Dr. Gabe Mirkin's
Pocket Guide
to
Fitness
and
Sports

by

Gabe Mirkin, M.D.

About the Author:

Dr. Gabe Mirkin is an internationally recognized expert in sports medicine and fitness. He hosts a daily call-in talk show on fitness, health and nutrition. He wrote *The Sportsmedicine Book*, the all-time best selling book on the subject, and has been the fitness broadcaster for CBS Radio for more than 20 years.

Dr. Mirkin is a former competitive marathon runner, coach and organizer of long distance running. He ran his first competitive marathon in 1954. In the 1960s, he was among the first to host long distance races for women, children and older people. He hosted the first Road Runners Club of America National Championship for women at a time when women were threatened with life-time ban from Amateur Athletic Competition if they ran in races of more than 1.5 miles. He was the first national chairman of age group long distance running for the Amateur Athletic Union of the United States, and founded the Run for Your Life program for fitness runners.

Dr. Mirkin was one of the first college professors to teach sports medicine to undergraduates. He has been the medical editor of the three premier running journals, *Runner's World*, *Running Times* and *The Runner*. He has had a syndicated newspaper column on fitness for more than 20 years. He wrote the sports medicine sections of *The Merck Manual* for both the physicians' and lay editions. He is the author of nine books and 16 chapters on sports medicine for medical textbooks.

A practicing physician, Dr. Mirkin is board-certified in four specialties and is Associate Professor of Pediatrics at Georgetown University School of Medicine. He is a member of the Board of Examiners for the American Board of Sports Medicine, which certifies physicians for competence in sports medicine. He has hosted a daily call-in talk show on fitness, nutrition and health for more than 20 years. For a list of radio stations carrying the *Dr. Gabe Mirkin Show*, send a self-addressed stamped envelope to Box 10, Kensington, Maryland 20895.

Table of Contents

Before beginning any exercise program or making changes in your diet or physcial activities, including those described in this book, check with your physician or health care provider.

Dr. Gabe Mirkin's Pocket Guide to Fitness and Health

Edited by Diana Mirkin
Illustrations by Eric Hyne
The Mirkin Report, Publisher

ISBN# 0-964-2386-8-3

For additional information write to
The Mirkin Report
Box 10, Kensington, Maryland 20895.

Chapter 1. Fitness Basics

The best sports for fitness are the ones in which you exercise continuously, those that are least likely to injure you and the ones you enjoy the most. You become fit by exercising vigorously enough to increase the circulation of blood. It makes no difference to your heart how you increase your circulation. The best sports for fitness use your legs because the blood vessels in your legs are so much larger that you can circulate far more blood with your leg muscles. Furthermore, arm exercises tire you earlier because most people have weaker arms.

Some sports require a great level of fitness just to start. For example, to jump rope, you must spin the rope more than 80 times a minute to keep it from tangling. Many people can't jump 80 times a minute. The safest sports are low-impact aerobics, walking, swimming and pedaling a stationary bicycle. Running causes lots of injuries, because the force of your foot striking the ground can be three times your body weight, which can damage muscles and bones. Sports that don't keep you moving may be fun, but they won't make you fit. For example, the average tennis player spends 80 percent of their playing time waiting for the ball.

Use Interval Training to Improve Your Fitness

You have probably heard that you need to exercise continuously for 30 minutes to become fit. Almost 80% of adults can't exercise vigorously for that long, so many people won't even try to start an exercise program because they feel that exercising would just be a waste of time. However, according to the American College of Sports Medicine, you don't have to engage in vigorous exercise *for sustained periods* to gain substantial health benefits. If you exercise for 30 seconds, rest for 30 seconds and alternate exercising and resting, you should be able to increase your exercise time without much discomfort and without injuring yourself.

This is called *interval training,* and top athletes in all sports use it. More than 35 years ago, the Swedish physiologist, Per Olof Astrand, showed that you can increase your exercise load markedly by alternating exercise with rest periods. He showed that you could exercise for up to 30 seconds intensely and continuously without accumulating much lactic acid in your bloodstream. Lactic acid makes muscles hurt and feel tired. However, the amount that accumulates in 30 seconds of hard work is quickly cleared from your bloodstream. Then you can exercise for another short burst. Your muscles get stronger as you build up the number of intervals you can complete. An example of a typical workout is to start off by pulling on a rowing machine for 30 seconds, resting for 30 seconds and then alternating rowing and resting for several minutes. Stop when your muscles hurt or feel heavy.

Use Different Types of Exercise for Fitness and Muscle Strength

You can't train for heart muscle fitness and skeletal muscle strength with the same exercises. To strengthen your heart muscle, you have to exercise vigorously enough to speed up your heart rate and keep it elevated for a while. To strengthen your

skeletal muscles, you have to exercise against increasing resistance in bouts of no longer than 50 seconds (see Chapter 3, *Strength Training for Everyone*.)

To make your heart muscle stronger, you must exercise vigorously enough to make your heart pump more blood. The formula for heart-lung fitness is to exercise vigorously enough to raise your heart rate at least 20 beats a minute above your resting rate, working up to 30 minutes three times a week. If you can't exercise continuously for thirty minutes, work until you feel tired, rest, then repeat the cycle.

To strengthen your skeletal muscles, you need to exercise against increasing resistance by lifting heavy weights or pushing against special strength-training machines. The greater the resistance without causing injury, the greater the gain in strength. However, when you exercise against resistance, your muscles fatigue very rapidly. If you exercise against resistance for more than 50 continuous seconds, you increase your risk of tearing your muscles. A good program would include cycling, swimming or jogging on Mondays, Wednesdays and Fridays and using strength machines on Tuesdays and Thursdays.

What Causes Muscle Soreness?

Expect your muscles to feel sore on the day after you exercise vigorously. Hard exercise tears your muscle fibers to shreds. If a doctor cuts out a piece of your muscle on the day after you exercise and looks at it under a microscope, he will see bleeding and disruption of filaments that hold the fibers together as they slide over each other during a contraction.

Muscles contain chemicals called enzymes that help you to convert foodstuffs to energy. When muscles are damaged by hard exercise, they release enzymes, such as CPK, into the bloodstream. Doctors can then measure levels of CPK enzymes in the bloodstream to determine how badly muscles are damaged. Those exercisers with the highest post-exercise blood levels of CPK also have the most muscle soreness. Running fast downhill and lifting very heavy weights cause more post-exercise soreness than other exercises because they cause the most muscle damage and take the longest time for recovery. Cooling down by exercising at a very slow pace after you have exercised more vigorously does not prevent muscle soreness. Cooling down speeds up the removal of lactic acid from muscles, but a buildup of lactic acid does not cause muscle soreness. Stretching does not help because muscle soreness is not caused by contracted muscles. You can prevent muscle soreness by stopping exercising when your muscles start to feel sore, but then you will not improve. All athletic training is done by stressing your muscles with a hard workout, taking easy workouts until the soreness disappears, and then taking another hard workout.

Don't Worry About Your Maximum Heart Rate

You never have to take your pulse when you exercise. You can tell whether you are working at your training heart rate just by noticing how hard you breathe. Your pulse rate can be used to tell you the slowest your heart can beat to be strengthened by exercising and the fastest that your heart can beat and still pump blood through your body. To strengthen your heart, you should exercise hard enough to increase your heart rate to at least 20 beats a minute beyond what it does at rest. When your heart reaches this rate, your body requires more oxygen than it does at rest, and you

start to breathe more deeply and rapidly, but you should still feel comfortable and be able to talk. When you exercise at your maximal heart rate, you gasp for breath and breathe as hard as you can. You only have to do this if you are training for competition.

For fitness, start out slowly and gradually increase the pace until you start to breathe harder and faster. You are now at your minimal training rate to strengthen your heart. As you get stronger and more fit, your exercise program will get so easy that you are no longer breathing hard. That means it's time to pick up the pace or work against greater resistance. There's no need to monitor your pulse rate.

Your Heart Does Not Get Tired During Exercise

A healthy heart is so strong that it is never a cause of tiredness during exercise. Tiredness during exercise comes from your muscles. They run out of fuel or out of oxygen. Skeletal muscles use both fat and sugar for energy. When your muscles run out of their stored sugar supply, called glycogen, they cannot contract and function adequately. You feel tired, your muscles hurt and you have difficulty coordinating them. On the other hand, your heart muscle gets energy directly from fat and sugar in your blood and even from a breakdown product of metabolism called lactic acid. It is virtually impossible for the heart muscle to run out of fuel unless you are starving to death.

It is also impossible for a healthy heart to run out of oxygen. Oxygen comes to the heart through arteries on its outside surface. If these arteries are not plugged up with plaques, they are large enough to supply all the oxygen that the heart can possibly need. However, fatty plaques in arteries can block the flow of blood. When the heart does not get enough blood, it will hurt and can start to beat irregularly. Exercise can't hurt a healthy heart. If you develop heart pain during exercise, something is wrong and you need to check with a doctor immediately.

Intensity of Exercise and Weight Loss

If you eat a low-fat, high-fiber diet and exercise at least three times a week and are still overweight, you probably need to pick up the pace (*International Journal of Obesity*, June 1998). Hard exercise burns more calories while you exercise. It also gives you larger muscles that burn more calories at rest, and it increases your metabolism so that you burn more calories after you finish exercising. You do not increase your metabolism with slow, relaxed exercise.

Some books recommend that you should exercise at a slow rate because you burn a greater percentage of fat when you exercise slowly than when you exercise intensely. This is foolish because when you exercise at a low level of intensity, you burn fewer calories during and after exercise, so the total number of calories you burn in a 24-hour period is far lower. Burning fewer calories causes you to lose less weight.

Intense exercise stresses muscles, so you shouldn't do it more often than once or twice a week. If you want to use exercise to help you lose weight, pick a sport you enjoy and do it intensely once or twice a week. Take off the day the day after your intense workouts, and go easy on the other days.

Pick Up the Pace

Walking is one of the safest and most effective sports for fitness, but to become fit, you have to move fairly fast. You should exercise vigorously enough to increase your heart rate at least 20 beats a minute more than when you rest. Walking at a leisurely pace will not raise your heart rate very much. You can increase your speed by taking longer steps or by moving your feet at a faster rate.

To lengthen your stride, swivel your hips so that you reach out further forward with your feet. This causes you to twist your body from side to side, which forces your toes to point to the outside when your feet touch the ground. By pointing your feet forward after your heel strikes the ground, you will gain a few inches. To move your feet at a faster rate, you have to move your arms at a faster rate also. Every time one leg moves forward, the arm on the same side moves back and the arm on the other side moves forward. For every step forward, there is an equal number of arm movements forward. To move your arms faster, you have to keep your elbows bent. The fulcrum of your arm swing is at your shoulder. The straighter your elbows, the longer your arms swing as a pendulum from your shoulder, reducing the frequency of arm swings. Bending your elbows shortens the swing and allows you to move faster.

Swimming is not the Best Exercise for Weight Loss

If you want to lose weight, lower cholesterol, or help to control diabetes, swimming is better than nothing, but not that much better. A report from the University of Colorado shows that obese people who start a supervised swimming program do not lower their fasting blood sugar, insulin, total cholesterol, good HDL cholesterol and bad LDL cholesterol levels. They also did not lose weight or redistribute their body fat (*Clinical Physiology*, July 1997).

The results are better in people who start land-based sports such as running, aerobic dancing, racquetball or cycling. When you exercise on land, your body is surrounded by air which insulates you, causing your body to retain heat and your body temperature to rise for up to 18 hours after you finish exercising. Increased body temperature speeds up your metabolism and helps you to lose weight and lower cholesterol. On the other hand, when you swim, your body is surrounded by water which is an excellent conductor of heat away from your body, preventing your body temperature from rising. Swimming is a wonderful exercise for fitness, but will not contribute much to a weight loss program.

Passive Exercise Won't Make You Fit

What do you think when you see an advertisement for a stationary bicycle with motor driven pedals or a motorized table that moves your body up and down? A report in *Medicine and Science in Sports and Exercise* (February 1998) shows that they don't make you fit. Exercise strengthens your heart only when you do it vigorously enough to increase your heart rate at least 20 beats a minute above resting. The faster you make your heart beat, the greater the training effect to make your heart stronger.

In this study, men were asked to sit on a stationary bicycle and keep their feet on pedals that were driven by a motor. When the people kept their feet on slowly driven pedals, their hearts did not beat faster, but when they kept their feet on pedals driven

at a high speed, their hearts did beat faster. However, it still didn't strengthen their hearts because the faster heart rate produced by fast passive pedaling is due to stimulating hormones, such as adrenalin, rather than increased circulation of blood. Hormones do not make your heart stronger, the increased circulation of blood during exercise does. If you want to become fit, move your own muscles. Having a table move your body or motor driven pedals move your legs will not make you fit.

It's Normal to Sweat More After Exercising

Do you know why you sweat more after you finish exercising than you do while you exercise? Your body temperature varies throughout the day going from around 97 degrees in the early morning to about 99 degrees in the early evening. Exercise raises body temperature considerably. When you exercise, more than 70 percent of the energy that powers your muscles is lost as heat. Less than 30 percent drives your muscles. Athletic competition can drive temperatures as high as 105 degrees without harming the athletes.

To keep your body temperature from rising too high, your heart pumps large amounts of heat in the blood from your hot muscles to your skin and you sweat. The sweat evaporates and cools your body. The amount of sweat that your body produces depends on the temperature of the blood that flows through your brain. When the temperature of the blood rises, you sweat more. During exercise, your heart beats rapidly to pump blood to bring oxygen to your muscles and to pump the hot blood from the muscles to the skin where the heat can be dissipated. When you stop exercising, your heart slows down also, pumping less blood to the skin. The heat accumulates in your muscles, causing blood temperature to rise higher, so you sweat more after you finish exercising than during exercise.

Stress and Recover

If you want to get faster or stronger, you should switch to hard workouts every other day. You improve in sports by stressing your muscles and then waiting for them to recover before you stress them again. When you exercise vigorously, your muscle fibers are injured--there is bleeding into the fibers and disruption of the Z bands that hold muscle filaments together as they slide by each other during a contraction. If you stress your muscles again while they are still recovering from a previous hard workout, you can tear them and then you won't be able to exercise at all. On the other hand, if you rest by taking the day off or exercising other muscle groups, the stressed muscles heal and are stronger than they were before you took your hard workout. Most athletes wait at least 48 hours to recover before they exercise intensely again.

Stress refers to how *hard* you exercise, not how *much*. For example, competitive runners run very fast only one to three times a week, and more slowly on the other days. Weight lifters lift very heavy weights only once a week. They lift lighter weights with fewer repetitions in the rest of their workouts. You can gauge the severity of stress by the amount of burning in your muscles you feel during exercise. If you slow down or stop when you feel burning and heaviness, you will probably be able to exercise on the next day. On the other hand, if you keep on pushing through the

burning and heaviness, you will probably feel dead-legged for the next one to three days. You should then take the next day or two off, or work out at a leisurely pace. You will be far more fit than the person who does the same low-intensity workout every day.

How to Avoid Injury

Nobody can exercise vigorously in the same sport every day. If you think that you can, expect to be injured. All athletic training is done by stressing and recovering. It's called the hard-easy principle. On one day, you exercise vigorously and your muscles feel sore. Then, for the next few workouts you exercise far less intensely until the soreness disappears. Only then should you attempt another hard workout.

If you do not compete in sports, it is better to exercise only every other day or to alternate sports that stress different parts of your body. For example, on one day, you could stress your legs on your stair-stepper. On the next day, you could stress your back and shoulders by pulling on a rowing machine. The hard-easy principle applies to your skeletal muscles, not your heart. You can exercise hard on consecutive days as long as you do not use the same set of skeletal muscles. It's much better to exercise vigorously one day and take the next day off than to just lollygag along every day.

Stretching Can Make You a Better Athlete

There is no evidence in the scientific literature that stretching prevents injuries, but it can help you to be stronger and faster. Longer muscles can exert a greater torque on joints to help you cycle and run faster, jump higher, throw further and lift heavier. Muscles and tendons tear when the force on them is greater than their inherent strength. Strength training, but not stretching, strengthens muscles. When you exercise against resistance, your muscles become larger and stronger and are less likely to tear.

There are two ways to stretch. You can stretch only as far as you can hold for several seconds or you can bounce as hard and as fast as you can. Research shows that bouncing gives you the maximum stretch, but it also increases your chance of injuring yourself. Icing or heating the muscles prior to stretching does not increase their ability to stretch, although warming up a muscle by exercising prior to stretching helps to prevent injuries. Always warm up your muscles before you stretch. Resting muscle temperature is around 97 degrees. Cycling slowly for several minutes will raise muscle temperature to more than 99 degrees and help to make it more pliable and resistant to injury. You can stretch after warming up or after you finish your workout.

Fast, forceful stretching will give you greater flexibility than slow deliberate stretching, but it also will increase your chances of injuring yourself. Athletes can do bouncing short stretches and hope that it doesn't injure them. However, fitness exercisers probably should do slow deliberate stretches no further than they can hold for five seconds. If you compete in sports, try to stretch every day and do bouncing stretching no more than two or three times week.

Cooling Down After Exercise Prevents Dizziness

Slow down gradually after exercising vigorously. Cooling down prevents feeling faint and passing out. When you sit or stand, your heart's major task is to raise blood from your feet. When you exercise, your heart's main function is to pump blood to your exercising muscles. If it had to do the extra work of raising blood from your feet, it would pump so little blood to your muscles that you would tire with the mildest exercise. Therefore, you heart has to depend on your leg muscles to raise blood against gravity. When your leg muscles relax, the veins near them fill up with blood. When they contract, they squeeze the veins near them and pump blood up toward your heart. Alternately contracting and relaxing leg muscles pump extra blood through your body.

When you stop suddenly after exercising vigorously, your leg muscles stop pumping and your heart has to pick up the extra work. To make your heart beat faster and stronger, your body increases production of its own natural stimulants called adrenalin and noradrenaline. This can cause the heart to beat irregularly, depriving your brain of adequate oxygen, so you feel dizzy and can even pass out. People with heart disease can develop irregular heart beats. Cooling down does not prevent muscle soreness. It increases circulation and helps to clear lactic acid from your muscles at a faster rate, but muscle soreness after exercise has nothing to do with lactic acid accumulation. It is due to muscle damage caused by exercise. You cool down to prevent dizziness, not muscle soreness.

Running for Fitness

Most joggers and runners should train the same way that competitive runners do, even if they jog only for fitness. Here's a program that you can follow even if you do not plan to compete. First get a physical exam to see if you are healthy. Then start out by running every other day until your legs feel tired or hurt. Gradually work up to the point where you can run for thirty continuous minutes. Then you are ready to start training.

Plan one fast and one long workout a week. The other workouts should be at a slower pace and can be skipped if you feel tired. Your fast run can be on Wednesday and your long run on Sunday. Wednesdays, start out slowly and gradually increase the pace until you start to feel uncomfortable as you breathe hard and your muscles start to hurt. Slow down until you recover, then gradually pick up the pace again. Repeat until your legs start to feel heavy. Each week, try to improve by spending more time running fast and less time running slowly. Take the next day off because your legs will be sore. If you feel better on Friday and Saturday, jog slowly for a short distance. On Sunday, try to run for 30 minutes, and each week, extend your running time until you can stay out for 60 to 90 minutes of brisk running. Take the next day off, then jog slowly on Tuesday and try to go fast again on Wednesday.

You can apply the principles of this training schedule to any fitness activity, not just running. Whether you choose to cycle, swim, row, or perform any other continuous activity, the concept of one fast and one long day per week will help you to get the most out of your program.

You Can Improve Your Running Form

Your center of gravity is the spot in your body with equal weight in front and in back. Every motion you make is aimed at keeping your body balanced around your center of gravity. When you run and move one part of your body forward, you must move another backward to keep you from falling on your face. When you move your left leg forward, you must also move your right arm forward and your left arm backward. When you move your right leg forward, you automatically move your left arm forward and your right arm backward.

People with poor running form often look funny because when they move their right leg forward, they don't move their left arm forward fast enough. It is usually of little value for a coach to tell an awkward student to change his or her form. Have your team members repeat the motion of running over and over so the brain can coordinate the body's motions about his or her center of gravity. With repetition and increased speed, the body will move more smoothly. They should run at least every other day and when they are in good shape, have them run short interval sprints as fast as they can.

Exercise Together on a Tandem Bicycle

One of the best sports for couples who like to exercise together is riding a tandem bicycle. You can't ride away from your better half, no matter how much you could beat him or her in a race. A fit bicycle rider spins the pedals 80 to 90 times a minute. A beginner may spin them at half that rate. When you ride a tandem, both of you spin at the faster cadence and both can get a good workout. The person who puts the most pressure on the pedals does the most work. Even though one of you may be doing twice the work, you both can work near your limit. On a good tandem, you can go faster together down hills and on level ground because two engines generate more power than one. However, you will lose ground to single bikes when you climb hills. The wind resistance for two isn't much more than for one, but the weight is much greater, and it takes a lot more power to lift a heavier weight up hills.

The better rider usually sits in the front seat. When you start, lock one foot in the pedal and keep the other on the ground. Push off with one step and raise yourself to the seat. The person who sits in the back copies the motions of the person in the front. When turning, both riders lean toward the turning side at the same time. When climbing a hill, the person in the back stands first while the front person keeps the bike stable, and a few seconds later the person in the front can stand up too. To learn about group tandem rides throughout the country, write to Tandem Magazine , POB 2939 Eugene, Oregon 97402

Chapter 2. Serious Competition

Knowledgeable competitive athletes plan their training programs months in advance, using a technique called background and peaking. First they spend many months in background training, in which they work out for long hours, mostly at low intensity, followed by a shorter period of peaking training in which they do far less work, but at a much greater intensity.

A distance runner may run 100 miles a week during his winter background training. A few months before her most important racing season, she reduces her workload to around 40 miles a week, but she runs almost as fast as she can two or three times a week. In his background period, a weight lifter lifts many tons of lighter weights. As he gets closer to his main competitive season, he takes workouts in which he lifts very heavy weights, but does far fewer repetitions. In his background period, a shot putter lifts tons of lighter weights each week and throws mostly for form, not distance. Then as he gets into his season, he does far less lifting, but with heavier weights. He also spends one day a week throwing as far as he can.

You should do the same. Start your exercise program at low intensity and low volume. Gradually increase your workload for several months before you try to run fast, lift heavy or exercise intensely.

Faster Running Improves Performance in Many Sports

If you want to improve in baseball, football, basketball or hockey, learn to run faster. To run fast in competitive sports, you have to run fast in practice and lift heavy weights to become stronger. Run a series of short fast sprints with a short rest between each. Do resistance exercises because stronger muscles drive you forward with more force.

You can always tell when a coach knows what he or she is doing. This year, one professional basketball team has so many injuries that they had to bring new players to the team. No coach should ever require players to run sprints at the end of every practice or lift heavy weights more often than twice a week. Every time you run fast or lift heavy, your muscles fibers are damaged and feel sore on the next morning, and take at least 48 hours to heal. If you try to run fast or lift heavy when your muscles feel sore, you are at increased risk for tearing them and not being able to play at all. In the preseason, knowledgeable coaches have their players scrimmage hard and run sprints on one day, and practice plays and take it easy on the next. During the season, they play so often that players should not be asked to do much hard training.

Training for a Triathalon

People who compete in triathalons have to train for three sports. To be proficient in a sport, you need to train at great speed in that sport. However, every time you exercise intensely, your muscles are damaged and it takes at least 48 hours for muscles to recover enough to exercise intensely in that sport again. Therefore, athletes in endurance sports set up their training programs so that they train very intensely no more often than every other day. To increase endurance, you have to perform a long endurance workout, but you can't do it more often than once a week.

For a triathalon, athletes have to train for running, cycling and swimming. Since each sport stresses different muscle groups, it is possible to train intensely in one sport and then on the next day, to train intensely in a different sport. Running stresses primarily the lower leg, cycling the upper leg, and swimming the upper body. Running causes the most muscle damage and requires the longest recovery periods, so most triathletes run on one day and swim and cycle on the next. A typical training program includes one fast and one long workout in each sport once a week. For example, run long on Sunday, swim fast and cycle easy on Tuesday, run easy on Wednesday, swim long and cycle fast on Thursday, run fast on Friday, and cycle long on Saturday.

Cross Training Reduces Athletic Injuries

Triathletes are injured only one third as often as marathon runners even though they do far more work, swimming, cycling and running. Training intelligently for three sports is less likely to injure you than training too hard for one. Training is limited by damage to skeletal muscles. Every time you exercise, your muscles develop small tears with bleeding. It takes at least 48 hours for muscles to heal from exercise. Each sport stresses a particular group of muscles most. Marathon runners train every day and stress the same muscles that have not had adequate time to recover from the previous day's workout, so they are at increased risk for injury.

On the other hand, top triathletes train at different sports on consecutive days. Running stresses the lower leg muscles most, cycling stresses the upper leg muscles most and swimming stresses the arms and shoulders most. Triathletes should set up a workout schedule that includes two sports on one day and one on the next. Of the three sports, running causes the most muscle damage. Muscles are protected by the water in swimming and by the rotary pedal motion in cycling. However, the force of the footstrike in running tears up muscles. So a knowledgeable triathlete runs on one day and cycles and swims on the next.

Run Fast to Train for a Marathon

Many runners have the mistaken impression that they have to run a lot of miles to be able to run fast in a marathon or any long race. Most will find that running too many miles slows them down. To run fast in races, you have to run very fast in practice. However, on the day after you run very fast, your muscles will feel sore and if you run fast when your muscles feel sore, you will injure yourself and not be able to run at all. Take easy workouts until your muscles feel fresh again. Most competitive runners set up their programs so that they run fast on Tuesdays and Thursdays and longer on Sundays. The rest of the time they run slowly or not at all.

Interval training helps you to run much faster than you could possibly run continuously. Your goal is to be able to run repeat intervals with short rests in between on your fast days. For example, once you are in good shape, on Tuesdays try to run four half-mile repeats at a very fast pace with a quarter mile jog between each. If you can run a mile flat out in six minutes, you probably will try to run each half mile repeat in around three minutes and 15 seconds. On Thursdays, you can try to run eight to 12 repeat quarter miles at close to the same pace of around 90 seconds

each. On Sundays, try to run briskly for 90-120 minutes. The rest of the time, jog slowly, being careful not to run so much that it interferes with your two fast and one long day each week.

Longer Strides Make You Run Faster

The only way you can run faster is to take more steps per minute called cadence or take longer strides. Nancy Hamilton of the University of Northern Iowa videotaped runners at several competitions. She found that faster and younger runners had the same cadence as slower and older runners, but took longer strides. However, if you ask people to take longer strides, they will run slower because you cannot consciously control your stride length.

More than 75 percent of the energy from running is stored in your tendons and while you toe off the ground, the tendons spring back to drive you forward. Trying to take longer strides loses kinetic energy and slows you down. The only reasonable way to extend your stride is to develop a greater flexibility of the hip and to a lesser degree the ankle, and to do exercises to strengthen the muscles in the back of your legs to propel you forward. Stretch the quad muscles in the front of your leg and do exercises to increase flexibility of the hip to give you a greater backward movement of your hip. Competitive athletes and older exercisers can benefit from leg presses and knee extensions to strengthen their quadriceps muscles. They should perform sitting toe touches to stretch hamstrings, wall pushups to stretch calf muscles, standing quad stretches to stretch the muscles in the front of the upper legs and hurdler stretches with the legs raised to increase hip flexibility.

Jump Higher with Stronger Muscles

Special strength-training exercises can help you jump higher. Each muscle is made up of thousands of small, stringy fibers. There are two ways to become stronger: you can increase the size of the muscle fibers, or you can learn to contract a greater number of fibers at the same time. For improved jumping, you need to contract more fibers. Any weight-bearing exercise will increase the size of the muscle fibers, but to teach your brain to contract a greater number of fibers simultaneously, you must do strength training exercises that work your muscles in exactly the same way that they are used when you jump.

You strengthen the muscles you use for jumping by lifting from a squatting position with heavy weights on your shoulders. You can use dumbbells or one of the jump-training machines that are found in most gyms and health clubs. Use the heaviest weight you can lift eight times in a row. With the weights on your shoulders, lower your body by bending your knees, then straighten them to stand erect. Do this eight times every other day, and not more than three times a week. As you get stronger, you will be able do the exercise more than eight times. When you can do 12 lifts, increase the weight by about 10 pounds. Repeat the cycle, increasing the weights in 10-pound increments.

Recover Faster By Taking a Day Off

Your muscles often feel sore on the day after you exercise vigorously, and you may wonder if you will recover faster by taking the day off or by exercising at a leisurely pace. Muscles are supposed to hurt the day after a hard game of tennis, a long run or a fast bicycle ride. Your muscle fibers are damaged and run out of their stored fuel supply called glycogen. Biopsies done on muscles 24 hours after vigorous exercise show disruption of muscle fibers and bleeding into them. It takes at least 48 hours for muscles to heal.

A major source of energy for muscles during exercise is glycogen, the sugar that is stored in them. When you exercise vigorously, your muscles use up most of their stored glycogen and because they are damaged, cannot store as much glycogen as before. Exercising damaged muscles causes further damage and slows healing. Exercising muscles low in sugar uses up more muscle glycogen. It does not increase the rate that glycogen is stored. When muscles feel sore on the day after you exercise vigorously, even mild exercise of those muscles delays recovery. You will recover faster if you take the day off or exercise in another sport that does not stress your sore muscles.

How to Build Endurance

You can't compete effectively in sports that require endurance just by running, skiing, swimming or riding long distances. You have to exercise at a very fast pace at least once a week. It's called the principle of specificity. The best way to train for competition is to move as fast as you can. However, every time that you exercise intensely, your muscles are injured and it takes at least 48 hours to recover. Most athletes allow two to four days of easier training to help them recover from their hard workouts.

Runners run much faster in races now than they did 40 years ago because they run much faster in training on their hard days. Forty years ago a typical hard workout was to run a quarter mile, 40 times averaging 67 seconds for each quarter mile repeat. Now, a runner will rarely run more than 12 quarters, but each quarter mile repeat will average less than 60 seconds, a much faster pace. To compete in sports requiring endurance, you should exercise very intensely not more than three times a week and do a lot of much slower training the rest of the time. For example, exercise very fast on Tuesday and Thursday, long on Sunday and go easy the rest of the week.

Train With Both Long and Short Intervals to Run Faster

To run very fast in races, distance runners have to run very fast in practice. They use a technique called intervals. Interval training is running a fixed number of repeats of a fixed distance at a fixed pace with a fixed recovery. There are two types: long and short. A short interval takes 30 seconds or less to run and does not build up significant amounts of lactic acid in the bloodstream, so a runner can do lots of repeat short intervals in a single workout.

Long intervals take more than two minutes. They build up considerable amounts of lactic acid in the bloodstream and are very tiring. When an athlete runs them very fast, he can do only a few. Long intervals usually include repeat half or three-quarter miles. Most top runners do one long and one short interval workout a week. If they try to run intervals more often than that, they feel too stiff to run intervals fast

enough to improve their race speed. For example, one day a week they do a long interval workout of four half-miles at close to top speed. A top marathon runner will run four half-mile repeats averaging around two minutes each. On their short interval day, they may do around 100 repeats of distances from 40 to 176 yards. They also do one long run a week. A typical program would be short intervals on Tuesday, long intervals on Thursday, a long run on Sunday and slower jogging the rest of the time.

Interval Training Rest Periods Vary

To become stronger and faster, athletes use a technique called interval training. They exercise very intensely, rest and then alternate intense bursts of exercise and rest until their muscles start to feel heavy. The length of the rest periods varies for different sports. Runners run a short distance as fast as they can and recover enough to run the same fast pace several times: a quarter mile 12 times, averaging 1 minute, with a 110 yard slow jog between each. A weight lifter may lift a heavy weight ten times in a row, rest, and then repeat another set of ten. Research shows that runners need very short recoveries between intervals, usually only about 30 seconds. However, weight lifters need much longer recoveries, at least two and one half minutes.

Runners become short of breath and feel a burning in their muscles when lactic acid starts to accumulate in muscles. It takes only a few seconds for a trained athlete to recover from hard running and clear lactic acid, so runners need usually need only a short (30 second) recovery between each hard run. On the other hand, weight lifters feel a burning caused by a tearing of the muscle fibers. An article in the *British Journal of Sports Medicine* (September 1997) shows that it takes a much longer time for the pain to disappear so they can again lift very heavy weights.

Training for Hot Weather Competition

To prepare for athletic competition in hot weather, train in the heat, drink plenty of fluids and salt your food. Thirty years ago, Tom Osler, a math professor at Glasssboro State, won several national running championships when he competed in very hot weather, but was far less successful in colder weather. He attributed his phenomenal success to restricting salt from his diet. The theory seemed reasonable. When you compete in the heat, you lose tremendous amounts of water and salt. Could restricting salt and water teach your body to conserve salt and water during competition? Recent research shows that restricting either salt or fluid during training will not increase endurance. It tires them earlier so they can't train. It's like being beaten by a stick. No matter how often you are beaten, it won't increase your tolerance.

The most crucial factor in preparing your body for exercise in the heat is exercising in the heat. Restricting fluids does not help your body to acclimatize better. Several studies show that water loading and salting your food to taste help you to compete. Markedly increasing your intake of fluids for a week before competition can increase your endurance. The extra salt helps your body to hold the extra water.

Test Your Fitness with Recovery Pulse Index

A simple way to test the effectiveness of your exercise program is to find out how well it is training your heart. This is done by measuring your recovery pulse -- how much your pulse slows down in one minute after you stop exercising.

A quick recovery signifies a strong heart. The stronger the heart, the more quickly it recovers from stress and the less frequently it must beat. If you are reasonably fit, you can test yourself periodically to chart your improvement. Work out as hard as you can for five minutes. Stop and immediately place one or two fingers at the side of your neck where you can feel a strong pulse. Count your pulse for six seconds, then multiply that number by 10. It is important to count for only six seconds, since your heart rate decreases very quickly once you stop exercising.

Exactly one minute later, take your pulse again in the same way. Then subtract the second pulse rate from the first. The difference between the two rates is your Recovery Pulse Index. You are in good shape if the second count is at least 30 beats lower than the first, and you should be able to increase the difference as your heart gets stronger.

If you think that your slow heart rate is a measure of fitness, you could be wrong. Your recovery heart rate is a far more dependable indicator. A study in *Medicine and Science in Sports and Exercise* (July 1996) shows that a 20-week program of endurance training does not slow the resting heart rate, and therefore cannot be use as a measure of fitness. Hard exercise cannot hurt a healthy heart, but it can cause irregular heart beats in people who have damaged hearts.

How to Tell if You are Overtraining

Exercise is supposed to make you feel good. If it doesn't, you're sick or exercising too much. There's a proper dose for everything. If you don't get enough sleep, you feel awful, but if you get too much sleep, you can develop a headache. The same applies to eating. If you don't get enough food, you'll be sick. If you eat too much, you'll also feel sick. It's the same with exercise. If you get the right amount, your muscles feel a pleasant fatigue, your mood is good and you are more alert. When you exercise too much, your joints, muscles, tendons and bones hurt. You don't look forward to your next exercise session. Your lymph nodes can swell, you feel tired and you are at increased risk for developing frequent infections and injuries.

If you want to enjoy exercising, find out how much you need to feel good. If exercising every other day makes you feel good, you don't need to exercise more than that. Exercising in the same sport more often than every other day markedly increases your chances of injuring yourself. If you want to exercise more often than every other day, go harder on one day and easier on the next. If you don't feel like exercising, take the day off. Your body talks to you; your job is to listen.

You Can Expect to Get a Second Wind

If you become short of breath in a race and feel so tired that you want to give up, you may be pleasantly surprised to find that you suddenly feel better. During sustained exercise, your body requires considerable amounts of oxygen. The harder you work out, the more oxygen you need. Sometimes you exercise so intensely that

your heart is unable to pump all the oxygen-rich blood your muscles need, which can cause an oxygen deficit. When this happens, your muscles become tired and feel heavy. You may lose control over your muscles and feel cramps in them. You will also breathe hard and pant as your body tries to take in more air.

To compensate for this oxygen deficit, your body naturally slows down. But you won't feel it because you're still working equally hard just to help your body catch up. Because you aren't exercising as intensely as before, your body requires less oxygen, and you gradually meet your needs. When you no longer have an oxygen deficit, your muscles will hurt less and you'll feel refreshed. That's when you pick up your pace. Again, you won't notice the change in pace, just the renewed vigor. That's what athlete's call their "second wind." It's just your body's natural way of letting you exercise longer.

Chapter 3. Strength Training for Everyone

Almost everyone should lift weights. Weight lifting strengthens bones, muscles ligaments and tendons, increases coordination for tasks requiring strength and gives confidence and mobility to disabled people. Just exercising doesn't do much to strengthen muscles. If it did, marathon runners would be the strongest people in the world. To become strong, you have to exercise your muscles against progressively greater resistance, such as lifting heavier weights. Just exercising doesn't strengthen bones either. Female marathon runners sometimes stop menstruating and lose tremendous amounts of bone, even though they may run more than 100 miles a week. To regain bone, they have to eat more food which will usually start them menstruating again or they need to take estrogen.

People with muscle and nerve diseases can also benefit from lifting weights. They may be unable to work out as long or as hard as a healthy person and they take longer to recover from their workouts. However, if they stop exercising when their muscles feel heavy or hurt and they take off when their muscles feel sore, they can become very strong (*Archives of Physical Medicine and Rehabilitation*, February 1998.)

Anyone starting a weight training program should be guided by an experienced instructor. Exercise with machines three times a week, never on consecutive days. On each exercise, use the heaviest weight you can lift comfortably ten times in a row. Then allow at least 48 hours for your muscles to recover. Do not lift if they feel sore.

Strong Muscles in Thirty Minutes a Week

Some body builders lift weights for more than six hours a day, but you don't have to waste that much time to become very strong. Training for weight lifting is done in sets. A set of ten means that you lift and lower a heavy weight ten times continuously before you rest. If you repeat these sets of ten three times with a rest period between each set, you have done three sets of ten.

Most competitive bodybuilders spend hours trying to do many sets over and over again. You don't need to do that. Various studies show that you can gain up to 80 percent of your maximum strength by picking out four to eight specific lifts, lifting one set of ten of the heaviest weight in each, and repeating your program twice a week. The reduced workload causes fewer injuries and leaves you with a lot of extra time to do other things.

Lifting weights enlarges your muscles and makes you stronger, but it does not make you fit. Fitness refers to your heart and is gained by exercising in an activity where you move continuously, such as running, cycling, skating, dancing, walking or swimming. A complete exercise program should include lifting weights two or three times a week and doing a continuous sport for 30 minutes three times a week.

Build Strength to Increase Your Endurance

You can increase your ability to run or cycle long distances by becoming stronger. Scientists used to think that training was so specific that the only way to increase endurance was to exercise for a long time several times a week, but recent research shows that strength training increases endurance (*Sports Medicine*, March 1998). Muscles are made of millions of fibers. When you contract a muscle for the first time as you start to exercise, you use only one to five percent of your muscles fibers. The second time that you contract a muscle, you use a greater percentage. As you continue to exercise, you contract a greater percentage of muscle fibers until you use a constant number of fibers. As your muscles start to feel tired, they contract with fewer fibers, causing you to work harder for the same force of each contraction.

If each muscle fiber is stronger, your muscles will contract with more force with fewer fibers, and the only way to enlarge and strengthen muscle fibers is to exercise against increasing resistance. Athletes in endurance sports should lift weights or push on strength-training machines to help them compete more effectively, but they must maintain their endurance program and lift weights not more than two or three times a week, and only when their muscles do not feel sore.

How to Get Very Strong

A study from the University of Florida in Gainesville shows that most people will become as strong by lifting weights in one set of ten as performing three sets of ten for the same weight (*Medicine and Science in Sports and Exercise* , October 1996.) To become very strong, you have to exercise your muscles against resistance to the point where your muscles start to burn. The only stimulus that makes muscles larger is to stretch the muscle fibers while the muscle shortens. To help you picture how muscles shorten, think of two toothpicks lying end to end. Then, slide the toothpicks along each other, so that the toothpicks end up beside each other. Your muscle fibers function in a similar manner. When you lift a heavy weight, the fibers are stretched as the fiber filaments slide along each other.

The first time you lift a heavy weight, you use only a small percentage of your muscle fibers, perhaps three percent. As you continue to lift and lower a weight, you bring in more and more fibers, until 30 to 50 seconds have elapsed, and lactic acid starts to accumulate in the muscle. This reduces the number of contracting fibers. You use the most muscle fibers when you exercise them against heavy resistance for 30 to 50 seconds, the time that it takes to lift and lower a heavy weight slowly eight to twelve times. This stimulus of exercising against heavy resistance is so strong that a person can enlarge a muscle even if he is fasting, losing weight and all other muscles are getting smaller. Pick the heaviest weight that you can lift and lower slowly ten times in a row. Stop lifting if you feel pain or start to lose control.

Eccentric Lifting for Greatest Strength Gains

A study in *Medicine and Science in Sports and Exercise* (October 1996) shows that becoming very strong requires lifting the heaviest weights that you can. The only way to become stronger is to lift heavier weights. Lowering weights slowly will make you stronger than lifting weights because you can lower heavier weights than you can lift. Lowering a weight, or eccentric lifting, causes far more damage to muscle fibers than

lifting it up, so you shouldn't perform lowering workouts more often than once a week.

This type of workout can cause severe injury, including ruptured blood vessels and irregular heart beats, unless you are in great shape, have a strong heart and blood vessels, and know when to stop. It should be done only by people preparing for high-level athletic competition in which the risk of serious injury is worth the extra gain in strength. Do not attempt to do eccentric lifting unless you have been lifting weights for at least a year. Do not take an eccentric workout when your muscles feel sore or you have tender spots in your muscles or tendons. Stop lifting immediately if you feel specific pain or tearing. Always have two spotters to take the weight from you if you lose control of the weight or feel severe pain or tearing.

Pick about ten exercises for different muscle groups. Do weekly easy, moderate and hard workouts. For example, on Monday go moderate: lift the heaviest weight that you can lift ten times in a row for each exercise. On Wednesday do an easy workout, using weights that are only 85 to 90 percent of what you used on Monday. Do three sets of ten which will feel easy. Friday is your hard day. Start out by lifting the heaviest weight that you can lift ten times in a row. Then add five to ten pounds. You will need two strong friends to lift the weight and you will try to lower it as slowly as you can six times in a row. Then add some more weight and try to lower that weight slowly three times in a row. This workout will hurt. Allow at least two days to recover and then start the cycle over on Monday.

Lifting Weights Will Not Make You Musclebound

If you require extraordinary coordination or dexterity for your profession or hobby, you can still benefit from a weight lifting program. The idea that lifting weights will make you musclebound is nonsensical. Strength training improves coordination. Your brain is a master switchboard that coordinates your muscles. Lifting weights does not interfere with brain function, and it improves coordination in

It will not interfere with the coordination that you need for such fine muscle movements as playing the piano or shooting a basketball.

Muscles are made up of two different types of fibers. The red, slow-twitch fibers are used for endurance and the white, fast-twitch fibers are used for strength and speed. When you strengthen a muscle, you train the same fibers that also make you faster, so strength training helps you to move faster. Coordination is controlled by the ability of your brain to coordinate the more than 500 muscles in your body. Strengthening a muscle does not hinder brain control of muscles. In fact, strength training can improve coordination in events requiring strength. Stronger muscles use fewer fibers for the same task and therefore are easier to control.

Full length, range-of-motion strength training can also improve flexibility. To make a muscle more flexible, you need to stretch it. When you lift a heavy weight, your muscles stretch before the weight starts to move. In addition to making you a better athlete, strength training will also help you in everyday activities, such as opening stuck doors, jars and faucets, and doing your household chores.

Small Muscles Increase Risk of Stress Fractures

Forty-five percent of competitive female runners develop stress fractures, small cracks on the surface of the bones in their legs or feet. A study in the *American Journal of Sports Medicine* (November-December 1996) shows that having small calf muscles is the most common risk factor. When you run, your feet hit the ground with a force equal to or greater than three times body weight, which can shatter bones. The largest bones are usually the strongest, and people with the largest bones have the largest muscles. Runners with the smallest circumference around their calf muscles are the ones most likely to suffer stress fractures.

Stress fractures usually start out as a minor discomfort in the foot, lower leg or pelvis that occurs near the end of a long run. Usually the pain goes away as soon as you stop running. On the next day, it hurts in the same spot earlier in the run. If it hurts to touch a spot on a bone and does not hurt an inch away, you probably have a stress fracture. Most of the time, you don't need a cast, but should stop running for the three to six weeks it takes for you to be able to run without pain. If you have to exercise, ride a bike or swim. X-rays are usually not sensitive enough to diagnose stress fractures. If your doctor wants to prove the fracture, he will order a bone scan. Other risk factors for stress fractures include restricting food and having irregular periods. Women with stress fractures that do not heal may need to take a bone strengthener called alindrinate, or estrogen if they lack that hormone.

Children Can Lift Weights Too

Young children can become very strong by lifting weights and they are no more likely than adults to injure themselves. Children can be protected from injury by being supervised by experienced lifters. They should do only two handed barbell exercises, rather than using single handed dumbbells. They should never lift a weight that is heavier than they can lift ten times in a row, and they should stop lifting immediately when they start to hurt or lose their form. Lifting weights does not affect a child's growth rate. Bones grow only from the growth centers which are

located near their ends and weaker than normal bone. These center solidify and become as strong as bone when a person stops growing. There is no evidence that a properly supervised weight lifting program increases a child's chances of damaging these bone growth centers.

There are two ways to become stronger: you can make your muscles larger and you can contract a greater percentage of the fibers in a muscle simultaneously. Muscles are made up of thousands of individual fibers. When you lift a heavy weight, you contract only around 3 to 5% of your muscle fibers at the same time. Weight lifting does not make young children's muscles very large. Instead, it teaches them to contract a greater percentage of their fibers together.

Forget Isometric Exercises

Isometric exercise means to push against something that doesn't move, such as a wall. Thirty years ago, most weight lifters and many athletes used isometrics, but they're not used much anymore. The strength gain during isometric contractions is only within 20 degrees of the angle you are holding. On the other hand, when you lift weights, you become strong through a much wider range of motion. Isometrics cause your blood pressure to rise higher than the other methods of strength training. If you have weak blood vessels or heart trouble, you can rupture a blood vessel or develop an irregular heart beat.

According to Dr. John D. Fair, Chairman of the Department of History at Auburn University, the popularity of isometrics was the result of the success of some weight lifters who took synthetic male hormones called anabolic steroids and claimed that their isometric exercises made them strong. They told the world that they were using a revolutionary new training method, but it was the drugs that caused their improvement. Steroids made them stronger by helping them to recover faster from tough workouts so they could do more work. Now we know that isometrics don't give you any benefit. Steroids *are* still used, even though they can be dangerous and are banned by most sport authorities. .....

Muscles Won't Turn into Fat

Many people believe that if you build up a lot of muscle and then stop exercising, the muscle will turn to fat. That's nonsense. When you exercise, your muscles become larger and stronger. Muscles contain protein which is composed of amino acids. The amino acids constantly travel out of the muscles into the bloodstream and then back into the muscles. This happens whether or not you exercise. When you exercise, you drive amino acids into the muscle tissue at an increased rate, increasing the muscle's size and strength.

If you stop exercising, there is less stimulus for the amino acids to return to the muscles, so they become smaller. The amino acids go into your bloodstream, and since your body has no way to store extra protein after it is released by your muscles, it is broken down into ammonia and organic acids that are eliminated in your urine. People often get fatter when they stop exercising because they continue to eat as much food as they did when they were more active. The extra calories that are no

longer burned up with exercise are stored as fat. Your muscles get smaller and the fat padding gets larger, but your muscles never turn into fat.

Do Sit-Ups Correctly to Strengthen Stomach Muscles

Sit-ups can strengthen your belly muscles, but doing them incorrectly can hurt your back. They should be done while you lie on your back with your knees bent enough for the soles of your feet to touch the floor. Place both hands on your chest and slowly raise your head off the ground. Then, slowly raise your shoulders about one foot and then lower them to the ground. Do this slowly ten times, rest a few seconds and then do two more sets of ten. After a week or two, this exercise will feel easy, so do it with a light weight, wrapped in a towel, held behind your neck. As you become stronger, you can use heavier weights.

There's no need to do more than 30 sit-ups in one workout. To strengthen your belly muscles, you increase the resistance, not the number of repetitions. Keep your knees bent to protect your back. If you do a sit-up with your legs straight, you place a great force on the iliopsoas muscles that increase the arch in your back, which can damage the ligaments and joints in your back. If you have strong back muscles, you can keep the arch in your back down on the ground, which helps to protect your back from injury. If you have weak belly muscles, you may arch your back excessively when you sit up and increase the chances of tearing the structures in your back. You need to raise your shoulders only about one foot because going higher than that uses the quadriceps muscles in the front of your upper legs, not your belly muscles.

Don't Wear Ankle Weights

Ankle weights do not help you to run faster or longer, or jump higher. Training is specific. To run faster in competition, you have to run fast in practice. Ankle weights slow you down because they interfere with your coordination and make you work much harder to raise your knees. To train your muscles so you will be able to run longer, you have to run faster or for a longer time. The heavy weights will tire you earlier so you will not be able to run as fast or as far.

Using ankle weights won't help you to jump higher, either. To jump higher, you have to strengthen your leg muscles in the same way that you would use them to jump. When you wear ankle weights, you strengthen your leg muscles for lifting weights off the ground with your feet. When you jump, you raise your body off the ground. To help you to jump higher, you have to raise your body up against resistance. You do this by doing leg presses or squats with heavy weights on your shoulders.

Ankle weights can also increase your chances of being injured. Since they force you to lift a much heavier weight when you raise your knees, they strengthen the quadriceps muscles in the front of your upper leg without strengthening the hamstrings in the back equally. This can make your quad muscle proportionately so much stronger than your hamstrings that you are prone to injury.

Chapter 4. Injuries and Problems

Muscle pulls are a hazard of exercising. The immediate treatment is RICE: Rest, Ice, Compression and Elevation. Stop exercising immediately, apply an ice bag wrapped in a towel on the injured part, wrap a bandage loosely over the ice bag, and raise the injured part above the heart. Remove the ice after 15 minutes and reapply it once an hour for the first few hours. After a few days of rest, you can start a program of massage and stretching to hasten healing.

The only drugs that have been shown to help heal muscles are anabolic steroids and beta agonist asthma medications such as clenbutarol or albuterol. Anabolic steroids are illegal and have dangerous side effects. Clenbutarol and albuterol appear to be safe in the low doses that are required to hasten muscle healing, but have not been approved by the Food and Drug Administration for use in the United States. A person caught taking these pills can be banned for life from Olympic competition. It's alright to take pain medicines such as ibuprofen, but they do not speed healing. You may make matters worse if you mask the pain that warns you not to use the injured muscle. Cortisone-type injections block pain and reduce swelling, but they may actually delay healing.

In the long term, the only effective treatment is rest. You should not exercise that part of your body until you can do so without feeling pain. When you return to exercising, start out at reduced intensity and duration, working back up gradually to your normal load. Stop immediately if you feel pain.

When Do Athletic Injuries Occur?

A report from Wolverhampton University in England shows that elite athletes are most likely to suffer injuries just before the start of their competitive seasons (*Clinical Journal of Sport Medicine*, January 1998). Knowledgeable athletes divide their training programs into background and peaking periods. In their background periods, they exercise at a markedly reduced pace and try to build up the volume of their workload. For example, after their major competitive season, long distance runners take a few easy weeks and then start to build back up their mileage from 30 to around 140 miles a week, but they do not run very fast.

As they start to approach the time of the year that they want to be at their best, they start to reduce their mileage and run much faster. Two or three times a week, they will include workouts that are run at close to their fastest pace. In their background period, competitive weight lifters may lift as much as 60 tons a week. As they approach their main competitive season, they lift few weights, but they lift to much heavier maximums. This study shows that increasing intensity is much more likely to injure you than increasing volume, whether you run, cycle, skate, or ski faster, throw further or lift heavier.

Massage Therapy has Medical Benefits

Many physicians are skeptical about the health benefits of deep massage therapy. Several recent studies show that deep massage helps control asthma, makes muscle

injuries heal faster, improves training in athletes and helps alleviated the pain and discomfort of childbirth. Asthmatic children whose mothers massaged their chests reported immediate decrease in anxiety, lowering of the stress hormone, cortisol, an improved attitude toward their asthma and improvement in lung function tests (*Journal of Pediatrics*, May 1998). Researchers at Ball State University reported that vigorous deep instrument-assisted massage done 21 to 29 days after severe tendon injury hastens healing.

Massage therapy can also help athletes to train better. Athletes train by taking a hard workout that makes their muscles sore and then taking easier workouts until the soreness disappears. A 30-minute massage two hours after a hard workout lessens next-day muscle soreness and allows athletes to recover faster so they can perform more work and compete at a higher level. Women who receive massage during labor report less depression, anxiety and pain, and have significantly shorter labors and hospital stays and less postpartum depression. Why then do some physicians still not recommend massage therapy for some of their patients? A study from the University of Calgary shows that the physicians who do not approve of massage know least about how it is done and when to recommend it (*Canadian Family Physician*, May 1998).

Rotator Cuff Injuries

The rotator cuff muscles hold the head of the long bone of your upper arm tightly in the socket of your shoulder. Sports that require moving the arm over the head repeatedly can cause tearing and swelling of the tendons of these muscles. Baseball pitchers, swimmers, weight lifters and tennis players often suffer this injury. Chronic irritation can cause pain, swelling and tearing of the rotator cuff. If you continue to exercise in spite of the pain, you will tear the tendons from their attachments.

Initially, pain occurs only when you hold your arm over your head and bring it down or forward forcibly. Later, it will hurt when the arm is moved forward for any reason, such as to shake hands. Usually, it hurts when you push things away and does not hurt when you pull objects toward you. A torn rotator cuff will cause tenderness over the tendons, especially when the elbow is raised above the shoulder. It will hurt when you pull your arm across your chest, and you will have difficulty raising your elbow over your shoulder. An arthrogram is often not sensitive enough to diagnose a partial tear of the rotator cuff but can show a complete tear.

The treatment is to avoid any motion that hurts and strengthen the uninjured shoulder muscles. Do weight-lifting exercises that bring the weights toward the body and do not hurt, such as upright rows and downward "lat pulls". You may need surgery if the rotator cuff tendons are torn completely, or if the tendons do not heal within one year.

Plantar Fasciitis

One of the most common injuries in tennis and jogging, is plantar fasciitis, pain on the bottom of the heel. A band of tissue called the plantar fascia extends from your five toes, along the bottom of your foot to attach on the bottom of your heel. When you run, you land on your heel and raise yourself on your toes as you shift your weight to your other foot, causing all your weight to be held up by your plantar fascia.

Such repetitive force can tear the fascia from its attachment on your heel. Several factors increase force on the fascia, such as shoes that have stiff soles that do not bend in the right place just behind the ball of your big toe, shoes that are too wide for your feet, running too fast for the present strength of your plantar fascia, or not allowing enough time to recover between fast workouts. It can also be the first site of pain for arthritis. Doctors have no medications that help heal the plantar fascia. Cortisone injections and aspirin-like pills can reduce pain, but they can also delay healing.

If you have plantar fasciitis, stop running and limit walking until you can run without feeling pain. You can usually pedal a bicycle, since you pedal with your knees and hips and place little force on your fascia. Use shoes that have flexible soles. Wear arch supports that limit the rolling in motion of your feet, stretch your calf muscles and wear night splints. Surgery to cut the plantar, called fasciotomy, is usually ineffective and may even prevent healing. I have treated some patients with infractible pain, unconventionally, with 10 milligrams per day of alindronate for three months.

Dealing with Knee Damage

Once you break cartilage in your knee, it will never heal. To prevent further damage, start an exercise program that strengthens the muscles that control your knee. Bones are soft and need to be covered at their ends with a thick white gristle called cartilage to keep them from wearing down. Broken cartilage can never heal and no surgical procedure can put it back together. Doctors can remove broken cartilage but that only increases a person's chances of needing a knee replacement in the future, particularly if the exerciser continues to run and jump (*Arthritis and Rheumatism*, April 1998).

Former world-class athletes are supposed to have tough, strong bodies, but they suffer high risk for permanent knee damage (*Medical Journal of Australia,* February 1997), while regular non-competitive exercisers are at very low risk. Former elite athletes damage their joints because the competitive drive that makes them champions often causes them to exercise through pain and convert simple wear and tear injuries to those that do not heal. You should exercise regularly because weak muscles increase your chances of increasing joint damage. If you injure your knee, pick a sport that does not pound on the joint, such as cycling or swimming, and stop exercising if you feel pain.

Anterior Compartment Syndrome

After they have run for a few minutes, some people suffer anterior compartment syndrome, pain in the front outside part of their lower leg that worsens as they continue to run and usually disappears after they stop. Conventional treatment is surgery, but a report from Australia shows that massage may be as effective (*Clinical Journal of Sport Medicine*, January 1998).

The muscles in the front part of your lower leg pull or hold the front part of your foot up when you run. They are covered with a tight fibrous case in a limited space. When you run, the muscles fill with blood and grow larger. If the capsule is so tight that it can't expand, pressure increases in the muscles until the pressure in the muscles

is greater than the pressure of the blood trying to flow through the muscles, limiting and even shutting off the blood supply to cause pain. Conventional treatment is to cut the length of the capsule in the front of the lower leg from below the knee to above the ankle. This procedure allows the muscles to expand during running and stops the pain. The report from Australia shows that deep, painful massage therapy can stretch the capsule enough to allow the enclosed muscles to expand without shutting off the blood supply.

Cortisone Injections Into Joints Require Caution

Doctors often inject cortisone-type medications into painful damaged joints and tendons. Single injections can relieve pain and swelling and appear to be safe, but recent papers show that repeated injections can damage joints and delay healing. Scientists in Greece injected cortisone-type drugs repeatedly into the joints of rabbits and showed that they damage cartilage (*Acta Orthopaedica Scandinavica*, October 1997). A paper in the *Journal of Bone and Joint Surgery* (November 1995) shows that the injecting cortisone-type medications repeatedly into injured tendons and ligaments, delays healing and weakens tissue.

In light of these findings, you would think that doctors would stop injecting joints and tendons. However, people can be crippled by arthritis and a single injection into a damaged knee joint can allow an arthritic to walk without pain. The same principle applies to athletes and exercisers, who can develop pain in their tendons, muscles, fascia and ligaments from injuries. When injuries heal in a few days, no treatment is indicated, but sometimes they persist for months to cause pain, particularly in the facia on the bottom or back of the heel, in the large tendon in the back of the lower leg, or in the tendons on the elbows or shoulders. Cortisone-type drugs reduce swelling and lessen pain and can allow an athlete or exerciser to get back to sports, but cortisone injections weaken the tendons for about three months.

If you suffer chronic pain in the tendons, muscles, ligaments or fascia, check with your doctor to see if you have a chronic disease causing it, such as arthritis or hepatitis. The non-steroidals that are usually prescribed block pain but do not help tissue to heal. Your doctor may prescribe light rehabilitation exercises. If you receive a cortisone -type injection, make sure that you protect that area from hard exercise for at least two months after you receive the injection.

Helmets Help to Prevent Head Injuries

Helmets can prevent more than 80 percent of the 247 deaths and 184,000 head injuries suffered by children in bicycle accidents in the United States each year (*Pediatrics*, November 1996.) More than one third of all patients admitted to hospitals after bicycle accidents have severe head injuries and more than one fourth suffer permanent brain damage or death (*Clinical Neurology and Neurosurgery*, November 1996.)

Your brain is encased in a sac of fluid. When you hit your head, your brain bounces around in its sac, hitting one side of your skull and then the other, causing bleeding and damage. Your head is not like a woodpecker's. If you hit your head with the same force that a woodpecker uses when it pecks on wood, you would fall on the ground unconscious. Woodpeckers don't suffer concussions because their

brains are held solidly in place so they can't bounce around. Helmets are supposed to fit your head the same way a woodpecker's skull fits its brain. If you can move your helmet when you hold your head still, it doesn't fit. Most helmets have an adjustable inner liner and chin strap so you can get a snug fit. Wear the helmet level, not tilted back. Choose a light helmet, since one heavier than 1500 grams increases your chance of breaking your neck in an accident. Helmets are evaluated by two standards: the Snell Memorial Foundation 1984 Standard and the American National Standards Institute. Check the label on your helmet to make it meets these standards.

How to Treat Blisters

A report in the *Journal of the American Academy of Dermatology* (August 1998) shows that applying an antiperspirant, aluminum chloride, to your feet can help to prevent blisters during running and hiking. Rubbing your skin can shear off the top layer from the bottom, causing a layer of fluid to form between them. Wetness and heat markedly increase your chances of getting blisters. Wetness causes skin surfaces to stick together, increasing the shearing forces. Heat weakens the skin and makes it more susceptible to tearing. Sweat is produced in glands deep in your skin and travels to the surface through small pores. Antiperspirants irritate skin, causing pores to swell shut, preventing the sweat from reaching the surface. Dry skin is far less susceptible to forming blisters. However, the study shows that aluminum chloride is also a potent irritant, so it can cause your skin to become red and raw unless you use it intermittently. Adding powder, such a corn starch or baby powder, to your socks can also help to keep your feet dry.

You will always feel pain when a blister is forming. If in the skin of your feet hurts while you're exercising, take off your shoes and look for a cause. Usually, your socks will be wrinkled or your shoes won't fit properly. If it's your socks, straighten the wrinkle. If it's your shoe, try to soften the part of the shoe that rubs against your skin by rubbing in mineral or bath oil and stretching the shoe. If you still develop blisters, buy a new pair of shoes. If you're too frugal to throw away the shoes, take a piece of white tape and place it tightly on the spot on your skin where the shoe rubs. Studies at Walter Reed Army Hospital show that the most effective treatment for blisters is to sterilize a pin and the skin over the blister, stick the pin into the side of the skin at the edge of the blister, express the fluid, and then tape the top layer of skin tightly over its base.

Side Stitch

A side stitch is pain in the right upper part of your belly during running. Tim Noakes, A medical school professor from South Africa offered the first reasonable explanation and a successful treatment. Lack of oxygen to the diaphragm doesn't cause stitches because blood flow to the diaphragm is not shut off by running. Gas stretching the colon doesn't cause stitches because the pain does not disappear when you relieve yourself. A swollen liver capsule is not a cause because the liver is not swollen when you have a stitch.

Thick fibrous bands called ligaments extend downward from your diaphragm to hold your liver in place. When you run, your liver drops at the time that your

diaphragm goes up, stretching the ligaments and causing pain. Humans have a fixed pattern of breathing when they run. They have a 2 to 1 breathing ratio, they breathe once for each two strides. So, they breathe out when one foot, usually the right, strikes the ground. When you breathe out, your diaphragm goes up, and at the same time, the force of your footstrike causes your liver to go down. This stretches the ligaments that attach the liver to your diaphragm, causing pain. When you get a stitch, stop running and press your hand deep into your liver to raise it against your diaphragm. You can resume running as soon as the pain disappears.

Don't Run if Your Back Hurts

People with back pain need to exercise as much as everyone else, but running is usually a poor choice of activity. The bones of your spine are located one on top of the other, separated by pads called discs. Bones are much harder than discs, so when spinal bones are compressed and move closer together, they can flatten the discs like pancakes. Since the discs are shorter, they have to go somewhere else, so they widen and press on the nerves near them, causing pain. This is called a herniated disc. Anything that presses the bones closer together squashes the disc further and usually makes it hurt more. This study shows that during running, the force of the foot striking the ground is transmitted up the leg to the back, compressing the discs and causing pain.

The best sports for people with back pain are those that do not hurt when you do them. Riding a bicycle, walking slowly and swimming do not exert a jarring force on the discs to compress them, so they are recommended for people with back pain as long as it doesn't hurt while they exercise. Doctors often recommend special exercises to flatten the lower back, strengthen the belly muscles and stretch the lower back muscles. The key to exercising when you have a compressed disc is to stop exercising when you feel pain. You may need to try several different activities to find the right one for you.

Asthmatics Can Compete in High-Level Sports

People with asthma can usually compete in sports at a very high level when they know how to do it. People who cough and wheeze when they exercise have asthma at other times also. Exercise-induced asthma means that you start to cough and wheeze 7 to 15 minutes after you start to exercise or immediately after you finish exercising. It's not caused by exercise, it's caused by breathing dry cold air. That's why running is far more likely to cause an asthma attack than swimming. All people who wheeze with exercise can wheeze when they are exposed to other triggers such as irritants like smoke, allergens like cat dander and infections.

If you are wheezing before you start to exercise, using an albuterol inhaler will help you to exercise, but it will not allow you to compete at your best. For at least a week before starting an important competition, you may need to take an antibiotic if infected, or a cortisone-type inhaler, and sometimes even cortisone-type pills. You can also help to prevent an asthma attack during competition by taking two grams of vitamin C one hour before your event (*Archives of Pediatric and Adolescent Medicine*, Volume 151, 1997). Another preventative measure is to exercise intensely 45 to 60

minutes before you compete to bring on an attack of exercise-induced asthma. This can prevent further attacks for up to 2 hours. Another approach is to wear a face mask that warms the air when you exercise in cold weather. These are only recommendations from research reports, so check with your doctor.

Update on Exercise-Induced Asthma

If you cough or become short of breath 7 to 15 minutes after you start to exercise, particularly in cold weather, you probably have exercise-induced-asthma. Check with your doctor, who will listen to your chest while you open your mouth wide and breathe out as hard as you can to see if he hears wheezing. Exercise-induced asthma is usually caused by breathing dry cold air. Those who wheeze when they exercise may also wheeze when they are exposed to barometric pressure changes before a storm, infection, irritants such as smoke, and allergens such as ragweed and cat dander.

Exercise-induced asthma is usually treated with a beta-agonist inhaler, such as Ventolin or Proventil, just before you exercise. Taking a single montelukast pill daily and a salmeterol inhaler twice a day is far more effective (*New England Journal of Medicine*, July 1998). Many competitive athletes with significant exercise-induced-asthma take steroid inhalers four times a day and oral steroids in the form of prednisone when their chest is too tight to allow them to compete. They also wear a face mask when they exercise in cold weather.

Training With Lung Disease

All athletes know that they have to train intensely to become strong and fast for competition. They cannot improve on easy, low-key exercise, no matter how much time they spend. The same applies to training people with the lung diseases, emphysema, chronic obstructive pulmonary disease, asthma and chronic bronchitis. To strengthen their muscles and improve lung function they must exercise more intensely. Each time they exercise intensely, their muscles are damaged and feel sore on the next day. If they try to exercise then, they are likely to injure themselves. Training for people with chronic lung diseases requires a program that increases the intensity of their workouts gradually and allows days off for recovery whenever their muscles feel sore.

They should start out by walking very slowly on one day until their legs feel sore and then they should stop. On the next day, they could use a rowing machine or conduct an orchestra with their arms until they feel heavy and then stop. They should take at least one day a week off and do nothing when they feel soreness. Ideally, they should try to walk and conduct a little faster one day a week. They should always check with their doctors to see how much exercise they can tolerate.

Air Pollution and Exercise

Automobile exhaust fumes are the principal source of air pollution in the North America and overlying clouds increase pollution. Usually the sun rays heat the ground to warm air closest to the ground. Hot air rises, taking large amounts of pollutants skyward. On air inversion days, the clouds prevent the sun's rays from

getting through to the ground, so the air near the ground is not heated, remains cold and doesn't rise, causing the air with its pollutants to remain close to the ground.

Air pollutants such as carbon monoxide, ozone, carbon dioxide, and sulfur dioxide can damage your lungs. When you exercise, you breathe more deeply and more frequently so that you breathe in more pollutants. However, you don't retain more pollution. Bicycle riders in rush hour downtown Washington traffic breathe in more carbon monoxide than car riders do, but have lower blood levels of carbon monoxide. There is less pollution before the heavy morning traffic peak from 7 to 9, and at least two hours after the evening rush hour ends. Stay away from streets with heavy traffic if you can.

Elite Athletes Often Develop Osteoarthritis

Elite athletes are supposed to have tough, strong bodies, but several studies show that former elite athletes have a much higher incidence of arthritis than non-athletes (*Medical Journal of Australia* , February 1997). Many factors cause arthritis: an overactive immune system, as in rheumatoid arthritis, when your antibodies and cells attack and damage your joints; an infection in your joint; crystals forming in and grinding away your cartilage, as in gout; or a gradual wearing away of cartilage called osteoarthritis. Osteoarthritis is the type that is common among former elite athletes. That may make you think that it's not a good idea to compete in sports. However, the data show that casual exercisers are far less likely than non-exercisers to suffer osteoarthritis.

The most likely explanation for the higher incidence of arthritis in former elite athletes is that the intense competitive drive that it takes to be a champion causes them to endure joint injuries and damage cartilage. They may injure their joints during competition, or they ignore pain and train through wear and tear injuries and suffer joint injuries that never heal. What does this mean to the casual exerciser? Make sure that you set up a program in which you do not exercise intensely on consecutive days and stop when you feel pain. It's exercising when you hurt that leads to osteoarthritis in elite athletes.

High Blood Pressure Treatment for Exercisers

The two types of drugs usually used to treat people with high blood pressure, beta blockers and diuretics, are the ones most likely to interfere with a person's ability to exercise. Beta blockers, such as Inderal, make you tired early in exercise by blocking your body's ability to respond to your own natural stimulants. Diuretics make you tired by causing you to start each exercise session dehydrated.

The vast majority of people with high blood pressure can achieve normal blood pressure by going on a low-fat diet and losing weight, but there are some who cannot control their high blood pressures without taking drugs. The drugs least likely to affect a person's ability to exercise or compete in high level sports are: Ace Inhibitors (Accupril, Altace, Capoten, Lotensin, Mavik, Monopril, Prinivil, Univasc, Vassotec, Zestril); Angiotensin-II-Receptor Blockers (Cozar); Calcium Channel Blockers (Adalat, Calan, Cardene, Cardizem, Covera, Dilacor, Dynacirc, Ispotin, Nimotop, Norvasc, Plendil, Procardia, Silar, Tiazac, Vascor, Verelan); and Alpha-1 Blockers

(Cardura, Dibenzlene, Esimil, Hylorel, Hytrin, Minipres) . If your blood pressure medication interferes with your exercise program, check with your health care provider to see if one of these drugs would be appropriate for you.

Early Training for Girls and Fertility

Before 1965, girls under the age of 14 were not allowed to run in races of more than one half mile. Members of the governing body of the Amateur Athletic Union were afraid that running long distances as a girl would prevent a woman from being able to have children. We now know that girls who train seriously in sports before they reach puberty are just as fertile, marry as often, become pregnant, have the same rate of obstetrical complications, and have children at the same age as non-athletes. Seriously training female athletes start their periods later than their non-athletic classmates. For every year that a young girl trains hard before puberty, her menstruation can be delayed by an average of five months. However, the delay in the onset of menstruation may be helpful rather than harmful because it allows more time for girls to grow taller. Bones grow only in special growth centers near their ends. When a girl starts to menstruate, her growth centers close and stop bone growth forever. Delaying puberty keeps the growth centers open longer and allows the children extra years to grow. However, the severe caloric restriction practiced by some young girls in sports such as gymnastics can result in reduced adult height and may lead to eating disorders.

Young female athletes are just as trainable and are no more likely to be injured than grown women. However, potential psychological damage *is* a serious concern. A tough coach or parent can sour the child on exercise. In one study, almost 90% of young female primary and middle school cross country runners did not go on to compete in high school.

Athletes with Irregular Periods Need Treatment

Because female athletes are far more likely than non-athletes to menstruate irregularly, some doctors do not treat irregular periods in athletes. All female athletes with irregular periods need to be evaluated for the cause and most need to be treated. A study in the *International Journal of Sports Nutrition* (March 1996) shows that the vast majority of women who develop irregular periods while they train for athletic competition do not need to stop training and do not need to take medications. All they have to do is eat a lot more food. Irregular periods in female athletes are almost always caused by not getting enough calories.

A woman should menstruate every 25 to 35 days. If she does not, she usually lacks one or both of her female hormones. Estrogen stimulates the uterus and breasts to grow. Progesterone stops the stimulation. Women whose bodies produce only estrogen have their breasts and uterus stimulated all the time and are at increased risk of developing uterine cancer. These women need to be given progesterone to protect them from cancer. Other women with irregular periods lack both estrogen and progesterone. Estrogen is necessary to keep bones strong. All women who lack estrogen will have a weakening of their bones, no matter how much they exercise. These women are at increased risk for developing osteoporosis and need to be given

estrogen to protect their bones. Irregular periods can also be caused by other factors such as not releasing an egg each month or a brain tumor.

Causes of Chronic Fatigue in Athletes

Competitive athletes often reach a point in their training when they feel tired and can't get through their workouts. There are lots of theories to explain this phenomenon and most are wrong. Athletes used to be told that tiredness is caused by low mineral levels and were advised to eat lots of fruit for potassium, nuts for magnesium, and salt tablets for sodium. However, researchers have repeatedly shown that healthy athletes rarely suffer from deficiencies of potassium, magnesium, sodium, or calcium. Viruses and other infectious agents will certainly cause athletes to feel fatigued. However, most of the time, doctors don't find any.

The most-common cause of chronic fatigue in competitive athletes is muscle damage. You train for competition by taking a very hard workout on one day, which tears your muscle fibers to shreds and makes your muscles feel sore on the next day. Then you're supposed to take easy workouts until the soreness disappears. However, many athletes are so obsessed with training that they attempt other hard workouts before their muscles have recovered and stop feeling sore. This prevents muscle fibers from adequately storing muscle sugar for fuel, so they contract with less force and tire earlier. If the athlete keeps pushing, either his muscles stay sore and fatigued for several days and weeks or he tears one of his muscle completely. Then he is exhausted and has to rest. If you are a competitive athlete and find that you can't get through your workouts, the odds are overwhelming that you are training too much. Take a rest, and if you do not recover in a few days, ask a doctor to look for a hidden infection or other cause.

Chest Pain with Cold Weather Exercise May Signal Heart Disease

If you develop chest pain when you exercise in *cold* weather, and not when you exercise in *warm* weather, check with your doctor. You could have heart disease. The blood supply to your heart comes from arteries on its outside surface. The blood that is pumped inside your heart's chambers brings almost no oxygen to your heart muscle. If you have arteriosclerosis, fatty plaques in your heart's arteries restrict the flow of blood to your heart, and therefore, your heart has to pump faster to bring more oxygen to your heart. Cold wind blowing on your face constricts your blood vessels and raises your blood pressure, which increases the resistance against the flow of blood so your heart has to work harder to pump blood through your body. It also slows your heart rate so that less blood is pumped to your heart muscle. A harder working heart requires increased flow of blood, but a slower heart rate brings less blood to the heart, so the heart suffers from lack of oxygen and hurts. While freezing your face slows your heart and can cause chest pain, freezing your fingers makes your heart beat faster and brings more oxygen to your heart. Putting your fingers in cold water may not cause chest pain, while exposing your face to a cold wind may do so. If you develop chest pain in cold weather, check with your doctor for heart disease, and cover your face with a scarf or wear a balaclava when you go out into the cold.

Hypothermia

If your body temperature drops below 90 degrees, you can die. Several summers ago, a group of people were hiking in blue jeans and denim jackets on the Appalachian Trail and it started to rain. The people felt terribly cold and some started to shiver. To reach shelter, they tried to walk as fast as they could, but one of the woman sat down on a log, couldn't get up and wasn't able to grasp the hand of a person trying to help her. She couldn't talk or move. That meant that her body temperature had dropped about 5 degrees Fahrenheit. People in her group carried her to a sheltered area, took off her clothes and placed her in a sleeping bag with a couple of the other women, using their body heat to warm her. Fortunately, she survived. She could have died.

When your body temperature drops one degree, your speech becomes slurred. With a drop of 2 to 3 degrees, you lose fine control of your hands. When it drops 3 to 5 degrees, you can't walk, and if it drops much further than that, you can develop irregular heart beats and die. If there is any chance that you might be caught in the rain, don't wear cotton. When wet, cotton clothes lose their insulating properties and offer no advantage over being naked. If you are going to be a long distance from help, carry an insulated sleeping bag or blankets in a water-proof container. Know the signs of hypothermia as your temperature drops. If some one in your party can't walk, get help immediately.

You Should Never Get Frostbite

Frostbite occurs when your skin freezes, but it should never happen to you. When your skin is exposed to cold, blood vessels in the skin close, causing it to turn white and your skin temperature to drop from a normal 90 degree temperature to 80 to 60 and when it reaches 59 degrees, your body tries to save your skin by opening blood vessels, causing the skin to turn red, itch and burn.

When this happens, get out of the cold. Otherwise, blood vessels in your skin close again and your skin temperature can drop below 30 degrees and freeze. Members of Polar Bear clubs swim in the middle of winter, but they know they must get out of the water as soon as their skin starts to burn and itch. They towel off and get out of the cold. If you can't get out of the cold when your skin turns red and itches, you can skin can freeze. Don't warm the frozen part if there is any chance that it will be frozen again. Specially trained personnel can warm the frozen area rapidly in a bath set at 104 to 109 degrees.

How to Avoid Heatstroke

Every year people pass out and die during exercise from a condition called heat stroke, a sudden uncontrolled rise in body temperature that affects the brain so that it can't function properly. Heat stroke doesn't just happen. You get plenty of warning. First your muscles are affected, then your circulation and then your brain. As your temperature starts to rise, your muscles feel like a hot poker is pressing against them. As it rises further, the air that you breathe feels like it's coming from a furnace and no matter how rapidly and deeply you try to breathe, you won't be able to get enough air. When this happens, stop exercising. If you continue to exercise, your body

temperature will rise further and affect your brain. Your head will start to hurt, you'll hear a ringing in your ears, you may feel dizzy, you may have difficulty seeing and then you will end up unconscious on the ground.

When a person passes out from heatstroke, his brain is being cooked just like the colorless part of an egg turns white when it hits the griddle. Get medical help immediately. Usually, the victim should be carried into the shade and placed on his back with his head down and his feet up. He should be cooled by any possible means. Liquid should be poured on him. It doesn't matter whether it's from a hose or a glass. It could be water, coke, milk, or whatever you have. After he is revived, he should be watched for more than an hour as his temperature can start to rise to high levels again.

Chapter 5. Eat to Compete

It takes a lot of energy to run, cycle or ski long distances; to play three sets of tennis, 18 holes of golf or a pickup game of basketball; or to walk through a mall for more than an hour. A study from Loughborough University in the United Kingdom shows that you can markedly improve your performance in all these events by starting to eat and drink as soon as you start exercising (*Medicine and Science in Sports and Exercise*, November 1996.)

The energy for your brain comes almost exclusively from the sugar in your bloodstream. When blood sugar levels drop, you feel tired and have difficulty coordinating your muscles. However, there is only enough sugar in your bloodstream to last three minutes at rest. To maintain blood sugar levels, your liver has to release sugar into your bloodstream. But there is only enough sugar in your liver to last around twelve hours at rest and far less than that when you exercise, so when you exercise for more than an hour, you have to start replenishing your energy reserves as soon as you start to exercise. Hunger during exercise is a very late sign of not getting enough calories. This study shows that you can increase your endurance a great deal by starting to eat anything or to drink fluids that contain sugar as soon as you start to exercise. This will give you far greater endurance than taking food after an hour of exercise or when you are hungry.

Eating for Endurance

If you are going to exercise for more than an hour, you can increase your endurance by eating at least every 10 to 15 minutes. A feeling of general tiredness during exercise is usually caused by low levels of stored sugar in your liver, while a feeling of muscle fatigue is usually caused by low levels of stored muscle sugar. Your brain gets more than 98 percent of its energy from sugar flowing to it in the bloodstream, but there is only enough sugar in your bloodstream to last for three minutes. Your liver must constantly release sugar from its cells into your bloodstream. However, there is only enough energy in your liver to last about 12 hours without replenishment.

Your muscles get their energy from many sources: sugar and fat stored in them, and sugar, fat and protein in the bloodstream. When your muscles run out of their stored sugar supply, they can hurt and feel tired. Bicycle racers have to ride almost flat out for five or more hours, so you will see their race courses littered with apple cores and banana peels, chicken bones, peanut butter and jam sandwiches and just about everything else. You can increase endurance by eating frequently, and you can eat whatever you like: chicken, fresh or dried fruits, steak, sandwiches or anything else. The sugar you get in sports drinks is not adequate to support strenuous exercise for long periods of time.

How to Avoid Running Out of Blood Sugar

During a long bicycle race, the leading rider falls from his bike and lies shaking in a seizure. He has bonked, or passed out from low blood sugar. Your brain gets

almost all its fuel from sugar in your bloodstream. When your blood sugar level drops, your brain cannot get enough fuel to function properly and you feel tired and confused and can pass out. There is only enough sugar in your bloodstream to last 3 minutes. To keep your blood sugar level from dropping, your liver has to constantly release sugar from its cells into your bloodstream, but there is only enough sugar in your liver to last 12 hours at rest. During exercise, your muscles draw sugar from your bloodstream at a rapid rate. Your liver can run out of its stored sugar and your blood sugar level can drop and you bonk. This is common in bicycle races when a rider does not eat frequently, but is rare in long distance running races.

When you run, your leg muscles are damaged from the constant pounding on the roads and you must slow down. However, you pedal in a smooth rotary motion which does not damage your muscles, you can continue to use up blood sugar at a rapid rate and your blood sugar level can drop and you can pass out. To prevent your blood sugar from dropping too low during exercise that lasts more than a couple of hours, eat at least every 15 minutes. It doesn't matter what you eat: peanuts, sandwiches, chicken, an apple or a banana or anything else. Almost all people can take small amounts of food frequently during exercise without developing stomach cramps.

What's the Best Exercise Drink?

The most effective way to prevent tiredness during exercise or competition lasting more than a couple of hours is to drink lots of fluid and take extra calories as often as possible. The best drinks for you, whether you are a recreational exerciser or a competitive athlete, are those that you like best (*Aviation Space and Environmental Medicine*, April 1998).

If you feel thirsty while you're exercising, you already have lost more than two pints of fluid. No matter how much you drink after that, you will not be able to catch up on your deficit. Thirst is a late sign of dehydration. You lose water during exercise primarily through sweating. Sweat contains a far lower concentration of salt than blood. So, exercisers lose far more water than salt, causing the concentration of salt in the blood to rise. A person will not feel thirsty until the concentration of salt in the blood rises high enough to trip off thirst osmoreceptor in the brain. It takes a loss of between two and four pints of fluid to do that.

It really doesn't make much difference what you drink as long as you get plenty of fluid, along with calories and salt in your food or drink. Salt is necessary to increase the rate that your body absorbs and holds water, while sugars supply you with energy. If you eat salty food, such as salty peanuts, along with your drink during exercise, you don't need salt or sugar in the drink and can use plain water.

Carbonated Beverages are OK

During exercise lasting more than an hour, you have to drink lots of fluid just to keep going, and the more fluid you drink, the less likely you are to become exhausted. The most important factor that determines how much you drink is how much you like the taste of the drink, and carbonated soft drinks taste best to many athletes. More than half of the cyclists in the 1997 U.S. Professional Championships drank cola soft drinks (*Sportscience News*, December 1997). Doctors used to think that the carbon

dioxide bubbles would acidify the blood and tire you during competitions, but researchers at Washington University in St. Louis showed that the bubbles in soda do not affect blood acidity and therefore do not harm performance.

The best drinks for competition contain about ten percent sugar, the amount found in almost all popular sodas and juices. Earlier research had concluded that drinks containing less than 5% sugar would be absorbed better, but more recent research shows that these studies were flawed because they were done on athletes at rest. Another concern was that the caffeine in many soft drinks is a diuretic that would cause you to lose more fluid, but research at the University of Guelph shows that it is not a diuretic during exercise. It appears that the caffeine in soft drinks helps muscles burn more fat and less carbohydrate, so that muscles preserve their stored sugar and can exercise longer. The only theoretical concern is that a person with a weak heart might develop irregular heart beats from the increased stimulation of caffeine.

Salt is Essential in Hot Weather

made that United States national team if they had known about research done in 1991. When you exercise intensely in temperatures above 80 degrees, you lose more than 2 or 3 pounds or pints of fluid each hour. You can replace fluid by drinking, but your stomach will allow only a little more than 1 pint of fluid, or half your losses, to pass through it each hour. So, no matter how much or often you drink during intense exercise, you will always lose more fluid than you can take in. As you lose fluid, your body temperature rises and you become weaker and more tired.

You can markedly increase water absorption by making it leave the stomach faster. Immediately after water leaves your stomach, it is absorbed through your intestines. Research by Nancy Rehrer of the University of Limberg in the Netherlands has shown that filling the stomach with water markedly accelerates stomach emptying. If you drink a large amount of water a half hour before a competition, you will start a race with a full bladder and be the worse off. However, if you drink 20 ounces or a little more than a pint of water just before the race starts, your stomach will be full and your bladder will be empty. Almost a pint will pass into the intestines in 20 minutes. Then you should take in about 3 ounces of water every 10 minutes if possible.

Alcohol Does Not Improve Athletic Performance

A running magazine published a story about a runner who felt tired near the end of a marathon, stopped for a few seconds, took a few gulps of vodka and then was so rejuvenated that he resumed running and sprinted past many other runners on his way toward the finish line. Alcohol affects your brain; when the runner thought that he was passing other runners, they were actually passing him.

Researchers at Rutgers University asked exercisers to pedal a bicycle for thirty minutes at a brisk pace, and then repeated the test several days later after each exerciser had two drinks. (A drink is the amount of alcohol that will remain in your blood stream for one hour: 12 ounces of beer, five ounces of wine or two-thirds of a shot glass of liquor.) They couldn't pedal as far after taking alcohol. Alcohol reduces the force of the contractions of your heart so that it can't pump as much blood through your body; increases the amount of oxygen that your body needs, so you tire sooner; makes you sweat more so you dehydrate earlier; and causes muscles to use up stored carbohydrate faster so they tire earlier. The only athletes helped by alcohol are shooters. Alcohol can make their hands more steady.

Exercise Affects Body Fat Content More Than Diet

Body fat is controlled more effectively by exercising than by dieting. When you exercise, you burn more calories, but you do not increase your intake of calories to replace all the extra calories that you burn (*Medical Science in Sports and Exercise*, August 1997). One day of very intense exercise does not increase your hunger significantly. But some people lose weight when they start an exercise program, while others do not. It makes a big difference how you exercise. To use exercise to help you lose weight, you should exercise intensely at least once a week. A study from Baylor University School of Medicine shows that after you finish exercising at a relaxed pace, you do not increase the rate that you burn calories, but when you exercise intensely,

your body temperature rises and it remains elevated, causing you to burn more calories for several hours after you finish exercising.

Intense exercise damages muscles so you shouldn't do it more often than once or twice a week. If you want to use exercise to help you lose weight, pick a sport and do regularly for a few months. When you are in shape, you should try to exercise intensely once a week. To prevent injuries, take off the day before and the day after your intense workout. Go easy on the other four days.

Iron Deficiency Can Decrease Endurance

Not having enough iron in your body can tire you during exercise, even if you are not anemic. Iron deficiency is rare in male athletes, but as many as 30 percent of female athletes who compete in intercollegiate sports have this condition (*American Journal of Clinical Nutrition*, August 1997). If they are tested only for anemia, they wouldn't find out that they are iron deficient. Less than 50 percent of the iron in your body is in your red blood cells; the rest is in your liver, spleen, bone marrow, lymph nodes, and muscles. You will not develop a low blood count from iron deficiency until you have used up all of your iron reserves. You can have low iron reserves but not be anemic.

During intense exercise, your muscles accumulate a product of metabolism called lactic acid, causing pain, tiredness and poor coordination. Muscles contain an enzyme called alpha glycero phosphate oxidase that helps to break down lactic acid. This enzyme contains iron. When your iron reserves are low, alpha glycero phosphate oxidase cannot do its job efficiently and lactic acid accumulates in your muscles and bloodstream, so you tire earlier during exercise. All female athletes should be tested for iron deficiency by having blood drawn for a serum ferritin level. If it is low, they need to take iron supplements, usually for a year.

Most People Can Exercise After Eating

You can go swimming right after you eat, provided that you're in reasonable shape, you eat small amounts, you don't exercise too intensely in the beginning, and you stop if you feel belly pain. Your stomach is a muscular balloon. Whenever it fills with food, its muscles contract and require large amounts of blood. When you exercise vigorously, your heart pumps large amounts of blood to your skeletal muscles. If your heart is not strong enough to pump blood to both your stomach and your skeletal muscles, blood is shunted from your stomach muscles and they start to hurt. However, most people can exercise after eating without suffering cramps.

Some people say that you shouldn't eat sugar before you exercise because it will cause your blood sugar level to rise and your pancreas to release insulin, which will then cause your blood sugar to drop too low and you will feel tired during exercise. However, sugar will sweeten your performance. The major cause of tiredness that you feel in your muscles during exercise is lack of stored sugar in muscles. Taking any extra calories before and during exercise helps to preserve the sugar that is stored in muscles and help you to exercise longer. If you are going to exercise for more than an hour, eat or drink whatever you like before and during your exercise. You need plenty of fluid and enough calories from any source -- carbohydrate, fat or

protein -- to sustain your muscles. Most people can eat fatty foods, sugars or anything else without suffering from cramps.

Timing is More Important than Content of Pregame Meal

Many athletes are superstitious about what they eat before a competition, but they can usually eat anything they want, provided that the food passes through their stomachs by the time they start competing. *When* you eat your pregame meal is far more important than *what* you eat. The pre-competition meal should be eaten not more than three hours before competition. Your brain gets more than 98% of its energy from sugar in your bloodstream and when blood sugar levels drop, you feel exhausted. However, there is only enough sugar in your bloodstream to last three minutes. To keep blood sugar levels from dropping, your liver constantly releases large amounts of sugar from its cells into your bloodstream. However, there is only enough sugar in your liver to last twelve hours when you rest and far less when you exercise.

If you eat more than a couple hours before you compete, you will start you completion with low liver sugar levels and you will tire earlier during competition. If you eat too close to the start of competition, the food may remain in your stomach and cause cramps. Most athletes eat to one to three hours before game time. You can eat anything that passes from your stomach rapidly. Usually fatty foods take longer to pass from the stomach, so some people avoid fatty pancakes, bacon and fried potatoes, but others can eat these foods within a half hour of competition and suffer no ill effects whatever.

Don't Fast Before Competition

A few years ago, an article in a popular running journal advocated fasting before a marathon to improve performance. Scientists and knowledgeable coaches recommend eating before and during athletic events that require endurance. How long you can exercise a muscle depends on how much sugar, called glycogen, you can store in that muscle before you start your competition and how long you can keep glycogen in that muscle during competition. When a muscle runs out of its stored glycogen, it hurts and you have difficulty coordinating it.

Every time that you exercise a muscle, you use up stored glycogen. When you eat after exercising, some of the food is stored as glycogen in your muscles. Not eating during exercise uses glycogen without replacing it. Fasting before an athletic competition causes you to start with reduced stores of glycogen in your muscles and you tire earlier.

Those who advocate fasting before competition have misinterpreted basic research. There is data to show that fasting causes your muscles to burn more fat and thus spare glycogen. This is irrelevant if you don't have enough glycogen stored when you start to exercise. You will run out of stored muscle sugar faster and tire earlier. If you plan to compete in an event that requires endurance, cut back on your workouts for three days prior to competition and eat your regular meals plus some extra carbohydrate, such as bread, spaghetti, fruits, whole grains and beans; eat a meal within two hours of your event; and take food or sugared drinks during your event.

Chapter 6. Straight Talk About Performance Enhancers

In the 1960's American athletes claimed that they were being beaten by East Germany athletes because of anabolic steroids, synthetic male hormones. Most American doctors claimed that American athletes were sore losers because male hormones did not make an athlete stronger. Most American athletes knew that many American doctors were idiots because an athlete can tell when he is taking a drug that makes him a better athlete. Athletic training is done by stressing and recovering, taking a hard workout and then feeling sore muscles on the next day and taking easy workouts until the soreness disappears. When an athlete takes male hormones, he learns quickly that workouts that used to take 3 days for recovery suddenly take one day. So, runners can run more miles and weightlifters can lift more and heavier weights. A weightlifter looks in his diary and sees that he has gone from lifting 20 tons a week to 40 tons, or a runner goes from running repeat quarter miles in 63 seconds to averaging 59 seconds. It is the increased recovery that allows them to do more quality work that makes them better athletes.

In 1983, I was part of an American delegation of sports physicians who visited Germany to discuss research we were doing on athletic competition. We talked about replacement fluids for endurance sports, the treatment of athletic injuries and training methods. The lying East German physicians presented papers only on using exercise to rehabilitate men who had heart attacks. When East Germany was disbanded, we learned that the East Germans were disgusting liars. Almost all their research was on drugs to improve performance and young children were objects of a government sponsored conspiracy to test drugs on athletic performance. Many of the young girls looked like men with acne and had huge masculine muscles and hair on their bodies. We learned that the huge doses of male hormones caused heart attacks and liver damage and it stopped young children from growing. Most likely Frank Shorter lost his Olympic gold medal in the marathon to Vladimar Cerpienski, who was part of the lying East German team that took steroids. Shirley Babashoff who was the world's greatest swimmer at the time was destroyed by the East German girls who were most certainly taking male hormones. How could she possibly compete against men?

Clenbuterol

When tests became available to detect athletes who were taking anabolic steroids, the East Germans continued to cheat by using clenbuterol, another drug that helped make their athletes stronger. Clenbuterol belongs to a class of drugs called beta agonists that are used to treat asthma. Clenbuterol hastens recovery so it can shorten the recovery period from three or more days to just one or two. The athlete can do more work and therefore becomes stronger. Because athletes can gain an unfair

advantage and also harm themselves, all beta agonists are banned by the International Olympic Committee. Clenbuterol is also used to grow larger cattle, and it is illegal to give clenbuterol or any other beta agonists to cattle. A report from Spain shows that humans can be poisoned by eating veal liver from cattle that have been given clenbuterol (*Public Health Reports*, May 1995). They developed nervousness, rapid heart rate, muscle shaking, muscle pain and headache 15 minutes to six hours after eating veal liver.

A useful application is suggested in a recent study that shows clenbuterol can possibly be used to strengthen hearts of people who are in heart failure (*Cardiovascular Research,* January 1998). Some weight lifters take albuterol, but the drug has not been approved by the FDA for building muscles.

Androstenedione

Now we learn that Mark McGuire takes androstenedione, a hormone that is produced naturally by our adrenal glands and is converted to testosterone in our bodies by the liver, adrenal glands and pancreas. So, taking androstenedione raises blood levels of testosterone and is, in effect, no different from taking testostoerne.

Soon, you will hear that androstenedione has exactly the same side effects as testosterone does because it is converted to testosterone. Androstenedione, itself is not dangerous. It is found naturally in the bodies of all men and women. Taking massive doses of it is dangerous because it causes rises in testosterone. AND every young kid in North America will want to take androstenedione because he wants to be like Mark McGwire.

Anabolic Steroids and Female Athletes

What do you think when female athletes from one country start breaking world records when the men from that same country produce mediocre performances in the same events? The women have to be taking male hormones to make themselves stronger. The East German female swimmers dominated world swimming in 1972, while their men didn't. The Chinese female swimmers dominated world swimming in 1992, while their men didn't. They should have competed against men because they took male hormones. In the 1996 Olympics, a female athlete improves from not even being ranked in her event to winning a gold medal. She attributes her success to extraordinarily hard workouts. Of course, male hormones help athletes to recover faster from hard workouts so they can do more work, and therefore improve their performance.

Can a woman take male hormones and escape detection? Yes! Even slight changes in male blood hormone levels can convert mediocre female athletes into champions. A normal woman has a blood level of testosterone between 10 and 100. Those who have levels below 20 usually are not aggressive and have smaller muscles and bones. Those who have normal levels near 100 are usually much more aggressive and have much larger muscles and bones. Since small increases in testosterone manufactured by a woman's body can increase athletic success, giving small amounts of these same hormones can also improve athletic prowess without raising blood testosterone levels much above those felt to be normal.

Creatine Phosphate

Some exercisers take creatine phosphate pills because they think that it helps to make them stronger. Most research shows that it doesn't but it may enlarge muscles and increase endurance when you are performing repeat bouts of all-out exercise (*International Journal of Sports Nutrition*, June 1997).

Your muscles need a source of energy when you exercise. During exercise, your muscles burn carbohydrates, fats and protein for energy, and these sources require adequate amounts of oxygen. When you exercise so vigorously that you gasp for breath and still can't get enough breath, you have to use alternative energy sources that do not require oxygen, such as creatine phosphate and ATP. For example, when you race 440 yards, you run low on oxygen before you reach 400 yards and continue to run on will power, pain and creatine phosphate. Respected scientists in England feel that giving creatine phosphate to runners will increase their ability to do repeat bouts of very fast running and it helps to increase endurance in people in heart failure (*European Heart Journal*, April 1998). Creatine supplements increase water retention to enlarge muscles, but they have not been shown to make you stronger.

Growth Hormone

Since blood levels of growth hormone drop with aging, some entrepreneurs tell you to take growth hormone pills to prevent the signs of aging or to help grow larger and stronger muscles. A report from the University of North Dakota shows that mice who are dwarfs because they lack growth hormone live one and a half times as long as mice that produce growth hormone *(Nature,* November 1996). Short men live five years longer than their taller countrymen and smaller breeds of dogs and horses live longer also. One study from the University of Wisconsin appeared to show that growth hormone makes older men more muscular, less fat and more sexual. More recent reports show that growth hormone does none of these and may even shorten lives. One study from the University of Washington shows that men who took growth hormone and lifted weights did not gain any benefit over men who just lifted weights *(Clinical Endocrinology*, August 1997).

Most athletes who have taken growth hormone feel that it has made them stronger and faster and has given them greater endurance. Scientists have shown that growth hormone increases blood levels of another hormone called insulin growth factor-1 that has been shown to enlarge and strengthen muscles, including the heart. Indeed, even small doses of growth hormone have been shown to decrease body fat and increase muscle size (*Aging-Clinical and Experimental Research*, June, 1997). Several members of a United States Olympic team claim that one athlete went from mediocrity to Olympic championships because of hard training and heavy doses of growth hormone. However, there is a price to pay. Growth hormone enlarges all the organs in the body including the heart, causing it to outgrow its electrical supply and beat irregularly. Think of this when an athlete dies mysteriously in the middle of the night. It can also damage joints to require joint replacements later in life.

DHEA

Millions of men and women take DHEA pills (dehydroepiandrosterone) because of studies that show that food restriction with adequate nutrients prolongs the lives of animals and prevents the expected drop in DHEA that occurs with aging. DHEA is a hormone that is produced by adrenal glands and converted to male and female hormones. Men with high blood levels of DHEA are more fit, have higher blood levels of the male hormone, testosterone, and have lower total cholesterols and better ratios of the good HDL cholesterol to the bad LDL cholesterol, while those with the lowest DHEA levels are at increased risk for heart attacks (*Journal of the American Geriatrics Society*, March 1998).

DHEA also may prevent heart attacks by blocking plasminogen activator antigen, and a DHEA cream appears to strengthen bones without adverse side effects. It may help to prevent brain damage and depression, and may be a treatment for lupus, a disease that can damage the kidneys. On the other hand, a recent study from Baylor College of Medicine in Houston shows that taking DHEA raises blood levels of insulin-like growth factor-1, that helps by increasing muscle and bone size and harms by increasing a person's chances of getting prostate or breast cancer or benign prostatic hypertrophy (*Fertility and Sterility*, July 1998). DHEA also raises total cholesterol and lowers blood levels of the good HDL cholesterol. Scientists cannot agree whether DHEA pills help or hurt.

Coenzyme Q-10

Athletes and regular exercisers are spending millions of dollars for coenzyme Q-10 supplements that are supposed to increase their endurance. A study from Australia shows that they don't (*International Journal of Sport Nutrition*, September 1997). Coenzyme Q-10 is made by your body and is found in the mitochondria of muscles. It helps your body use oxygen to power your muscles during exercise. Athletes who take coenzyme Q-10 pills have higher blood levels of that enzyme, but do not have greater endurance and do not increase their ability to take in and use oxygen. For coenzyme Q10 to increase endurance, it must get into the mitochondria. Studies show that coenzyme Q10 from pills gets into the bloodstream, but it cannot be recovered in the cells.

The U.S. Food and Drug Administration doesn't believe that coenzyme Q10 pills prevent heart attacks, allergies or cancers, prolong your life or make you a better lover, as some manufacturers claim. Reactions in your body produce chemicals called oxidants that damage cells and shorten life. To protect your cells from oxidant damage, your body produces antioxidants such as superoxide dismutase and coenzyme Q10. Since tissue levels of coenzyme Q10 drop with aging, it was tempting to think that reduced levels of this coenzyme cause aging. However, research shows that lowered levels are the result of aging rather than the cause, because coenzyme Q10 is found in the mitochondria, the energy sources of cells. With aging, the number of mitochondria and size of cells become smaller, so everything in the mitochondria is reduced. Coenzyme Q10 has been shown to be ineffective in treating heart attacks and diseases affecting the mitochondria. Years ago, a researcher at the University of Texas showed that people who have arteriosclerotic heart disease have lower blood levels of coenzyme Q10 than people who have normal hearts. People

with damaged hearts have less functioning heart muscle, so they can be expected to have lower levels of coenzyme Q10.

Protein Supplements are No Better than Food

Protein supplements are made from foods, such as milk powder, tuna fish and soybeans. No process has been devised by man that can make a protein extract from food more effective in building muscles than the food itself. It is illegal in this country for a manufacturer to claim that protein supplements will make you stronger, give you larger muscles or make you a better athlete. To support this position, the Food and Drug Administration commissioned a study by the Federation of American Societies for Experimental Biology (FASEB). The FASEB found no scientific reason for healthy people to take protein supplements.

Several other studies have shown that protein supplements do not help athletes to become stronger or develop larger muscles. Protein supplement manufacturers promoted "free form" amino acids, but scientific data show that adding acid to protein to separate the amino acids offers no benefit, since your stomach and intestines do that highly efficiently anyway. Then the manufacturers made the claim that specific amino acids, arginine, ornithine and lysine, raise growth hormone levels which make muscles larger and stronger. Recent studies have shown that these amino acid supplements do not affect insulin, testosterone, cortisone or growth hormone levels, they do not make athletes stronger and they do not build larger or stronger muscles.

Aspirin Does Not Improve Athletic Performance

Many athletes think that taking aspirin or other nonsteroidals before competition helps block the muscle pain that they feel when they exercise intensely and will help them to compete more effectively. It doesn't. When you exercise intensely, you run out of oxygen and your muscles start to burn. This is caused by breakdown products of energy metabolism accumulating in muscles to make them more acidic and hurt. Aspiring does not block the acidity and therefore, it does not block pain (*Medicine and Science in Sports and Exercise*, August 1997). The only way that you can stop the burning is to slow down to allow lactic acid to be cleared. On the other hand, a single dose of three adult aspirin tablets before exercise will not hinder strength, speed, coordination or endurance,

When you are injured, your muscles feel sore and taking aspirin will help to relieve some of the pain, but they do not help you to heal faster or improve strength. They can cause diarrhea, belly pain and bleeding. Taking aspirin and or other nonsteroidals for several days after injuring yourself can delay healing. Try to avoid exercising when your muscles feel sore because the soreness means that your muscle fibers are torn and frayed. Exercising before the fibers heal is likely to tear that muscle.

Over-the-Counter Stimulants

Some exercisers take over-the-counter pills to treat their stuffy noses or to help them lose weight. These drugs belong to a class of drugs similar to the amphetamines that killed an English bicycle racer, Tony Simpson, in the 1967 Tour de France and are prohibited in many competitions including the Olympics. However, a study from the University of West Virginia shows that over-the-counter doses of these drugs can be taken safely by most healthy people *(Clinical Journal of Sport Medicine*, July 1997). In the study, recreational cyclists took conventional doses of these stimulants and they did not change the maximum amount of oxygen that their bodies could use, time to exhaustion on the bike or blood pressure. However, their urine contained enough of the stimulants to disqualify them from competition.

Most healthy people can treat a cold or allergy attack with pseudoephedrine pills or take phenylopropanolamine to suppress appetite, but do not expect your athletic performance to improve. This does not mean that everyone can take these drugs safely. People with irregular heart beats, weak blood vessels or high blood pressure could be harmed by these stimulants.

Special Nose Strips Won't Improve Your Performance

Sports magazines contain advertisements for a special plastic strip that you can tape across your nose. It is supposed to help you run faster, jump higher, throw further and have greater endurance. The plastic strip may help people with chronic stuffy noses to breathe better at rest by widening the openings, but it can't possibly help you during intense exercise which forces you to breathe through your mouth.

People who have stuffy noses all the time often have a nasal allergic wrinkle, a line that forms across their noses half an inch above the tip parallel to the ground. They find that they can breathe better when they push the tip of their noses up and back. The nasal strip does the same thing, pushing the tip of the nose up and back and makes the holes in each nostril wider. However, competitive athletes do not breathe through their noses when they compete at maximum intensity. They couldn't get enough air through their noses to meet their needs for oxygen. The cross section of the two holes in the nose is less than one tenth the size of the cross section of your throat, so you would instinctively open your mouth when you exercise intensely. If you didn't, you would turn blue. One study from the University of Charleston in West Virginia demonstrates that the special nasal strip does not help bicycle riders to cycle longer. The strips may help you at rest because your nose helps to warm and clean the air.

Chapter 7. It's Never Too Late

Is it more important to exercise when you are young or when you are old? Harvard and University of Michigan varsity letter-winners do not live longer than their less-athletic classmates, but people who exercise regularly as they age live 3 to 7 years longer than non-exercisers. It's called reversibility. Every benefit gained by exercising is lost soon after you stop. Muscles enlarged by lifting heavy weights return to their previous size within a few weeks after you stop lifting and people who do aerobic exercise have slow heart rates and greater endurance.

Regular exercise is the most effective way to prevent the gradual weight gain that often comes with aging. If you're tired of being out of shape, check with your doctor. Then pick a continuous sport that you will enjoy doing such as walking, swimming, cycling, dancing, and so forth. Start out by exercising slowly and comfortably until your muscles start to feel heavy or hurt and then stop for the day. Do this every other day and gradually increase the time you spend exercising, always stopping when your leg muscles feel heavy or hurt. When you can exercise continuously for 30 minutes, three times a week regularly, you are fit and don't need to do more unless you want to.

Competitive Strategies for Seniors

To be competitive, you will have to run very fast in practice, but running fast markedly increases an older person's chances of becoming injured. The best runners in the world do not run fast more often than three times a week. They usually do not try to run fast on consecutive days and they run more slowly the rest of the time. If an older runner wants to avoid injuries, he probably should not run fast at all, but if he wants to be competitive, he has to run fast probably only once a week. The best master runners are those who took up running late in life or were genetically immune to injuries. Every injury that you have in your younger days tends to recur when you run fast in later years.

Try running fast on Wednesday and a little longer on Sunday. You probably shouldn't run at all on Thursday, the day after you run very fast. The most effective interval fast run takes around two minutes, the time it takes to build up considerable lactic acid in your bloodstream. You could run 660 yard repeats, one and a half times around a standard track, and try to do four to six as fast as you can with a slow jog of five to 10 minutes between each. A training schedule would include running fast 660 yard repeats on Wednesday, taking off Thursday, running a comfortable distance slowly on Monday, Tuesday, Friday and Saturday and a little longer on Sunday. This schedule can be adapted to any competitive sport for seniors.

Lifting Weights Faster Helps Older People

People over 70 often walk with faltering steps and find it difficult to get out of a chair because their muscles are weak. An exciting new study from the University of Miami in Coral Gables, shows that lifting weights fast may be the best way to improve their coordination and strength (*Federation of American Societies for Experimental Biology Annual Meeting*, May 1998).

Most people lift and lower weights very slowly. They may spend two seconds lifting a weight and three seconds lowering it, but moving the weights slowly doesn't give you very much power. So knowledgeable coaches recommend that athletes in sports that require power lift and lower weights very fast to make them quicker on the playing field. The authors of this study asked some older people to lift weights very slowly and others to lift very fast. All became stronger, but those who trained at fast speeds were more coordinated in pushing on levers at high speed, walking and doing other body movements. So the rule of specificity applies to people of all ages. If you want to be strong in events requiring fast movements, you have to lift and lower

weights rapidly. Lifting weight with fast movements helps older people to perform daily tasks more efficiently than lifting weights slowly.

Coordination Remains Intact with Aging

If you want your children to have an activity that they can follow for a lifetime, encourage them to play a musical instrument rather than competitive sports. Pablo Casals, Nadia Boulanger, Arturo Toscanini and Leopold Stokowski conducted major orchestras into their nineties. Casals and Eubie Blake gave concerts on the cello or piano in their nineties. Neither marathon runners nor weight lifters can perform well at that age. A study in the *Journal of Experimental Psychology* (December 1996) shows that trained musicians can continue to play at an extraordinarily high level, provided that they continue to practice. This is surprising because with aging, muscles lose strength and ability to recover from hard work. Tests on aging concert musicians showed that they retain the finger tapping speed and general reaction time of their youth, which are primarily measures of coordination, rather than muscle function. Being able to run long distances, lift heavy weights, or hit a baseball depends more on your muscles, which lose their function with age. Being able to play a musical instrument depends more on your brain's ability to coordinate the more than 500 muscles in your body. Your brain is far more durable than your muscles. Senility is an abnormal process that is caused by disease. If you want to give your children an activity that they can use for a lifetime, teach them music. Athletic ability flees with time.

Older Muscles Don't Take Longer to Heal

Several studies show that when older people damage their muscles during exercise, they heal just as quickly as younger people do. Most older people will find this hard to believe. In one study, older people recovered from vigorous exercise just as rapidly as college students. However, they have to exercise less frequently and with less intensity because they have fewer muscle fibers, and the remaining fibers lose some of their elasticity.

Muscles are made up of thousands of individual fibers, just as a rope is made up of many smaller threads. Each muscle fiber is innervated by a single nerve. As you age, your nerves start to die and disappear. When you lose nerves, you also lose function in the muscle fiber innervated by that nerve. Thus, older people have fewer fibers in their muscles and are more likely to injure themselves when they try to take the same workouts as younger people. However, your remaining muscle fibers are just as trainable as when you were younger, so you can become stronger and faster and increase your endurance as long as you stop exercising when you feel pain.

An excellent exercise program to retard the effects of aging includes strengthening your upper leg muscles by pedaling a recumbent stationary bicycle on one day and strengthening your back muscles and upper body by pulling on a rowing machine on the next. If you feel pain or fatigue, stop immediately and try again the next day.

How Exercise Helps to Prevent Heart Attacks

Oxygen and nutrition for your heart muscle comes from arteries on the outside surface of your heart, not from the blood pumped inside the heart's chambers. A heart attack occurs when fatty plaques accumulate on the inner surface of these arteries to obstruct the flow of blood partially, and then a clot forms to block the flow of blood completely. An article from Switzerland shows that a regular exercise program increases the number of blood vessels on the surface of the heart so if you suffer complete obstruction of blood flow to one area of the heart, your heart muscle stays alive by receiving blood from other arteries close by (*Journal of the American College of Cardiology*, July 1998).

A study from Harvard Medical school in the same issue confirms other reports that taking drugs to lower cholesterol can help to prevent heart attacks. Everyone should eat a diet rich in fruits, vegetables, whole grains and beans and exercise regularly, particularly those who have a family history of heart attacks. Changes in cholesterol from these lifestyle changes can be seen in as little as one week. If your good to bad blood cholesterol ratio is still unfavorable, you may need to start on drugs to lower cholesterol to prevent a heart attack.

Exercise Saves Diabetics

If you are diabetic, exercise to save your life. Diabetics suffer heart attacks, strokes, blindness, deafness, nerve and kidney damage, amputations and more. All these horrible effects are caused by blood sugar levels rising too high after meals, forcing sugar to attach to the surface membranes of cells. Bound sugar which is harmless is then converted to a poison called sorbitol which causes the damage. The key to preventing complications of diabetes is to prevent blood sugar levels from rising too high after meals. Doctors have a blood test called hemoglobin A1C that measures how much sugar is stuck on cells and they should follow diabetics monthly until the levels are normal, below 6.5.

Exercise helps to prevents nerve damage by preventing blood sugar levels from rising too high. It uses up stored sugar in muscles and liver, so after you eat, your liver and muscles rapidly remove sugar from the bloodstream and prevent sugar levels from rising too high. A regular exercise program can prolong the lives of all diabetics. Pick two sports, one that stresses your upper body such as rowing or swimming and one that stresses you lower body, such as walking or pedalling, and do them on alternate days.

A Healthy Lifestyle Prevents Ravages of Aging

A study from Stanford University shows that you can prevent the pain, misery and loss of mental function associated with aging and decrease your chances of living in a wheelchair by exercising and eating a low fat, high-fiber diet and avoiding smoking, excessive drinking and being overweight (*New England Journal of Medicine*, April 1998).

When it comes to preventing the ravages of aging, it matters little what you did when you were younger. Studies from Harvard and the University of Chicago show that varsity letter winners are not more healthy and do not live longer than their classmates who never participated in varsity sports, but those who exercise late in life are healthier and live longer than those who don't. The same applies to smoking.

Smoking a pack a day for more than 20 years doubles your chances of getting a heart attack. However, one year after stopping smoking, a persons chances of getting a heart attack return to those of the non-smoking population. Furthermore, one week after starting a low-fat, high-carbohydrate diet, your cholesterol can drop to normal and one week after stopping a low-fat diet, your cholesterol can raise to high levels. Loss of intelligence is related to ministrokes more than any other factor. The effects of aging and ministrokes are prevented by eating a low-fat, high-fiber diet based on fruits, vegetables, whole grains and beans, avoiding smoking and excessive drinking, and exercising regularly.

Index

www.DrMirkin.com
has hundreds of reports on fitness, health and nutrition by Dr. Gabe Mirkin and Diana Mirkin

Subscribe to Dr. Mirkin's free weekly fitness and health email newsletter
http://www.drmirkin.com/email/newssign.asp