decline/Underhand) Lat Pulldown (Underhand) Shoulder Shrugs High Cable Biceps Curl (Underhand) Bent Over Triceps Kickback (Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping	Standing Lunge Bridges Seated Calf Raise Internal Ankle Rotation Shoulder Press (Single Arm/Overhand) Monkey Curl Overhead Triceps Press Bent Over Rhomboid Fly (Overhand) Dumbbell Pec Fly (Flat/Parallel)	REST	Push Ups Crunches (Straight) Crunches (Side) Superman High Stepping
Week 5	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 30 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines	REST	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines	Quadriceps Cycling Hamstring Cycling Standing Calf Raise External Ankle Rotation Bench Dip Biceps Curl (Overhand) Shoulder Shrugs Bent Over Straight Arm Kickback (Parallel) Cable Pec Fly (Incline/Parallel)	REST	Push Ups Flutter Kicks Saxon Side Bends Swimmers Steam Engines
Week 6	**Cardio**	Zone 2- 30 minutes	REST	Zone 3- 40 minutes	Zone 2- 30 minutes	REST	REST	Zone 2- 50 minutes
	Strength	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers	Step Ups Hip Flexion Hip Extension Sock Grab Cable Chest Press (Incline/Parallel) Bent Over Rhomboid Fly (Parallel) Shoulder Press (Underhand) Monkey Curl Overhead Triceps Press	REST	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers	REST	REST	Push Ups Crunches (Straight) Crunches (Side) Superman Star Jumpers

Advanced
Acclimation Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 3 40 minutes	Zone 2 40 minutes	Zone 2 20 minutes	REST	Zone 2 45 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	REST	Workout A	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Advanced Acclimation Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Monkey Curl			
Shoulder Press (Overhand)			
Bent Over Rhomboid Fly (Parallel)			
Cable Pec Fly (Standard, Parallel)			

Advanced
Acclimation Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 2 40 minutes	Zone 2 40 minutes	Zone 2 20 minutes	REST	Zone 2 45 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	REST
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Overhand)			
Bent Over Straight Arm Kickback (Overhand)			
Shoulder Shrugs			
Concentration Curl (Parallel)			
Bent Over Triceps Kickback (Parallel)			

Advanced Acclimation Phase: Week 2 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Internal Ankle Rotation			
Shoulder Press (Parallel)			
Biceps Curl (Overhand)			
Overhead Triceps Press (Single Arm)			
Bent Over Front Deltoid Raise (Overhand)			
Dumbbell Pec Fly (Flat, Overhand)			

Advanced
Acclimation Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 40 minutes	Zone 2 40 minutes	Zone 2 20 minutes	REST	Zone 2 45 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Toe Raise			
Dumbbell Chest Press (Flat, Parallel)			
Lat Pulldown (Wide)			
Bent Over Triceps Kickback (Overhand)			
Monkey Curl			
Front Deltoid Raise (Overhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced Acclimation Phase: Week 3 (cont.)

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Concentration Curl (Underhand)			
Lateral Deltoid Raise			
Bent Over Row (Parallel)			
Cable Pec Fly (Decline, Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced
Acclimation Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 40 minutes	Zone 2 40 minutes	Zone 2 30 minutes	REST	Zone 2 60 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Decline, Underhand)			
Lat Pulldown (Underhand)			
Shoulder Shrugs			
High Cable Biceps Curl (Underhand)			
Bent Over Triceps Kickback (Parallel)			

Advanced Acclimation Phase: Week 4 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
External Ankle Rotation			
Shoulder Press (Single Arm, Overhand)			
Monkey Curl			
Overhead Triceps Press			
Bent Over Rhomboid Fly (Overhand)			
Dumbbell Pec Fly (Flat, Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Advanced
Acclimation Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 40 minutes	Zone 2 40 minutes	Zone 2 30 minutes	REST	Zone 2 60 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Toe Raise			
Dumbbell Chest Press (Flat, Underhand)			
Bent Over Row (Parallel)			
Bent Over Triceps Kickback (Underhand)			
High Cable Biceps Curl (Parallel)			
Lateral Deltoid Raise			

Advanced Acclimation Phase: Week 5 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Biceps Curl (Overhand)			
Shoulder Shrugs			
Bent Over Straight Arm Kickback (Parallel)			
Cable Pec Fly (Incline, Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Advanced
Acclimation Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 45 minutes	Zone 2 40 minutes	Zone 2 30 minutes	REST	Zone 2 60 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Incline, Parallel)			
Bent Over Rhomboid Fly (Parallel)			
Shoulder Press (Underhand)			
Monkey Curl			
Overhead Triceps Press			

Advanced Acclimation Phase: Week 6 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Internal Ankle Rotation			
Deltoid Around-the-Worlds			
Concentration Curl (Parallel)			
Bent Over Triceps Kickback (Parallel)			
Lat Pulldown (Close Grip)			
Dumbbell Pec Fly (Flat, Underhand)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Advanced
Build Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 3 40 minutes	Zone 2 40 minutes	Zone 2 30 minutes	REST	Zone 2 60 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	Workout A	Workout B	REST	Workout C
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Advanced Build Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Dumbbell Chest Press (Incline, Overhand)			
Cable Pec Fly (Decline, Parallel)			
Bent Over Row (Parallel)			
Bent Over Rhomboid Fly (Overhand)			
Bench Dip			
Overhead Triceps Press			
Monkey Curl			
Biceps Curl (Hammer)			
Shoulder Press (Overhand)			
Front Deltoid Raise (Overhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced
Build Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 35 minutes	Zone 2 40 minutes	Zone 2 30 minutes	REST	Zone 2 60 minutes
Strength	Workout A	Workout B (30 seconds rest between sets)	REST	Workout C	Workout D (30 seconds rest between sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B (30 sec rest between sets)	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Standing Lunge			
Bridges			
Hip Flexion			
Hip Extension			
Internal/External Ankle Rotation			
Standing Calf Raise			
Bicycles (Backward)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced Build Phase: Week 2 (cont.)

Workout D **(30 sec rest between sets)**	**Set 1 Weight/Reps**	**Set 2 Weight/Reps**	**Notes**
Shoulder Shrugs			
Lateral Deltoid Raise			
High Cable Biceps Curl			
Concentration Curl (Parallel)			
Floor Dip			
Bent Over Triceps Kickback (Overhand)			
Lat Pulldown (Wide)			
Bent Over Front Deltoid Raise (Overhand)			
Dumbbell Pec Fly (Flat, Overhand)			
Cable Chest Press (Standard, Parallel)			

Workout E	**Set 1 Reps**	**Set 2 Reps**	**Notes**
Push Ups			
Mountain Climbers			
Straight Crunches			
High Stepping			
Swimmers			
Jumping Lunges			
Standing Calf Raise			
Seated Calf Raise			

Advanced
Build Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 35 minutes	Zone 2 40 minutes	Zone 2 30 minutes	REST	Zone 2 60 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D (Drop Sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Quadriceps Cycling			
Hamstring Cycling			
Hip Adduction			
Hip Abduction			
Standing Calf Raise			
Seated Calf Raise			
Sock Grab			
Flutter Kicks			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Advanced Build Phase: Week 3 (cont.)

Workout D (Drop Sets)	Set 1 Weight/Reps Weight/Reps Weight/Reps	Set 2 Weight/Reps Weight/Reps Weight/Reps	Notes
Bench Dip			
Overhead Triceps Press			
Bent-Over Row (Overhand)			
Bent-Over Straight Arm Kickback (Parallel)			
Dumbbell Chest Press (Incline/Underhand)			
Cable Pec Fly (Decline/Overhand)			
Monkey Curl			
Biceps Curl (Overhand)			
Shoulder Press (Parallel)			
Deltoid Around-the-Worlds			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced
Build Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 40 minutes	Zone 2 40 minutes	Zone 2 30 minutes	REST	Zone 2 60 minutes
Strength	Workout A	Workout B (Supersets)	REST	Workout C	Workout D (Supersets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Superset 1: Step Ups Walking Lunge Mule Kick			
Superset 2: Hip Flexion Hip Extension			
Superset 3: External Ankle Rotation Internal Ankle Rotation Standing Calf Raise			
Abductor/Adductor Scissors			

Advanced Build Phase: Week 4 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Superset 1: Cable Chest Press (Standard/Parallel) Dumbbell Pec Fly (Flat/Overhand)			
Superset 2: Lat Pulldown (Underhand) Bent Over Rhomboid Fly (Parallel)			
Superset 3: Shrugs Front Deltoid Raise			
Superset 4: High Cable Biceps Curl Concentration Curl (Underhand)			
Superset 5: Floor Dip Bent Over Triceps Kickback (Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Superman			
Standing Broad Jump			
Saxon Side Bends			
Ski Jumpers			
Standing Calf Raise			
Seated Calf Raise			

Advanced
Build Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 45 minutes	Zone 2 35 minutes	Zone 2 30 minutes	REST	Zone 2 75 minutes
Strength	Workout A	Workout B (30 seconds rest between sets)	REST	Workout C	Workout D (30 seconds rest between sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B (30 sec rest between sets)	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Standing Leg Extension			
Standing Leg Curl			
Hip Adduction			
Hip Abduction			
Standing Calf Raise			
Seated Calf Raise			
Sock Grab			
Flutter Kicks			

Advanced Build Phase: Week 5 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout D (30 sec rest between sets)	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Shoulder Press (Underhand)			
Lateral Deltoid Raise			
Monkey Curl			
Biceps Curl (Underhand)			
Bench Dip			
Overhead Triceps Press			
Bent Over Row (Underhand)			
Bent Over Front Deltoid Raise (Parallel)			
Dumbbell Chest Press (Incline, Parallel)			
Cable Pec Fly (Decline, Underhand)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced
Build Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 40 minutes	REST	Zone 3 45 minutes	Zone 2 45 minutes	Zone 2 30 minutes	REST	Zone 2 75 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D (Drop Sets)	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Standing Lunge			
Bridges			
Hip Flexion			
Hip Extension			
External Ankle Rotation			
Internal Ankle Rotation			
Standing Calf Raise			
Scissors Kick			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced Build Phase: Week 6 (cont.)

Workout D (Drop Sets)	Set 1 Weight/Reps Weight/Reps Weight/Reps	Set 2 Weight/Reps Weight/Reps Weight/Reps	Notes
Floor Dip			
Bent Over Triceps Kickback (Underhand)			
High Cable Biceps Curl (Single Arm)			
Concentration Curl (Parallel)			
Cable Chest Press (Standard, Overhand)			
Dumbbell Pec Fly (Flat, Parallel)			
Lat Pulldown (Single Arm)			
Bent Over Straight Arm Kickback (Parallel)			
Shoulder Shrugs			
Deltoid Around-the-Worlds			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Mountain Climbers			
Side Crunches			
High Stepping			
Swimmers			
Ski Jumpers			
Standing Calf Raise			
Seated Calf Raise			

Advanced
Endurance Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 3 50 minutes	Zone 2 50 minutes	Zone 2 30 minutes	REST	Zone 2 75 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	Workout A	Workout B	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time ________ or

Cardio Machine (15 min) ___________ Speed _____ Incline _____ Resistance _____

Flexibility:

Sit and Reach Test _____

Apley Scratch Test (Down the Back) Right Side _____ Left Side _____

Apley Scratch Test (Up the Back) Right Side _____ Left Side _____

Muscular Strength:

Bench Squat _____

Standing Lunges _____

Bridges _____

Calf Raises _____

Dumbbell Chest Press _____

Bent Over Dumbbell Row _____

Dumbbell Shoulder Press _____

Dumbbell Biceps Curl _____

Overhead Triceps Press _____

Muscular Endurance:

Push Ups _____

Crunches _____

Wave-Offs _____

Bent Leg Stand _____

Advanced Endurance Phase: Week 1 (cont.)

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Lumberjacks			
Wave Offs			
Steam Engines			
Ski Jumpers			
Saxon Side Bends			
Standing Calf Raise			
Seated Calf Raise			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Cable Chest Press (Standard, Overhand)			
Bent Over Row (Overhand)			
Bent Over Triceps Kickback (Parallel)			
Monkey Curl			
Shrugs			

Advanced
Endurance Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 45 minutes	REST	Zone 3 50 minutes	Zone 2 50 minutes	Zone 2 30 minutes	REST	Zone 2 90 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Walking Lunges			
Hamstring Cycling			
Standing Calf Raise			
Bent Over Triceps Kickback (Overhand)			
Hammer Curl (Underhand)			
Front Deltoid Raise (Overhand)			
Bent Over Straight Arm Kickback (Parallel)			
Dumbbell Pec Fly (Incline, Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Mountain Climbers			
Straight Crunches			
High Stepping			
Swimmers			
Jumping Lunges			
Internal/External Ankle Rotation			
Toe Lift			

Advanced Endurance Phase: Week 2 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Extension			
Hip Flexion			
Dumbbell Chest Press (Incline, Overhand)			
Lat Pulldown (Standard)			
Single Arm Shoulder Press (Parallel)			
High Cable Biceps Curl (Underhand)			
Overhead Triceps Extension			

Advanced
Endurance Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 45 minutes	REST	Zone 4 40 minutes	Zone 2 50 minutes	Zone 2 30 minutes	REST	Zone 2 105 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Seated Calf Raise			
Cable Pec Fly (Incline, Overhand)			
Bent Over Row (Underhand)			
Bench Dip			
High Cable Biceps Curl (Overhand)			
Single Arm Lateral Deltoid Raise (Overhand)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Lumberjacks			
Side Crunches			
Bicycles			
Frog Pull			
Straight Leg High Stepping			
Standing Calf Raise			
Seated Calf Raise			

Advanced Endurance Phase: Week 3 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Hip Adduction			
Hip Abduction			
Arnold Press			
Monkey Curl			
Overhead Triceps Extension			
Bent Over Front Delt Raise (Parallel)			
Cable Chest Press (Decline, Overhand)			

Advanced
Endurance Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 45 minutes	REST	Zone 3 50 minutes	Zone 2 50 minutes	Zone 2 30 minutes	REST	Zone 2 75 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
Deltoid Around-the-Worlds			
Biceps Curl (Overhand)			
Overhead Triceps Extension			
Lat Pulldown (Underhand)			
Dumbbell Pec Fly (Incline, Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Superman			
Standing Broad Jump			
Saxon Side Bends			
Ski Jumpers			
Internal/External Ankle Rotation			
Toe Lift			

Advanced Endurance Phase: Week 4 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Extension			
Hip Flexion			
Single Arm Bent Over Triceps Extension			
Concentration Curl (Parallel)			
Shoulder Press (Overhand)			
Single Arm Bent Over Rhomboid Fly			
Dumbbell Chest Press (Flat, Overhand)			

Advanced
Endurance Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 45 minutes	REST	Zone 4 45 minutes	Zone 2 50 minutes	Zone 2 30 minutes	REST	Zone 2 105 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Walking Lunges			
Standing Leg Curl			
Seated Calf Raise			
Bent Over Triceps Extension (Overhand)			
Single Arm Monkey Curl			
Lateral Deltoid Raise			
Bent Over Row (Overhand)			
Single Arm Cable Pec Fly (Standard, Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
High Stepping			
Bicycles (Backwards & Forwards)			
Steam Engines			
Wave Offs			
Star Jumpers			
Standing Calf Raise			
Seated Calf Raise			

Advanced Endurance Phase: Week 5 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Adduction			
Hip Abduction			
Single Arm Cable Chest Press (Standard, Overhand)			
Bent Over Front Deltoid Raise (Overhand)			
Shoulder Shrugs			
Single Arm High Cable Biceps Curl (Underhand)			
Bench Dip			

Advanced
Endurance Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 45 minutes	REST	Zone 4 45 minutes	Zone 2 50 minutes	Zone 2 30 minutes	REST	Zone 2 120 minutes
Strength	REST	Workout A	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Standing Calf Raise			
Single Arm Dumbbell Pec Fly (Standard, Parallel)			
Bent Over Rhomboid Fly			
Overhead Triceps Extension			
Biceps Curl (Overhand)			
Front Deltoid Raise (Parallel)			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Mountain Climbers			
Side Crunches			
High Stepping			
Swimmers			
Ski Jumpers			
Internal/External Ankle Rotation			
Toe Lift			

Advanced Endurance Phase: Week 6 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Single Leg Squat			
Hip Flexion			
Hip Extension			
Single Arm Shoulder Press (Overhand)			
Concentration Curl (Underhand)			
Bench Dip			
Single Arm Lat Pulldown			
Dumbbell Incline Chest Press (Parallel)			

Advanced
Recovery Phase: Week 1

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Cardiovascular Assessment	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 60 minutes
Strength	REST	Flexibility & Muscular Assessments	REST	REST	Workout A	REST	REST
Notes							

Physical Assessment

Cardiovascular:

1.5-mile Walk/Run Time _________ or

Cardio Machine (15 min) ____________ Speed ______ Incline ______ Resistance ______

Flexibility:

Sit and Reach Test ______

Apley Scratch Test (Down the Back) Right Side ______ Left Side ______

Apley Scratch Test (Up the Back) Right Side ______ Left Side ______

Muscular Strength:

Bench Squat ______

Standing Lunges ______

Bridges ______

Calf Raises ______

Dumbbell Chest Press ______

Bent Over Dumbbell Row ______

Dumbbell Shoulder Press ______

Dumbbell Biceps Curl ______

Overhead Triceps Press ______

Muscular Endurance:

Push Ups ______

Crunches ______

Wave-Offs ______

Bent Leg Stand ______

Advanced Recovery Phase: Week 1 (cont.)

Workout B	Set 1 Reps	Set 2 Reps	Notes
Standing Leg Extension			
Standing Leg Curl			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Monkey Curl			
Shoulder Press (Overhand)			
Bent Over Rhomboid Fly (Parallel)			
Cable Pec Fly (Parallel)			

Advanced
Recovery Phase: Week 2

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 70 minutes
Strength	Workout A	REST	REST	Workout B	Workout C	REST	REST
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			

Advanced Recovery Phase: Week 2 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
Internal Ankle Rotation			
Shoulder Press (Parallel)			
Biceps Curl (Overhand)			
Overhead Triceps Press (Single Arm)			
Bent Over Front Deltoid Raise (Overhand)			
Dumbbell Pec Fly (Flat, Overhand)			

Advanced
Recovery Phase: Week 3

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 2 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 40 minutes
Strength	Workout A	Workout B	REST	Workout C	REST	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Bench Squat			
Hip Adduction			
Hip Abduction			
Toe Raise			
Dumbbell Chest Press (Flat/Parllel)			
Lat Pulldown (Wide)			
Bent Over Triceps Kickback (Overhand)			
Monkey Curl			
Front Deltoid Raise (Overhand)			

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced Recovery Phase: Week 3 (cont.)

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			

Advanced
Recovery Phase: Week 4

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 40 minutes
Strength	Workout A	Workout B	REST	Workout C	Workout D	REST	Workout E
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Decline/Underhand)			
Lat Pulldown (Underhand)			
Shoulder Shrugs			
High Cable Biceps Curl (Underhand)			
Bent Over Triceps Kickback (Parallel)			

Advanced Recovery Phase: Week 4 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Workout D	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Standing Lunge			
Bridges			
Seated Calf Raise			
External Ankle Rotation			
Shoulder Press (Single Arm)			
Monkey Curl			
Overhead Triceps Press			
Bent Over Rhomboid Fly (Overhand)			
Dumbbell Pec Fly (Flat, Parallel)			

Workout E	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
High Stepping			

Advanced
Recovery Phase: Week 5

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 30 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	Workout A	REST	REST	Workout B	Workout C	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Workout B	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Advanced Recovery Phase: Week 5 (cont.)

Workout C	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Quadriceps Cycling			
Hamstring Cycling			
Standing Calf Raise			
External Ankle Rotation			
Bench Dip			
Biceps Curl (Overhand)			
Shoulder Shrugs			
Bent Over Straight Arm Kickback (Parallel)			
Cable Pec Fly (Incline, Parallel)			

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Flutter Kicks			
Saxon Side Bends			
Swimmers			
Steam Engines			

Advanced
Recovery Phase: Week 6

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Cardio	Zone 2 30 minutes	REST	Zone 3 40 minutes	Zone 2 30 minutes	REST	REST	Zone 2 50 minutes
Strength	Workout A	Workout B	REST	Workout C	REST	REST	Workout D
Notes							

Workout A	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Workout B	Set 1 Weight/Reps	Set 2 Weight/Reps	Notes
Step Ups			
Hip Flexion			
Hip Extension			
Sock Grab			
Cable Chest Press (Incline, Parallel)			
Bent Over Rhomboid Fly (Parallel)			
Shoulder Press (Underhand)			
Monkey Curl			
Overhead Triceps Press			

Advanced Recovery Phase: Week 6 (cont.)

Workout C	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Workout D	Set 1 Reps	Set 2 Reps	Notes
Push Ups			
Straight Crunches			
Side Crunches			
Superman			
Star Jumpers			

Unit 7
Appendices

Appendix A- PAR Q & You

Appendix B- Passing the Open Water Swim Test

Appendix C- Summary of Research Regarding Exercise and Diving

Appendix D- Daily Plot of Resting Heart Rate

Appendix A
PAR Q & YOU

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO	
		1. Has your doctor ever said that you have a heart condition <u>and</u> that you should only do physical activity recommended by a doctor?
		2. Do you feel pain in your chest when you do physical activity?
		3. In the past month, have you had chest pain when you were not doing physical activity?
		4. Do you lose your balance because of dizziness or do you ever lose consciousness?
		5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?
		6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
		7. Do you know of <u>any other reason</u> why you should not do physical activity?

If you answered:

<u>YES to one or more questions</u>

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want - as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

<u>NO to all questions</u>

If you answered NO honestly to <u>all</u> PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active - begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal - this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively.

DELAY BECOMING MUCH MORE ACTIVE:
- if you are not feeling well because of a temporary illness such as a cold or a fever - wait until you feel better;
  or
- if you are or may be pregnant - talk to your doctor before you start becoming more active.

Please note: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

Note: It is important that you answer all questions honestly. The PAR-Q is a scientifically and medically researched preexercise selection device. It complements exercise programs, exercise procedures, and the liability considerations attendant with such programs and testing procedures. PAR-Q, like any other preexercise screening device, will misclassify a small percentage of prospective participants, but no preexercise screening method can entirely avoid this problem.

I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.

Name____

Signature____

Signature of Parent ____
or Guardian (for participants under the age of 18)

Date________________

Witness____

You are encouraged to copy the PAR-Q but only if you use the entire form.

*Developed by the British Columbia Ministry of Health. Produced by the British Columbia Ministry of Health and the Department of National Health & Welfare	Physical Activity Readiness Questionnaire-PAR-Q (revised 1994)

Appendix B
Passing the Open Water Swim Test

All internationally recognized open water training certifications require students to pass a basic swim test. The prerequisites from the Global Underwater Explorers Fundamentals Course include the most common benchmarks:

"[A diver…]

5. *Must be able to swim a distance of at least 50 feet/15 meters on a breath hold.*
6. *Must be able to swim at least 300 yards/275 meters in less than 14 minutes without stopping. This test should be conducted in a swimsuit and, where necessary, appropriate thermal protection."*

Many divers attracted to SCUBA training come from a strong fitness background and have no problems passing the required fitness test. This is a brief guide for everyone else.

While this might appear to be a "quick fix" exercise program, it is only meant to be a start. Passing your open water swim test should not be a once-in-a-lifetime achievement. You owe it to yourself and your dive buddies to be as fit as possible and to dive within your limits.

Swimming is also a no-brainer skill to have when you spend time around the water. People fall in, currents carry you away, and boats sink. These don't have to be life-threatening occurrences if you can swim back to the boat or to a floating life vest. Besides, ocean swimming is a great way to pass the time and stay active on a dive vacation or liveaboard.

In evaluating your ability to achieve the prerequisites, keep in mind that Olympic pools are 50 *meters* long by 25 *yards* wide. Most pools set up their lanes to be 25 yards long. If you are unsure, ask the pool staff.

Getting a Coach

By the end of eight focused weeks of training, you will either be able to pass these criteria or know you need instruction from a qualified coach. Don't let your ego prevent you from hiring professional instruction from the start. Swimming efficiently is almost impossible to learn on your own- at some point, every swimmer needs coaching to get the most out of his or her technique. Of course, if you can't swim *at all*, neither this nor any written guide will be of use to you.

In the United States, check out usms.org for US Masters Swimming teams in your area. These are adult swim teams with certified coaches. Though most do not accept non-swimmers, they will certainly be able to direct you to appropriate instruction. Many accept swimmers who can already swim 400 yards of continuous freestyle, and when you find yourself in this category, I highly recommend you join to take your fitness and techniques to a new level. They are generally fun, non-competitive groups of people who love to help others hone their swimming skills.

Another option would be to purchase an instructional video, such as Terry Laughlin's "Fishlike Freestyle" (see totalimmersion.net). This video will introduce you to the fundamental mechanics of the freestyle stroke (a.k.a. "the crawl"). Though it is no substitute for a coach, it is much better than trying to figure it out on your own.

Swim Workouts

Workouts listed are Yards x Sets. Though freestyle should be your primary stroke, switch to sidestroke or even elementary backstroke to complete the distances listed. Take as much rest as you think you need between sets without cooling down. If the progression of workouts is too slow, skip ahead until you are challenged.

Breath Hold Swimming

Breath hold swimming should only be done under the direct supervision of a certified lifeguard. Swim each attempt listed in the schedule for as long as you can, and as I emphasize below, *surface as soon as you think you should- don't push your luck*.

These hints may improve your breath hold swimming distance:

1. Don't push off the wall too hard. This will just put your body into "fighting" mode from the start. Just a gradual push like you're standing up from a chair is best.
2. Make sure you're fully submerged. If your kicks break the surface of the water, you'll lose thrust.
3. Look at the bottom of the pool rather than the opposite wall. Swimming face first with ruin your trim and streamline. Use the lane line to know when you're about to reach the other side. If you don't make it all the way, knowing how close you are won't matter until you surface, anyway. So, don't waste the energy worrying about it while you're swimming.
4. Emphasize a long stroke followed by a long glide. It's not a race to the other side- it's about getting the most distance out of the breath you took. After a point, the faster you swim, the less distance you'll get.
5. Surface as soon as you think you should- don't push your luck. The real value in this exercise is in learning efficiency of movement, not tolerance to hypoxia. When you get this right, you will be able to swim the length of the pool and not be gasping for breath when you surface.

Core Workouts

Upper body strength is also important to divers, as you must be able to manage your own gear. Swimming will do much to improve the strength in your back and shoulders, but you should supplement that with push-ups for your chest and crunches for your abdominal muscles, at a minimum. Following the other programs contained in this guide will be even better preparation for your diving ahead, but if you only have eight weeks to prepare for your swim test, then this program's focus on swimming is the way to go.

Push-ups can be done from the knees, if necessary. If you can't complete the given set of push-ups or crunches, remain in position, rest as little as possible and do as many more as you can. Repeat this cycle until you have completed the set.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 1		25 x 8 200 total		25 x 10 250 total		25 x 12 300 total	
Week 2		50 x 1 25 x 2 Repeat 2x 200 total	Push-ups x10 Crunches x10	50 x 1 25 x 3 Repeat 2x 250 total		50 x 1 25 x 2 Repeat 3x 300 total	Push-ups x12 Crunches x12
Week 3		50 x 6 300 total	Push-ups x15 Crunches x15	50 x 8 400 total		50 x 10 500 total	Push-ups x17 Crunches x17
Week 4		75 x 1 50 x 2 Repeat 2x 350 total	Push-ups x20 Crunches x20	75 x 1 50 x 3 Repeat 2x 450 total		75 x 1 50 x 2 Repeat 3x 525 total	Push-ups x20 Crunches x20
Week 5		75 x 3 225 total Breath Hold 2x	Push-ups x22 Crunches x22	100 x 1 75 x 2 250 total Breath Hold 4x		100 x 2 75 x 2 350 total Breath Hold 4x	Push-ups x25 Crunches x25
Week 6		100 x 3 75 x 2 450 total Breath Hold 4x	Push-ups x25 Crunches x25	100 x 5 500 total Breath Hold 4x		150 x 2 100 x 2 500 total Breath Hold 4x	Push-ups x27 Crunches x27
Week 7		150 x 3 450 total Breath Hold 4x	Push-ups x27 Crunches x27	200 x 2 100 x 2 500 total Breath Hold 4x		200 x 3 600 total Breath Hold 4x	Push-ups x30 Crunches x30
Week 8		250 x 2 500 total Breath Hold 4x	Push-ups x30 Crunches x30	250 x 2 500 total Breath Hold 4x		**Practice OW Swim Test**	

What's Next

Once you can pass the swim test, you should begin to incorporate other forms of exercise into your weekly schedule. Commit to the beginner fitness program contained in this guide to ensure that your fitness keeps up with your dive skills.

Appendix C
Summary of Exercise and DCS Research

Researchers have been examining the roles of exercise and fitness on decompression since 1907. The following studies represent our advancing knowledge of these roles as they apply to subjects covered in this book. In many cases, researchers examined numerous issues with fitness being only one component. These summaries only include the findings of each study relevant to this book. For a more complete understanding of this research, please refer directly to the publications referenced.

Exercise before Decompression

Dujic Z, Duplancic D, Marinovic-Terzic I, Bakovic D, Ivancev V, Valic Z, Eterovic D, Petri N, Wisloff U, Brubakk AO., Aerobic exercise before diving reduce venous gas bubbles formation in human., J Physiol. 2004 Mar 16:555(Pt 3):637-42. Epub 2004 Jan 30.

This study repeated in human subjects the results previously found in rats. Specifically, a single bout of interval training 24 hours prior to a simulated dive significantly reduced bubble formation, both in numbers and in size.

Wisloff U, Richardson RS, Brubakk AO., **Exercise and nitric oxide prevent bubble formation: A novel approach to the prevention of decompression sickness?,** J Physiol. 2004 Mar 16:555(Pt 3):825-9. Epub 2004 Jan 14.

Wisloff, et. al., found a protective effect of exercise performed by rats 20 hours prior to a dive. They found no effect, positive or negative, with exercise performed at 48, 10, 5, and 0.5 hours before a dive.

Wisloff U, Richardson RS, Brubakk AO., **NOS inhibition increases bubble formation and survival in sedentary but not exercised rats**, J Physiol (2003), 546.2, pp. 577–582.

This study found that sedentary rats weighing more than 300g produced significantly larger amounts of bubbles than rats weighing less than 300g. The larger rats were also more likely to die from the protocol. However, exercise done 20 hours before the simulated dive decreased bubble formation and increased survival in the larger rats. Exercise also attenuated the effect of NOS inhibition on the smaller rats.

Dervay JP, Powell MR, Butler B, Fife CE., **The effect of exercise and rest duration on the generation of venous gas bubbles at altitude.,** Aviat Space Environ Med. 2002 Jan;73(1):22-7.

A significant increase in DCS was found in subjects who performed leg exercise immediately prior to decompression, with an inverse correlation between rest interval and DCS for other intervals. Researchers calculated a micronuclei half-life of approximately 1 hour, suggesting that a minimum of 4 hours should separate lower body exercise and decompression.

Loftin KC, Conkin J, Powell MR., Modeling the effects of exercise during 100% oxygen prebreathe on the risk of hypobaric decompression sickness., Aviat Space Environ Med. 1997 Mar;68(3):199-204.

Researchers found that exercise during O2 prebreathe before decompression doubled tissue perfusion and nitrogen elimination. Incidence of DCS was significantly reduced.

Powell, MR, J Waligora, KV Kumar. Hypobaric decompression in simulated null gravity; a model using chair-rest adynamia., Undersea Biomed. Res., 22 (Suppl), 67, (1995).

Researchers attempted to explain the difference in DCS between subjects decompressing to altitude on the surface and astro/cosmonauts decompressing in space. Subjects decompressing to 4.3 psia who did not move their legs experienced lower incidence of DCS than those that walked both before and during pre-breathe. Researchers believed musculoskeletal stress generated micronuclei in the ambulatory subjects, leading to increased DCS risk.

Dietzel F, Koegel S, Smolle-Jüttner FM, Kovac H, Friehs GB., Dehydration causes decompression sickness: report of two different cases., Department of Thoracic and Hyperbaric Surgery, Medical School of Graz, Graz, Austria and Hyperbaric Center DCS1, Stuttgart, Germany 1994.

Researchers examined the cause of two cases of spinal DCS. In one case, the diver failed to ingest fluids after a night of much alcohol and little sleep. In the other, a very well conditioned diver ran 10km in the heat without rehydrating two hours before diving. Aside from dehydration, exercise itself was not determined to be a factor.

Aharon-Peretz J, Adir Y, Gordon CR, Kol S, Gal N, Melamed Y., Spinal cord decompression sickness in sport diving., Arch Neurol. 1993 Jul;50(7):753-6.

This Israeli study examined 16 years' data of spinal cord DCS in recreational divers. They found fatigue, dehydration, and extreme physical effort to predispose the divers to spinal DCS.

Powell, MR, J Waligora, W Norfleet. Decompression in simulated microgravity; bed rest and its influence on stress-assisted nucleation., Undersea Biomed. Res., 19 (Suppl.), 54, (1992)

Subjects were committed to 3 days of bed rest to simulate the effects of microgravity. Results found that bed rest reduced whole body gas phase formation compared with walking, supporting the theory that mechanical forces generate tissue gas micronuclei.

Kumar KV, Waligora JM, Gilbert JH 3rd., The influence of prior exercise at anaerobic threshold on decompression sickness., Aviat Space Environ Med. 1992 Oct;63(10):899-904.

39 subjects exercised at their anaerobic thresholds for 30 minutes, each of the 3 days prior to altitude decompression. No exercise was done in the 24 hours prior to decompression. No significant differences in DCS incidence were found between the exercise and non-exercise conditions.

Dick AP, Vann RD, Mebane GY, Feezor MD., Decompression induced nitrogen elimination., Undersea Biomed Res. 1984 Dec;11(4):369-80.

Results suggest that exercise during a dive increases nitrogen uptake on an air dive as measured by the amount of nitrogen eliminated after the dive.

Schibli RA, Buhlmann AA. The influence of physical work upon decompression time after simulated oxy-helium dives., Helv Med Acta 1972; 36:327-342.

Minimal decompression times were determined in 82 subjects for simulated He/O2 dives of varying depths and bottom times. In all cases examined, exercise at depth increased minimal decompression times.

Exercise during Decompression

Jankowski LW, Tikuisi P, Nishi RY. Exercise effects during divng and decompression on postdive venous gas emboli., Aviat Space Envrion Med. 2004 Jun;75(6):489-95.

Subjects were compressed in a wet chamber to 45 msw for 30 minutes, during which some were active and others inactive. Those that performed moderate, intermittent activity during the 55 minute staged decompression registered less venous gas emboli activity upon returning to surface pressure. Activity during the bottom time had no measurable effect on VGE.

Conkin J, Powell MR, Gernhardt ML. Age affects severity of venous gas emboli on decompression from 14.7 to 4.3 psia., Aviat Space Environ Med. 2003;74:1142-50.

Subjects decompressed under varying conditions. Those who performed lower body exercise during decompression had a higher incidence of DCS than those who performed no lower body movement.

Foster PP, Feiveson AH, Glowinski R, Izygon M, Boriek AM., A model for influence of exercise on formation and growth of tissue bubbles during altitude decompression., Am J Physiol Regulatory Integrative Comp Physiol (2002); 279: R2304-R2316.

This study examined the physiological response to exercise and its effect on the formation and growth of decompression bubbles. They describe competing influences- upon exercise during decompression to altitude, elevated O2 consumption increases bubble persistence in tissues, while increased perfusion suppresses bubble growth. Without the additional influence of motion-induced cavitation, the researchers feel exercise as a whole would lead to a reduction of bubble volume.

Webb JT, Krause KM, Pilmanis AA, Fischer MD, Kannan N. The effect of exposure to 35,000ft on incidence of altitude decompression sickness., Aviation Space Environ Med. 2001 Jun; 72(6):509-12.

Subjects were taken to 35,000ft for 3 hours while performing strenuous exercise, mild exercise, or seated rest. Exercise provoked a higher incidence and earlier onset of DCS regardless of intensity.

Conkin J, Powell MR., Lower body adynamia as a factor to reduce the risk of hypobaric decompression sickness., Aviat Space Environ Med. 2001 Mar;72(3):202-14.

Restricting lower body movement during denitrogenation and at altitude reduced DCS and VGE when combined with upper body exercise. This was shown to be more protective than exercise including walking.

Pilmanis AA, Olson RM, Fischer MD, Wiegman JF, Webb JT., Exercise-induced altitude decompression sickness., Aviat Space Environ Med. 1999 Jan;70(1):22-9.

Subjects were tested until a symptom-free decompression altitude was individually determined. Subjects then performed either isometric arm, isometric leg, dynamic arm, or dynamic leg exercises during subsequent exposures to the pre-determined altitude. Exercise induced DCS in 31-50% and venous gas emboli in 47-66% of exposures, with no difference found between isometric and dynamic exercise.

Janowski LW, Nishi RY, Eaton DJ, et al. Exercise during decompression reduces the amount of venous gas emboli., Undersea Hyperb Med 1997; 24:59-66.

29 subjects dove to 45 msw for 30 min using standard air decompression tables. Doppler scores for subjects who exercised during decompression were significantly lower than subjects who did not.

Flook V, The effect of exercise on decompression bubbles- a theoretical study., Proceedings of the XXII Annual Scientific Meeting of the European Underwater and Baromedical Society, Bled, Slovenia: EUBS; 1997: 55-61.

Flook discusses modeling that demonstrates exercise at depth (equivalent to normal finning) followed by rest during decompression increases the volume of gas in muscles by 93% and in pulmonary artery blood by 40%. This model suggests that activity at depth should be continued throughout decompression to reduce risk of DCS.

Krutz RW Jr, Dixon GA., The effects of exercise on bubble formation and bends susceptibility at 9,100m., Aviat Space Environ med. 1987 Sep;58(9 Pt 2):A97-9.

Subjects performed five deep knee bends and five upward arm extensions with 5lb weights every 15 minutes during exposure to 9,100m for up to 8 hours. Exercise decreased time to maximum venous bubbling and increased incidence of DCS compared to non-exercising controls.

Van der Aue OE, Kellar RJ, Brinton ES. The effect of exercise during decompression from increased barometric pressure on the incidence of decompression sickness in man., NEDU Report 8-49. Panama City, FL: US Navy Experimental Diving Unit; 1949.

Subjects either performed continuous moderate exercise or remained in bed for 2 hours after returning to surface pressure. Both shallow, lengthy (33-40ftsw, 12hr) exposures and deep, shorter (100-150fsw, 40-60min) exposures were examined. Since exercise resulted in an increased incidence of DCS in most scenarios studied, researchers recommended that the contemporary practice of exercise by divers during decompression and immediately after surfacing should be discontinued.

Exercise after DivIng

Pollard GW, Marsh PL, Fife CE, Smith LR, Vann RD., Ascent rate, post-dive exercise, and decompression sickness in the rat., Undersea Hyperb Med. 1995 Dec;22(4):367-76.

Researchers at NCSU studied 120 rats, finding that 30 minutes of post-dive walking increased risk of DCS at all ascent rates examined (30, 45, and 60 fsw/min).

Muth CM, Staschen CM, Warninghoff V, van Laak U, Radermacher P., **Exercise effects on central venous nitrogen tensions after simulated non-decompression dives.,** Undersea Hyperb Med. 1994 Sep;21(3):297-303.

The rate of post-dive nitrogen elimination was tripled in subjects that exercised for 30 minutes starting 10 minutes upon surfacing. Subjects exercised for 10 minutes at a depth of 66fsw, with a total bottom time of 20 minutes.

Fitness and Resistance to Decompression Sickness

Nikolaev VP. Probabilistic model of decompression sickness based on stochastic models of bubbling in tissues., Aviat Space Environ Med. 2004 Jul;75(7):603-10.

Researchers developed a model of gas bubbling in tissues leading to symptoms of DCS. According to this model, mammals with lower body mass and greater tissue perfusion are more resistance to DCS than mammals with larger body mass and lesser tissue perfusion.

Webb JT, Kannan N, Pilmanis AA., Gender not a factor for altitude decompression sickness risk., Aviat Space Environ Med. 2003 Jan;74(1):2-10.

This study examined 291 human subjects (197 men, 94 women) for differences in susceptibility to DCS. Subjects of either sex with higher body mass index and lower fitness were more susceptible to DCS.

Carturan D, Boussuges A, Vanuxem P, Bar-Hen A, Burnet H, Gardette B., Ascent rate, age, maximal oxygen uptake, adiposity, and circulating venous bubbles after diving., J Appl Physiol. 2002 Oct;93(4):1349-56.

This study compared two ascent rates (9m/min and 17m/min) from 35m dives for 25 minutes. Subjects who were younger, fitter, and less fat produced fewer bubbles than subjects who were older, fatter, and less fit.

Wisloff U, Brubakk AO., **Aerobic endurance training reduces bubble formation and increases survival in rats exposed to hyperbaric pressure,** Journal of Physiology (2001), 537.2, pp.607–611.

Rats were subjected to either a 2 week or 6 week program of interval training. .VO2max and ventricular weights were significantly higher at the completion of each program. Trained rats produced fewer bubbles than non-trained rats, though the same effect occurred in non-trained rats exposed to a single bout of interval training the day before the simulated dive. Survival of the protocol was almost assured in the exercised rats, whereas most of the sedentary rats died within 60 minutes of surfacing.

Carturan D, Boussuges A, Burnet H, Fondarai J, Vanuxem P, Gardette B., **Circulating venous bubbles in recreational diving: relationships with age, weight, maximal oxygen uptake and body fat percentage.,** Int J Sports Med. 1999 Aug;20(6):410-4.

40 male divers were compared for risk of bubble formation. While percent bodyfat was not a significant predictor, VO2max, total bodyweight, and age each had a measurable correlation with bubble formation.

Broome JR, Dutka AJ, McNamee GA., **Exercise conditioning reduces the risk of neurologic decompression illness in swine.**, Undersea Hyperb Med. 1995 Mar;22(1):73-85.

Treadmill conditioning reduced incidence of neurologic DCS in pigs, independent of age, percent bodyfat, and total bodyweight.

MR Powell. Exercise and physical fitness decrease gas phase formation during hypobaric decompression., Undersea Biomed. Res., 18 (Suppl.), 61, (1991).

Subjects either exercised or rested each of three days prior to decompression to altitude. The exercise group generated fewer bubbles than the rest group. The researcher attributed these results to an increase in vascularity, which aided elimination of dissolved gas.

Lehner CE, Lin TF, Rhode BA, et al. Respiratory decompression sickness in sheep after prolonged hyperbaric exposure: obesity as a risk factor in chokes., Undersea Biomed Res 1991; 18(suppl):71-72.

Sheep were exposed to 2.2-2.9 atm abs for 24 hours, then decompressed to ambient pressure. Respiratory DCS (“chokes”) were more frequently seen in heavier, fatter animals than lighter, leaner ones.

Curley MD, Robin GJ, Thalmann ED. Percent body fat and human decompression sickness., Undersea Biomed Res 1989; 16(suppl):29.

376 male military divers were examined for percent body fat and presence of DCS during a three dive series. Percent body fat in non-obese divers was not correlated with incidence of DCS in this study.

Jauchem JR. Effects of exercise on the incidence of decompression sickness: a review of pertinent literature and current concepts., Int Arch Occup Environ Health 60: 313–319, 1988.

This review article discusses the best understanding of exercise and DCS at its time. Jauchem examines the temporal effect of exercise, including its effect on nitrogen uptake and elimination, tribonucleation, and the influence of carbon dioxide.

Dembert ML, Jekel JF, Mooney LW. Health risk factors for the development of decompression sickness amongst US Navy Divers., Undersea Biomed Res 1984; 11:395-406.

Historical data was used to examine the relationship between body fat and incidence of DCS. Divers who experienced DCS had significantly higher body fat measurements than divers who did not experience DCS. Divers in the top quartile of body fat measurements had a 9 to 10 fold increase in DCS compared to divers in the bottom three quartiles and 5 to 6 fold over the calculated average DCS risk in all Navy divers.

Rattner BA, Gruenau SP, Altland PD., Cross-adaptive effects of cold, hypoxia, or physical training on decompression sickness in mice., J Appl Physiol. 1979 Aug;47(2):412-7.

As part of this study, mice were treadmill trained for 1 or 1.5 hours or swim trained for 15 minutes for 14 or 28 days. Treadmill-trained mice had significantly lower incidence of DCS versus non-exercised controls or swim-trained mice. Though not examined, the difference between results for treadmill and swim training could be due to the significant differences in duration of exercise.

Allen TH, Maio DA, Bancroft RW. Body fat, denitrogenation and decompression sickness in men exercising after abrupt exposure to altitude., Aerospace Med 1971; 42:518-524.

147 men were examined over 883 exposures as long as 4 hours at 35,000ft in either 100% oxygen or 70/30 oxygen/nitrogen. Men with less than 12 kg of body fat were significantly less susceptible to DCS than men with more than 12 kg of body fat under all conditions examined.

Philp RB, Gowdey CW. Experimental analysis of the relation between body fat and susceptibility to decompression sickness., Aerosp Med 1964; 35:351-356.

Rats of varying body fat were pressurized to 65 psig for two hours, then decompressed on a schedule lasting 16.25 minutes. Lean rats were less susceptible to DCS than either normal rats or fat rats. Measurements of the specific gravity of fat samples demonstrated significant nitrogen retention in these tissues.

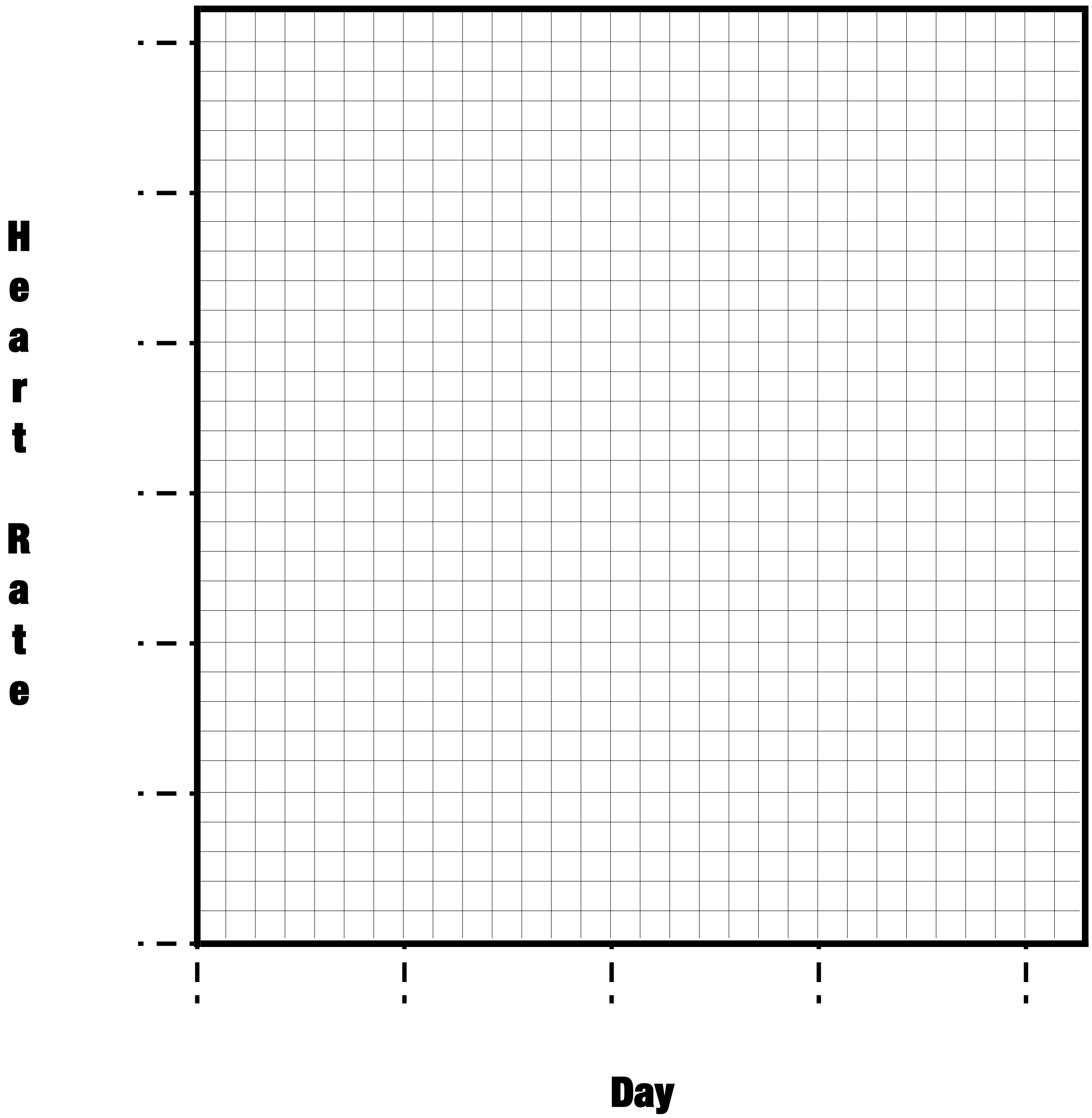
Boycott AE, Damant GCC. Experiments on the influence of fatness on susceptibility to caisson disease., J Hyg 1908; 8:445-456.

Rats, guinea pigs, and dormice were pressurized to over 100 psi for 1 hour. Fatness was a near linear predictor of death across all levels of body fat. Weight did not have a large correlation.

Vernon HM. The solubility of air in fats and relation to caisson disease., Proc Roy Soc 1907; 79:366-371.

Cod liver oil, olive oil, lard, and human fat were each shaken in bottles that contained air. Analysis of the shaken fats demonstrated that nitrogen was 5.3 times more soluble in human fat than in water or blood and blood plasma.

Appendix D
Daily Plot of Resting Heart Rate



Plot your first value on the "Heart Rate" axis near the middle- this will keep your range of daily heart rates within the bounds of the chart. Label the "Heart Rate" axis accordingly, with each label line representing a difference of 5bpm. Label the "Day" axis, as well, with each label line representing one week. See **Chapter 8- Training by Heart Rate** for more information on monitoring your resting heart rate.

FITNESS FOR DIVERS

Diver and fitness professional Cameron Martz combines the latest information about exercise and diving physiology in one book. We all know that physical fitness is important to good health on the surface, but research shows that our fitness also impacts our excursions underwater. Whether you consider yourself to be a recreational or a technical diver, you will find important information in this book to make your diving better, safer, and more enjoyable. Topics in this book include:

- **67 exercises to condition your body**
- **18 stretches for functional flexibility**
- **40 studies that show how fitness affects your diving**
- **6 months of exercise planned for beginners through advanced**
- **Important research on dive day activity and nutrition**
- **Techniques to help you reach your valves, prevent calf cramps, improve your SAC, and more...**

About the Author

Cameron L. Martz is certified as a Health & Fitness Instructor through the American College of Sports Medicine. After spending three years as a management consultant and eighteen months managing the marketing of a software company, Cameron decided to take his career out from behind a desk and into the gym. He spent three years as a triathlon coach for a leukemia research organization, and currently operates a personal training business in Raleigh, North Carolina.

Cameron's fitness articles for divers have been translated into six languages and published worldwide. He acts as the fitness advisor to several SCUBA diving organizations and maintains an informational website at DIVEFitness.com.

For more information on fitness and diving, visit...

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