

# Scientific Fitness Principles

There are several universally accepted scientific fitness principles that must be followed in order to get the most from exercise programs. These principles include :

## 1. The Principle of Individual Differences

The principle of individual differences simply means that, because we all are unique individuals, we will have a slightly different response to an exercise programme. Exercise programs should be based on our individual differences and responses to exercise. Differences have to do with body size and shape, genetics, past experience, injuries, and chronic conditions.

## 2. The Principle of Overload

The exercise scientific principle of overload states that a greater than normal stress or load on the body is required for training adaptation to take place. What this means is that in order to improve our fitness, strength or endurance, we need to increase the workload accordingly.

## 3. The Principle of Progression

The principle of progression implies that there is an optimal level of overload that should be achieved, and an optimal time frame for this overload to occur. A gradual and systematic increase of the workload over a period of time will result in improvements in fitness without risk of injury. If overload occurs too slowly, improvement is unlikely, but overload that is increased too rapidly may result in injury or muscle damage. The Principle of Progression also stresses the need for proper rest and recovery. Continual stress on the body and constant overload will result in exhaustion and injury.

## 4. The Principle of Adaptation

Adaptation refers to the body's ability to adjust to increased or decreased physical demands. It is also one way we learn to coordinate muscle movement and develop sports-specific skills. Adaptation explains why beginning exercisers are often sore after starting a new routine, but after doing the same exercise for weeks and months they have little, if any, muscle soreness.

## 5. The Principle of Use/Disuse

This simply means that your muscles hypertrophy with use and atrophy with disuse. This also explains why we decondition or lose fitness when we stop exercising.

## **6. The Principle of Specificity**

The Specificity Principle simply states that exercising a certain body part or component of the body primarily develops that part. The Principle of Specificity implies that, to become better at a particular exercise or skill, you must perform that exercise or skill.

# **Scientific Principles for Effective Muscle Gain**

## **1. Limited Energy Level**

A strength-training program should be short and simple as you only have a limited amount of energy per training session.

Scientific studies reveal that blood sugar levels (energy) start to deplete after 30 minutes, so exercise selection and the time taken to perform them is crucial.

What you should be aiming for is stimulating as many muscle fibres in the shortest period of time available.

Your blood sugar levels deplete after high intensity training (usually between 20 - 30 minutes) and remember that you need energy to recuperate after the workout.

The trick is to give yourself a high intensity workout before your blood sugar level depletes, and then you will have given your body the exercise that it requires to gain the maximum amount of muscle possible.

## **2. Progressive Overload**

Progressive Overload is the main exercise principle you need to be aware of in order to get the results that you're after with strength training.

The two most important points are:

- Complete your exercise with perfect technique
- Push maximally when doing a set and overload the weight on the bar progressively. (Overload your targeted muscles to beyond what they are used to.)

This means that when the body is stressed by high intensity training beyond its normal demands, the body will adapt to these new demands of improved strength.

Remember to always use GOOD TECHNIQUE. Technique must never be sacrificed for a heavier load.

## **3. Training Frequency**

The only way the majority of people can make any gains is to perform short intense workouts followed by long periods of rest so as to avoid overtraining.

Many studies conducted around the world have shown clearly that recuperation from strength training requires far more rest time than previously thought. Infrequent, short, high intensity weight training sessions, followed by the required amount of time to recover and become stronger, are necessary for you to increase your functional muscle.

### 1. Exercise selection for intensity

Exercise selection is crucial. There are only a few exercises that you really need to perform. These exercises consist of multi-joint movements.

### 2. Visualization

By training your mental state as well as your body you can even further progress in muscle growth.

## **Correct Exercise Order for Growth**

When working out it is best to train larger muscles first and smaller muscles last. Training large muscle groups (thighs, chest, and back) will take a majority of your energy; therefore you need to train your large muscle groups when you are at your strongest.

Smaller muscles (biceps, triceps, and forearms) should be trained after larger muscles because they don't require as much energy to train. If you train smaller muscles first then you will not have enough strength left to train your larger muscles.

Correct breathing application can provide for both reduced injury risk and enhanced growth and development potential.

### **Injury risk** (internal and external)

- Heart rate response
- Blood pressure
- Valsalva maneuver
- Lactic acid

### **Growth and development**

- Neural impulse activity
- Motor-unit recruitment
- Movement methodology

Difference between the Concentric and Eccentric phases of a movement.

Process of a neural impulse transmission.

Differences between “**Mass-Mover**” and “**Isolation**” exercises.

Compound exercises move the body through more than one joint movement, while isolation exercises only move the body through a single-joint movement.

Probably the best exercise to demonstrate the difference is the barbell squat. This "king" of all compound exercises moves your body using a majority of your muscle groups and bends you at your ankles, knees, waist, hips, and to some degree, even your shoulders.

Compare this to an isolation exercise such as leg extensions, which only move your body by bending one joint: the knee.

### **So which is better?**

To provide complete muscle fiber stimulation, you should take advantage of the benefits of both types of exercises. However, if your main goal is to build muscle, you should use compound exercises as the main focus point of your weight training program and bring in complimentary isolation exercises to supplement the "big movers".

Compound exercises allow you to lift heavier weights and work more muscle groups at the same time than isolation exercises. This saves you precious time at the gym while stimulating the maximum amount of muscle fibers.

In addition, compound exercises, due to the increased amount of muscle used for the movements, are better at sending your endocrine system a "distress call" to pump out more anabolic hormones such as testosterone and growth hormone.

### **Body Parts and Associated Compound Exercises**

Shoulders: Military Press, Hang Clean and Press, Arnold Press

Arms: Close-Grip Chin-Up (w/palms facing toward your face), Dips, Close-Grip Push-Up, Twisting Dumbbell Curl

Legs: Barbell Squat, Deadlift, Lunges

Back: Chin-Up, Pull-Down, Deadlift, Row

Chest: Push-Up, Dips, Bench Press

### **Aspects of “Proper Spotting”**

#### **Spotting Techniques**

Let me start out by saying that this is a big responsibility for either party. Choose your spotter wisely and make sure that you spot to your abilities.

Pay attention to the person you are spotting at all times.

Be prepared to help the person being spotted instantly.

Ask the person being spotted if they would like you to put your hands on the bar. (Some people do and some people don't.)

Ask the person being spotted how many reps they think they can handle on their own.

Make sure that you can handle the weight that you are spotting. If you don't think you can handle it don't try to help anyway.

Provide only the effort that the person requires from you. Don't jerk the weight around while someone is trying to lift it.

Offer encouragement to the person lifting the weight. This can really help them. They might be able to squeeze out those last reps.

Components and principles of the **“Forced-Reps”**

## **Advanced training applications**

Stripping (Requires a spotting partner)

### **Example:**

While doing a 225-pound bench press you are able to get 8 good reps out. After your eighth rep your spotting partner takes 20 to 40 lbs off the bar and you continue your reps until you can't go any further. Your spotting partner takes off another 20 to 40 lbs and you continue until failure.

This is a really intense way of lifting and you shouldn't do more than 1 to 2 sets using this method during a workout session.

Negative Reps (Requires a spotting partner)

### **Example:**

Load the bar using more weight than you would use normally. Lower the weight under your own power and have your spotting partner help you lift the weight to the starting position. A person has more strength in the negative portion (lowering) of an exercise. Do a few reps and your muscles will start to burn from the lactic acid. Rack the weight.

Don't abuse this exercise because it can lead to overtraining. This is a really intense way of lifting and you shouldn't do more than 1 to 2 sets using this method during a workout session.

### **Example:**

You are in the middle of an exercise and you get to the last rep and you can't go any further. Using partial reps you continue to bring up the weight as far as you can (a few inches) and then lower it. Get out 5 or 6 more reps if you can. This will work the muscle until it burns. This burn means you have stimulated many of your muscle fibers.

Partial Reps or Burns (Doesn't require a spotter)

#### **1. Piramiding**

- Incline
- Decline
- Combination

#### **2. Super setting**

- Same body part
- Different body parts

#### **3. Giant setting**

#### **4. Strip setting**

### **“Intensity Equation”**

## **Differences between free-weight and variable-resistance training**

Machines Versus Free Weights

### The Advantages of Machines:

They are great for beginners because they are safe and easy to use.

Machines guide your body through a certain range of motion.

You don't have to worry about balancing the weight as much as with free weights.

Machines don't require as much coordination.

Machines isolate each muscle group.

Machines let you get in a fast workout. You go through a circuit of machines and then you are finished.

Machines are usually arranged so that you work large muscle groups and then smaller muscle groups.

#### The Disadvantages of Machines:

Machines don't fit everybody. They can be hard to adjust.

Machines don't build as much balance or coordination.

Machines can put your body into a bad range of motion. (If you feel uncomfortable move onto another machine.)

Machines are not portable. They can't be moved around very easily.

Many bodybuilders believe that working out with machines alone doesn't build a very good body.

#### The Advantages of Free Weights:

Free weights are versatile. One set of dumbbells can be used for many exercises.

Free weights build better balance and coordination.

Free weights work your muscles in a way that matches real life.

Many bodybuilders primarily use free weights to gain their massive size.

Free weights allow you to strengthen muscles and tendons that wouldn't get much work when using machines.

#### The Disadvantages of Free Weights:

Free weights can be difficult because of the balance and coordination required.

A free weight workout will take longer than a machine workout.

You can get injured more easily using free weights.

## **Workout without a Gym**

### **Leg Exercises**

-Squats

-Lunges

## **Back Exercises**

-Chin-ups

-Bent Over Row

## **Chest Exercises**

-Push-Up

-Dips

# **Musculoskeletal Anatomy**

## **Terminology:**

**Anterior:**

**Posterior:**

**Superior:**

**Inferior:**

**Lateral:**

**Medial:**

**Proximal:**

**Distal:**

**Rotation:**

**Flexion:**

**Extension:**

**Adduction:**



**Abduction:**

**Muscle:**

**Tendon:**

**Supination:**

**Pronation:**

## **Back and Thorax:**

### **Bones of the Back and Thorax:**

Spine-

Ribs-

Pelvis-

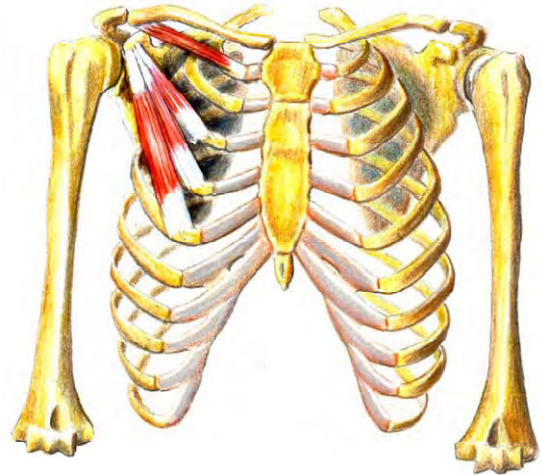


## **Muscles of the Thorax and Back:**

Pectoralis M



**Pectoralis Minor-**

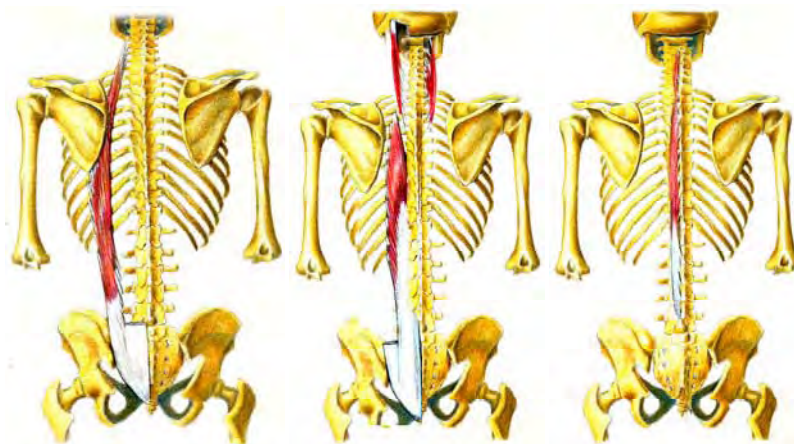


**Latissimus Dorsi-**



**Paraspinal/Vertebral-**

**Iliocostalis, Longissimus Dorsii, Spinalis:**



**Intercostalis Interni/Externi-**

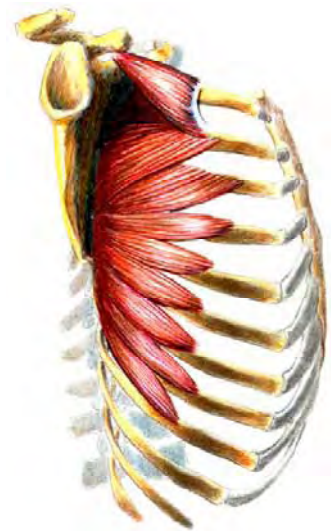
**Serratus Anterior-**

**Shoulder:**

**Shoulders Girdle Bones:**

**Scapula-**

**Clavicle-**



**Manubrium-**

**Humerus-**



**Muscles of Shoulder Girdle:**

**Trapezius-**



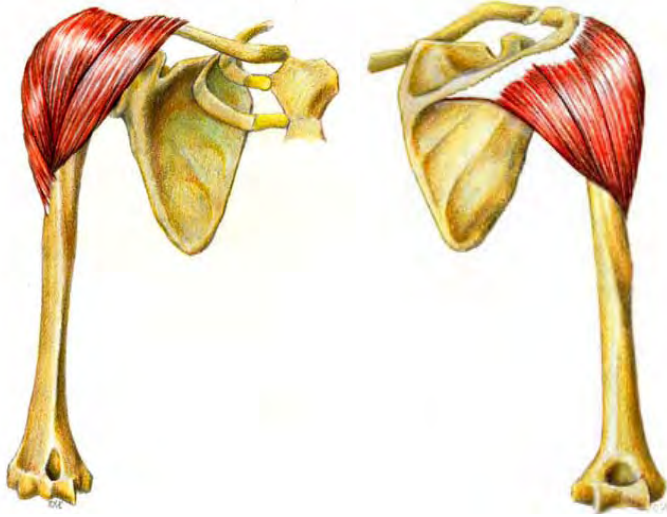
**Levator Scapulae-**

**Rhomboideus Minor-**

**Rhomboideus Major-**



**Deltoid-**



## **Rotator Cuff Muscles:**

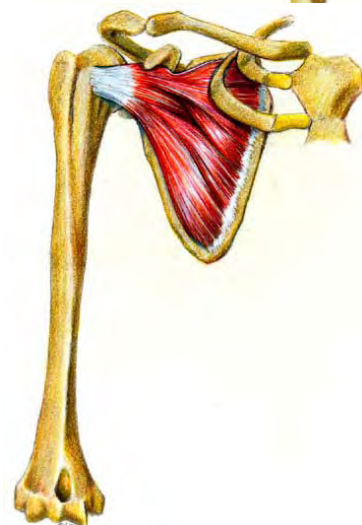
**Supraspinatus-**

**Infraspinatus-**

**Teres Minor-**

**Teres Major-**

**Subscapularis-**



## **Arms:**

### **Bones of the Arms:**

Humerus-

Radius-

Ulna-

Carpals-

Metacarpals/Phalanges-



### **Muscles of the Arms:**



**Coracobrachialis-**

**Brachialis-**

**Biceps Brachii-**





**Brachioradialis-**



**Wrist/Finger Flexors-**

**Triceps Brachii**



**Wrist/Finger Extensors-**

**Notes:**

## Legs:

### Bones of the Legs:

Femur-

Tibia-

Fibula-

Patella-

Tarsals-

Metatarsal/Phalanges-



### Muscles of the Legs:

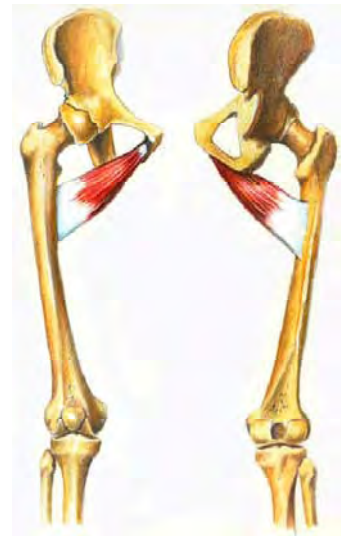


**Adductors-**

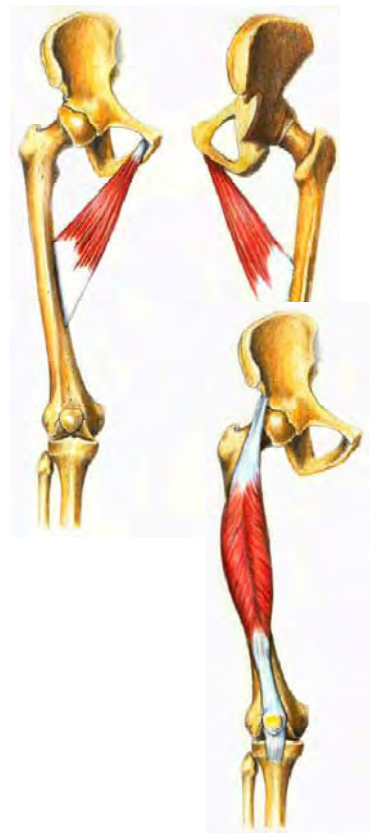
**Minimus:**

**Magnus:**

**Brevis/**



**Longus:**



**Quadriceps-**

**Rectus Femoris:**

**Vastus Lateralis:**

**Vastus Intermedius:**

**Vastus Medialis:**

**Tensor Fascia Lata/Iliotibial Band-**



**Hamstrings-**

**Biceps Femoris:**

**Semitendinosus:**



**Semimembranosus:**



**Gastrocnemius-**

**Soleus-**

**Notes:**



**Abdomen and Pelvis:**

**Bones of the Abdomen and Pelvis:**

**Rib Cage-**



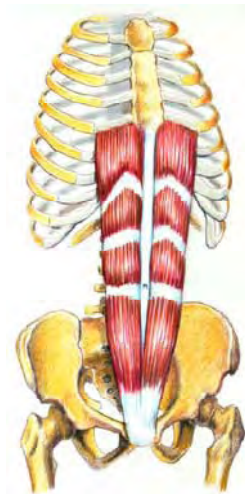
**Pelvis (Sacrum/Ilium)-**



**Muscles of the Abdomen and Pelvis:**

**Abdominal Muscles:**

**Rectus Abdominus-**



**Linea Alba-**



**Transversus Abdominus-**

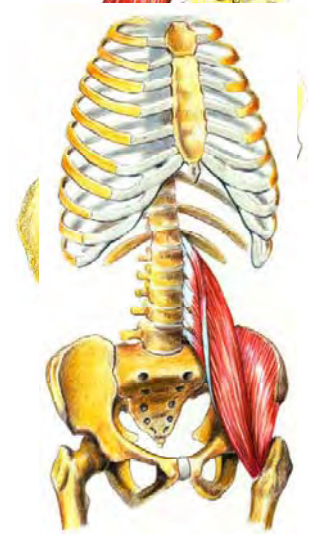


**External Obliques-**

**Internal Obliques-**



**Quadratus Lumborum-**

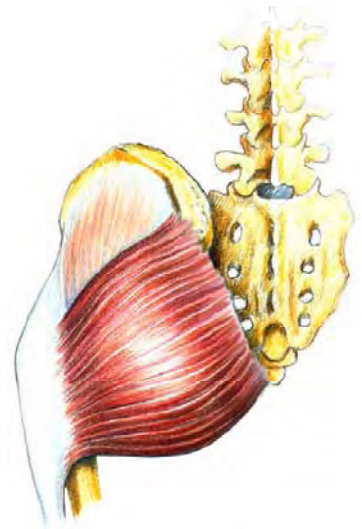




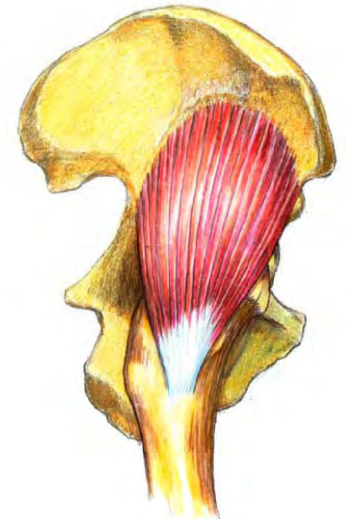
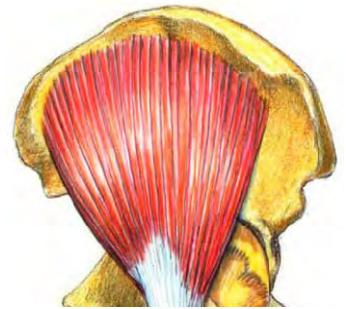
**Pelvis Muscles:**

**Iliopsoas (Psoas Major/Minor, Iliacus)-**

**Gluteus Maximus**



**Gluteus Medius**



**Gluteus Minimus -**

**Piriformis-**

**Notes:**

# **Common Injuries**

**Tendonitis:**

**Tendon Avulsions:**

**Strains:**

**Sprains:**

**Rotator Cuff Syndrome:**

**Shoulder Impingement:**

**Thoracic Outlet Syndrome:**

**Trapezius/Neck Problem:**

**Lateral/Medial Epicondylitis:**

**Disc Problems:**

**Piriformis Syndrome:**

**Patellar/Knee Problems:**

**Hamstring Tears:**

**Back Problems:**

**Pelvic Problems:**

**Hernia (Abdominal/Inguinal)**

## **Common Causes Of Injuries**

**1) Incorrect Technique**

**2) Too Much Weight**

**3) Bad Spotting**

**4) Training Too Often**

**5) Not Stretching**

**6) Lack of Concentration**

**7) Inadequate Warm-up**

## **8) Negatives**

## **9) Poor Training**

### **Notes:**

## **Major Muscle Pairs**

Many muscles work in opposition to one another, with one muscle producing movement in one direction and its partner producing movement in the opposite direction (biceps-triceps, quadriceps-hamstrings).

## **Muscle Physiology**

The muscular system produces the movement of limbs or bones by using the available oxygen supplied by the pulmonary and cardiovascular systems to create energy for movement.

Each muscle is comprised of many muscle fibres. Each muscle fibre is made up of myofibrils (small structural components that run the length of the muscle). Each myofibril is composed of a long series of sarcomeres (basic unit of muscle contraction). The sarcomere is made of 2 types of protein : a thin filament called actin and a thick filament called myosin.

## **Theory of muscle contraction**

In order for a muscle to contract, there has to be shortening at the sarcomere level. For the muscle to contract, the muscle cells convert energy (ATP) into mechanical work (contraction).

## **Fibre Types**

Each muscle in our body is made up of 2 muscle fibre types : slow twitch and fast twitch. The ratio of fast to slow is primarily determined by genetics. Exercise can increase the size of the fibres we are born with.

Fast twitch contract quickly and produce a great deal of force; fatigue quickly.

Slow twitch contract slowly and produce a smaller amount of force; resistant to fatigue.

## **Muscle Contraction**

Type:

1-Isotonic-concentric : when a muscle contracts with enough force to shorten, causing movement

2-Isotonic-eccentric : muscle generates tension; as it exerts force it lengthens

3-Isometric-static : no change in muscle length occurs

## **Neurological system:**

1- Central nervous system (CNS): brain and spinal cord. The CNS is a control centre of the nervous system because it receives information from the peripheral nervous system (PNS) and develops an appropriate response.

2- Peripheral nervous system (PNS): nerves that connect the extremities of the body to the brain, and deliver information about all parts of the body to the brain.

All nerve signals are transported in the body by neurons or nerve cells. There are two kinds of nerve cells : sensory and motor.

-Sensory neurons : carry information from the body to the CNS

-Motor neurons : carry the information from the CNS out to the muscles for response

-Motor unit : muscle fibres at the end of a motor neuron that it innervates or signals

## **Essential Nutrients**

There are six essential nutrients that your body needs on a daily basis :

- Water
- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals

## **Water**

Water is the most essential nutrient the body needs. Your body is made up of 40 to 60 percent of water. 40 to 60 percent of your body weight is water. Muscle composition is approximately 70 percent water. It is vital that while you exercise you continually drink water to ensure that your body does not dehydrate. If you feel thirsty, it will take around 20 minutes for the liquid to be utilized by the body. Obviously the amount of water you need depends on your body weight, height and any activity you take part in. On average you need around three and a half pints of water a day. This may seem a lot but a lot of water will come from your food such as fruits, which contain 75 to 90 percent of water.

## **Carbohydrates**

Carbohydrates are usually referred to as sugars or starches. Complicated carbohydrates are the carbohydrates that we keep hearing about that we should improve our food intake of. They are found in such foods such as potatoes, bananas, pasta, bread, and cereals. Carbohydrates are converted into sugars by the body. Carbohydrates come in two forms:

### *Simple Sugars*

Simple sugars are sugars like processed sugar and sugar from fruits. This kind of sugar is used almost immediately during exercise. Just eating these sugars would not give you endless amounts of instant energy because as the sugar level in your blood increases, more insulin is released to grab the sugar and dispose of it because there is too much. The insulin grabs all the sugar and more as well, so you eventually have even less energy than you started with. This is why when you eat a chocolate bar you feel great for about 15 minutes, but your body then loses energy and becomes slightly fatigued.

### *Complex Sugars*

This kind of sugar is taken from foods like potatoes, bread, pasta, rice, vegetables and fruits. The difference between these sugars and simple sugars is that complex sugars are released at a slower pace, so you do not get this insulin rush. As the sugar is released a lot slower it also lasts a lot longer because it takes the sugar a lot longer to be broken down. These complex sugars - or carbohydrates as they are better known - are much better for you than simple sugars. We need to be looking at around 55 percent of our daily intake of complex sugars.

## **Protein**

Protein is composed of amino acids, which help to build muscle mass. Cells in the body are being replaced all the time, every day, 365 days a year, so we need to give the body the tools to complete the task of keeping our body fit and healthy. Protein is found in such foods as chicken (white meat), egg white, beans, and skimmed milk, to name a few. The bigger and leaner your muscles are, the higher your basal metabolic rate is. Your basal metabolic rate is the amount of calories the body uses simply to maintain basic functions for the day; even while doing such



things as sitting and watching television your body will be burning more calories, which means burning away more body fat. We need about 70 to 80 grams of protein daily in our diet. If you eat too much protein the excess will also be stored as body fat. You should be looking at 20 percent of your daily calorific intake to be protein.

## **Fat**

Fat is another term for lipid. Too much fat in your diet can lead to obesity, heart disease, heart attacks, and strokes. Fat does have its uses however : the body needs some fat to process vitamins and minerals and to insulate its inner systems. Fat is also used by the body to provide energy to the body during exercise. Cheese, nuts, and cooking oil, to name a few, are high in fat content. There are three types of fat:

### *Saturated Fat*

Saturated fat is the worst fat for the body. Saturated fat causes the arteries to clog which in turn can cause strokes, heart attacks and coronary heart disease.

### *Polyunsaturated Fat*

Polyunsaturated fat has fewer fatty acid molecules than saturated fat, and so is a lot better for you than saturated fat. A type of polyunsaturated fat is Omega 3, found only in fish oils. This fat contributes to the development of the nervous system and a host of other bodily functions.

### *Mono Unsaturated Fat*

Mono unsaturated fat has even fewer fatty acid molecules than polyunsaturated fat, and for this reason is the best of all three fats. You should have a higher intake of mono unsaturated fat than the other two fats.

## **Vitamins and Minerals**

Vitamins are needed in small amounts to help the body with chemical reactions within its cells and are organic. Vitamins come in two forms : they are fat soluble or water soluble. Fat Soluble Vitamins (A, D, E, K) are stored in the fat tissue and can build up high levels of toxins in the body if they are not utilized. Water Soluble Vitamins (B, C) are excreted by the body if your daily amount of intake is too great.

Minerals are inorganic substances that regulate processes within the body. Minerals are put into different structures within the body to create enzymes, hormones, skeletal bones, skeletal tissues, teeth and fluids.

## **THE COMPONENTS OF PHYSICAL FITNESS**

## **The components of physical fitness are divided into two categories: Health Related and Skill Related**

Health related fitness is the ability of the heart, lungs, muscles, and joints to perform well.

Regular physical activity promotes physical fitness. Physical fitness is the condition of the body that results from regular physical activity.

There are five areas of Health-Related Fitness:

1. Cardiovascular Endurance
2. Flexibility
3. Body Composition
4. Muscular Strength
5. Muscular Endurance

Skill-Related Fitness is the ability to perform skills used in sports and physical activities. It can help you improve your performance in sports and games. There are six areas of skill related fitness:

1. Agility
2. Balance
3. Coordination
4. Reaction Time
5. Speed
6. Power

**Health-related components** help you maintain good health. Your body systems, like the cardiovascular, respiratory, and muscular systems, all work together.

1. **Cardiovascular Endurance:** Shows how efficiently your heart, circulatory system, and respiratory system work together over a long period of time.

Examples to increase cardiovascular endurance: running, cycling, swimming

2. **Flexibility:** The ability of joints to move through their full range of motion.

Examples to increase flexibility: stretching, gymnastics

3. **Body Composition:** Shows the relative amounts of fat body mass to lean body mass.  
Examples to lower fat: all cardiovascular activities

4. **Muscular Strength :** The amount of power a muscle can produce.  
Examples to increase strength: weightlifting, gymnastics, push-ups

5. **Muscular Endurance:** A muscle's ability to produce power for a long duration.  
Examples to increase muscular endurance: running, swimming, weightlifting

**Skill-related components of physical fitness:** Help you perform skills needed for sports and dance activities. They can help you have fun in active play.

1. **Agility:** The ability to change the direction of movement quickly while staying in control of your body.

Examples: shuttle run, soccer, basketball, tag, dodge ball, dance

2. **Balance:** The ability to maintain body equilibrium in different movements or not to fall.

Examples: gymnastics, dance, throwing a pass on the run

3. **Coordination:** The ability to combine at the same time the movements of various body parts.

Examples: setting a volleyball, hitting a golf ball

4. **Power:** The ability to combine strength and speed.

Examples: high jumping, sprinting, figure skating

5. **Reaction Time:** The time between you senses recognizing a stimulus and your body moving in response.

Examples: hitting a ball, starting a race

6. **Speed:** The time it takes you to move a certain distance.

Example : sprinting, receiving

## **CARDIOVASCULAR TRAINING - INTRODUCTION**

Cardiovascular exercise (aerobic exercise) forms an important pillar within the entire anti-aging exercise program. It is one of the greatest anti-aging bullets that is available to anyone. A list of benefits from aerobic exercise resembles that obtained with growth hormones: gain of muscles and strength, loss of fat, increased energy, greater well-being and a decrease in anxiety and depression. Moreover, aerobic exercise also increases the level of HDL cholesterol, lowers blood pressure, improves the immune system and helps protect the body against a host of diseases, including cardiovascular diseases, strokes, hypertension, diabetes, and osteoporosis.

While research has shown that cardiovascular exercises increase longevity, the remaining questions still under research are how much exercise is sufficient and how much is over doing it?

A famous study looked at 17,000 male alumni of Harvard University between the ages of 35 and 74. Results show that as the physical activities of the men increased, their death rate decreased. Men who spend at least 2,000 kilocalories per week doing moderate exercises such as tennis, swimming, jogging or brisk walking lowered their overall death rate by 25-33% and decreased their risk of coronary artery disease by an astounding 41% when compared to the more inactive fellow alumni.

The interesting fact not previously known is that going over 3,500 kilocalories actually makes things worse, with a slight increase in death rate. The lesson to be learnt is that moderate exercise is the key to longevity while over-exercise can lead to increased oxidation and tissue damage. While your heart may get a wonderful workout, the rest of the body suffers tremendous damage from oxidative stress that happens during extreme forms of exercises such as triathlons and ultra-marathons (100 miles).

Cardiovascular exercises benefit any age group. However, any exercise of aerobic capacity should be structured properly and should be scaled moderately to fit the particular needs of each person. You are advised to consult your physician to get medical clearance first, especially if you are over 35 years old.

It is important that you understand the variety of cardiovascular exercise training methods in your program. If you are training for a competitive sport or a particular race, you may want to consider interval training as well as component training to add to your regimen. Interval training is an intermediate form of cardiovascular training.

Men burn 10-15% more calories for the same exercise than women due to bigger muscle size. If you are a woman, you would have to work about 10% harder than if you were a man.

## **A PRESCRIPTION FOR AEROBIC EXERCISE**

In selecting your aerobic exercise, consider the following: the type of activity, the duration of activity, the frequency, the intensity and the progression. Fitness experts, such as doctors in American College of Sports Medicine, have established recommendations for the quantity and quality of exercise required for the development and maintenance of both body composition and cardiovascular fitness for cardiovascular health. To this end, aerobic exercise is preferred.

Aerobic activities stimulate breathing by using large muscle groups in a continuous and rhythmical manner. Exercises such as jogging, running, walking, hiking, dancing and swimming are such activities.

## **DURATION AND FREQUENCY OF AEROBICS**

15-50 minutes of continuous or discontinuous aerobic activity is the minimal required for health and fitness. A better gauge is through measurement of calorie expended, the ultimate standard in

any aerobic exercise. 3-5 times a week of aerobic activities is considered by most sports experts to be appropriate. This can be further broken down into smaller blocks of 10 minute each without sacrificing anti-aging effect. In an anti-aging perspective, your frequency is determined by the amount of kilocalories burnt over a 1-week period. As we know today, the optimum longevity burn rate is 2,000 kilocalorie per week. If you burn 1,000 kilocalories per exercise session, then on an aerobic perspective, you only need 2 aerobic sessions per week to achieve this goal. The 2,000 kilocalories include calories burnt during strength training as well. If your weight training is 2 times a week for 30-45 minutes each time, you will be burning 400-500 kilocalories per week. From an aerobic perspective, you need only to burn 1,500 kilocalories per week (3 aerobic sessions of 500 kilocalories per session).

### **MAXIMUM HEART RATE**

From an anti-aging perspective, our goal with regards to cardiovascular exercise is to monitor the optimal point at which our heart is doing maximum work. Because of age-related deterioration of the heart muscles, a young person's maximum heart rate is different from that of an older individual. Fortunately, the targeted heart rate is a relatively easy number to calculate based on the formula of 220 minus your age. Therefore, if you are 50 years old, your maximum target heart rate should be  $220-50=170$ . In other words, this is the maximum heart rate that you should not exceed, regardless of what form of exercise you take. If you happen to have had a stress test done by your cardiologist, you will note that this is a number similar to the point your cardiologist will tell you to stop. From an anti-aging perspective, we want the heart to be stressed but yet at the same time not over-stressed. Over-stressing the heart has certain advantages and disadvantages. If you are young and training for a competitive event, it is not unusual for the heart to be stressed to the maximum, especially during integral training. Stressing the heart at maximum target heart rate would allow peak performance, especially in sprint-type events where a powerful burst of energy is required.

### **INTENSITY (TARGET HEART RATE)**

The intensity of an activity can vary. Most anti-aging experts are in agreement that between 60% and 80% of one's maximum heart rate is a good, reliable index of intensity. Your maximum heart rate is calculated simply by the following formula: 220 less your age. If you are 50 years old, then your maximum heart rate is  $220-50=170$  beats per minute. If you take 70% of this then you arrive at 109, 80% of 170 equals 135. Therefore if you exercise in an aerobic capacity which enhances your cardiovascular fitness, your exercise target heart rate should be between 109 and 135. This is of course a very general formula and does not apply to those who are training for competitive sports. As your cardio fitness increases, your ability to train closer to your maximum cardiac heart rate level will also improve automatically.

### **AEROBIC ZONE**

For anti-aging purposes, however, the goal is to keep the heart in healthy condition but not to over-stress the cardio muscles. For that reason, you should adjust your exercise in such a way that your heart rate is no more than between 60-80% of your maximum heart rate. At this level, 85% of your calories burnt are fat, 5% are protein and 10% are carbohydrates. If you are training at 70-80% of your maximum heart rate, you are increasing your endurance capacity. In this zone, your functional capacity will greatly improve and you can expect to increase the number and size of the blood vessels, as well as increase your aerobic capacity and respiratory rate. At this level, 50% of your calories burnt are from carbohydrates and 50% are from fat and less than 1% are from protein. If you are training at 80-90% of your heart rate, then you have entered into another zone. In this zone, the exercise intensity is high and more calories are burnt. 85% of the calories burnt are from carbohydrates, 15% from fat and less than 1% are from protein. For anti-aging purposes, it is not recommended that you enter into this zone for a prolonged period of time. A burst of exercise within this zone just to stimulate the heart and to challenge the heart to meet adverse conditions on an intermittent basis is acceptable, however.

Training at 90% -100% of your maximum heart rate is not recommended for anti-aging purposes. In this zone, the highest number of calories are burnt, and the lowest percentage of fat calories. Almost 90% of calories burnt here are carbohydrates, only 10% are fat and less than 1% are protein. Very few people can last within this zone for more than a few minutes.

## **PROGRESSION**

For an unfit or overweight individual, small progression is advisable. This is especially true if you are starting an exercise program after a sedentary lifestyle. It is generally recommended to progressively increase your intensity effect by approximately 5-10% per month. Of course, the recommended rate of progression varies with each individual, so be sure to consult your physician before any increase. It is usually best to progress slowly and increase gradually in the spirit of keeping your motivation and interest intact.

## **THE AEROBIC WORKOUT**

To safely undergo an exercise program, it is necessary to include at least 3 phases: warm up, work out, and cool down. Each phase has its particular purpose.

### Warm up phase of the aerobic workout

The warm up phase usually includes stretching and breathing exercises. This may last 5-10 minutes with the purpose of increasing the body temperature, and loosening the joints and legs to prevent any undue strain or soreness. A slight heart rate increase is also a benefit of the warm up phase and gets the heart muscles ready for the work out phase. You should be at 50-60% of your target heart rate during this phase.

### Work out phase of the aerobic workout

The work out phase usually lasts from 15 to 50 minutes. The ideal period is approximately 20-40 minutes. To improve cardiovascular fitness and body composition, as well as to lose weight, continuous aerobic exercise of low to moderate intensity is recommended. Strenuous, high intensity workouts are not encouraged for anti-aging purposes although it may be recommended for competitive sports. The reason is because during intensive and strenuous exercises the metabolism rate of each cell increases, resulting in an increase in production of oxidised products that are also known as free radicals. Free radicals are damaging to the cells and are a leading cause of aging.

### Cool down phase of the aerobic workout

The cool down phase lasts from 5 to 10 minutes and brings the physiological system back to its resting level at a gradual pace. A gradual reduction in cardiac output after a vigorous work out is considerably safer than an abrupt stop in aerobic activity. This gradual cool down gives our heart time to get used to the decrease in blood flow and decrease in oxygenation and gives it time to rest. One of the best cooling down exercises includes slow walking.

### **WALK, JOG, OR RUN?**

Running guru Kenneth Cooper, M.D. reports a study by his research group at the Cooper Aerobic Center in Dallas in which 3 groups of pre-menopause women were trained to walk 3 miles a day, 3 days a week, for 6 months at various speeds. A 4th non-walking group served as a control. The interesting finding is that for those walking at a 20-minute per mile pace, the aerobic fitness increased by 4%. For those walking at a 15-minute per mile pace, the increase in aerobic fitness was 9%. Finally for those who were jogging at a 12-minute per mile pace, the aerobic capacity increased by 14%, more than triple that of the slowest walker. In fact, the energy expenditure and heart rate within the group were equivalent to those women who ran 9-minute miles. The lesson is that for both weight loss and aerobic fitness, the faster you go, the more fuel you use, the better your heart and your metabolism respond. While we know that the higher the intensity, the better the cardiovascular and aerobic fitness, any aerobic exercise program must be tailored to your specific needs, especially if you are over the age of 35. We now know that over-exercise is counter-productive and does not increase longevity. For anti-aging purposes, therefore, you should perform aerobic exercise that will keep your heart rate at about 70%-80% of your maximum heart rate (MHR) while expending approximately 2,000 kilo-calories per week in divided sessions.

### **INTERVAL TRAINING**

Interval training consists of repeated intervals of relatively high intensity events such as jogging or running or sprinting incongruent with relatively light intensity events such as walking. The light interval would be done in range from 50-70% of your maximum heart rate while the hard interval training would range from 85%-100% of your maximum heart rate. As mentioned earlier, interval training is highly desirable for the competitive athlete. It is also interesting and

beneficial for anti-aging purposes if provided as a break in routine and to train your body to adapt to different stresses from different activities. Interval training also causes a rise in our base metabolic rate (BMR) after the exercise has ended. This increase effectively causes a body to burn more calories and keep fat off. It is, therefore, especially appropriate if you want to reduce the fat in your body.

## **COMPONENT TRAINING**

Component training is a method combining several types of cardiovascular exercises, one immediately after another. For example, you would jog for 15 minutes on a treadmill followed by 15 minutes on the bicycle and then 15 minutes of swimming. This is somewhat equivalent to a mini-triathlon event. Component training offers a variety to the normal routine and is good for aerobic training. Note that the heart cannot recognize whether the calories burned come from bicycle training or treadmill training or a rowing machine. The key in this particular training method is to utilize different parts of your body and to include some variety so your motivation is being kept up.

While cardiovascular exercise forms an important weapon within the anti-aging exercise arsenal, it is by no means a magic bullet. An optimum anti-aging program involves a combination of aerobic exercise, proper diet supplements, and weight training so that your body has adequate lean body mass to carry you through an active lifestyle. All anti-aging exercise programs must be preceded by a good flexibility-training program lasting 5-10 minutes as well as a cool down stretching exercise immediately after training. With regards to nutrition, it is important that our body and muscles are replenished with the proper nutrients after an exercise program. During exercise, our energy comes from a substance called glycogen, that our body makes from carbohydrates. Providing proper nutrients will ensure that our muscles have the key components to rebuild cells and prevent using our existing reserves as a reservoir of energy for aerobic function.

## **MEASURING PROGRESS**

If improving your appearance is your primary motivation for cardiovascular exercise other than anti-aging, then your mirror is your best gauge. The scale, unfortunately, is not a good indicator because we could be gaining muscles and losing fat and that will not show up on the scale. The measurement of a lean body mass as well as the percentage of body fat are good indicators as they give you a good gauge of how your body composition is changing. Ideally, with a good cardiovascular and weight training exercise, you should be losing fat and gaining lean muscle mass. Your body composition should change accordingly.

You can also measure your progress by the duration and intensity of your cardiovascular exercise routine. If you are able to increase your exercise duration or find that you are making the same progress but with less effort, then your cardiac health is improving. The simplest way is to jog continuously for one mile at a comfortable pace and measure the time it takes. You know you are in excellent cardiac shape if your time is less than 8 minutes. If you can do it within 11-13 minutes, you've achieved anti-aging benefits.

Ultimately, your progress is best measured by how you feel. When you are consistent in your cardiovascular program, chances are you will feel better, have more energy and a better outlook



in life. This may take a few weeks, but it will come. You will realize that your daily tasks have become easier and that the activities and sports you enjoy will not only become easier but also become more enjoyable. Your friends will notice the significant change in you after you have been consistently on the program. Anti-aging is a life-long process that does not yield immediate results. Many of the benefits will only be apparent years later.

## **EXERCISE PRECAUTIONS**

Cardiovascular exercise performed immediately after a full meal is not recommended. You should wait at least 60-90 minutes after a full meal before engaging in any kind of intensive cardiovascular exercise. The reason is simple. After a full meal, most of your blood supply goes to your stomach area to help the stomach to digest the food. Blood flow to other vital organs decreases. The larger the amount of food you eat, the longer the time you should wait before beginning aerobic exercise.

## **WORKING OUT IN HOT WEATHER**

Another factor that increases the risk of injury and complication is exercising in hot weather. Your body is used to a certain level of perspiration where sweat is taken out of your body and evaporated at a rate that your body can sustain. In a hot weather where there is excessive perspiration, it would only place increased stress onto your body. To overcome this, try the following:

Allow 5-7 days to accommodate to a hot environment.

Avoid training during the hottest part of the day, that is usually between 11am and 5pm, especially during the summer.

Be well hydrated by taking in lots of water prior to the workout.

During exercise, drink plenty of fluids along the way especially if it is a long aerobic session such as a road race.

Monitor your heart rate and do not go above your targeted aerobic heart rate during the course of the activity. If necessary, slow down your rate of exercise or shorten your aerobic sessions so that you are in a comfortable position throughout the workout.

## **POLLUTANTS**

Pollutants have an adverse effect on our bodies. Pollutants are oxidants and cause oxidation of our cells resulting in free radicals.

While fresh air is available outdoors, exposure to oxidants such as ozone, carbon monoxide and sulfur dioxide from car exhaust can be detrimental to your health.

## **WALKING**

Walking is an exercise for all ages. Young and old love to walk. Walking is particularly good for anyone over 40 because of its safety. Rarely do you hurt your ligaments, injure your legs or your thighs or knees after walking. Walking is also simple and easily adaptable to busy schedules. A quick walk can burn as many calories as a slow jog. Besides, other benefits include improved cardio-respiratory health, decreased body fat, decreased weight and decreased risk of heart disease. The key to proper walking is suitable footwear. While there are specialized walking shoes available at most shoe stores, many people prefer good running shoes with adequate cushion especially at the heel as well as the forefoot and the mid-sole area.

Always warm up, stretch and cool down during the walking session. Begin walking slowly for 5-10 minutes at a 15-20 minute per mile pace in order to increase circulation of blood to your calves, quadriceps and hamstrings. As you build up after the warm up phase, you can walk at a faster pace. Concentrate on your form, having the heel strike first onto the road and follow by rolling motion and lift up after the mid-sole. As you walk, remember to keep your back straight, your abdominal tight and pump your arms back and forth naturally. Gauge your progress by the amount of time you spend walking rather than by the intensity at first. Whether you are a world class walker or a novice, you take almost the same number of steps per minute during this exercise process. The goal, therefore, is not to walk fast but to walk at a pace that is sufficient to get your heart rate up to your targeted exercise heart rate.

## **WALKING ON A TREADMILL**

Walking on a treadmill has advantages in that you can walk and exercise at any time of the day, any time of the year without exposure to adverse environmental factors. Walking on the treadmill, however, can be slightly boring and it takes some time to get used to it, especially in the beginning. For the beginner, start the treadmill belt running at slow speed. If needed, hold on to the handrail in front or beside you while walking until you feel comfortable. Often times, a trainer by your side may be a good safety precaution when you get started. Do not close your eyes while running because you will need your eyes to help maintain balance. Each treadmill always has a safety catch that allows the treadmill to stop automatically when the safety cord is pulled. This simple but highly effective precaution measure should be taken regardless whether you are a beginner or an advanced treadmill walker or jogger.

## **JOGGING**

Jogging, an excellent cardiovascular exercise, is also popular because of its simplicity and adaptability to busy schedules. People of all ages can jog, although it is more appropriate for those in good shape and those who are not more than 30-40 pounds overweight and have no knee problems. Like any exercise, jogging can have its pitfalls and you must be aware of these. First of all, you must concentrate on the form of your running. The back must be straight, the hands in a natural and relaxed position. The foot must land on the heel first, followed by a rolling motion

to the mid-sole and take off. Try not to land on your mid-sole with each stride as you will be sprinting in that particular posture and you would become tired relatively quickly. If you hear a “thump” sound on the ground as you land, chances are you are landing improperly.

Concentrating on your form and your posture during the run is an important way to get started. Do not compare yourself with other runners who may be more advanced than you. Whether you are an Olympic runner or a novice jogger, researches have shown that your foot strikes the road approximately 150-180 times per minute. What this means is that it doesn't matter whether you are running at an Olympic pace or just slow jogging around your neighborhood, the amount of trauma sustained by your knees and your cartilage is the same. Many people are unaware of this important fact. Try it yourself and see if it is true. Excessive exercise to complete a certain distance is not beneficial from an anti-aging perspective. In other words, if you take 5 hours to complete a marathon as compared to a world class athlete, then essentially your knees are getting twice as much pounding as compared to those who take two and a half hours to complete the same race. The smarter way from the anti-aging perspective and the preservation of our joints is to exercise in such a way as to maximize aerobic capacity based on a moderate exercise level.

Interval training as well as component training techniques may be used from time to time for specific goals such as race preparation. It also gives a slight variety to the sometimes boring routine of just running on a day-to-day basis.

Always warm up, stretch and cool down during the jogging session. Begin the session by jogging at low intensity or even a fast walk. This will stretch your calves, quadriceps and hamstring muscles. After the exercise session, cool down by walking first for 5-10 minutes followed by stretching of the exercised muscles.

## **CYCLING**

Cycling is a non-weight bearing exercise that is especially good for the overweight or the elderly person. Stationary cycling is preferred over outdoor cycling for the elderly or during inclement weather. Cycling outdoors is a perfect activity for those who do not like walking or jogging. Cycling is a good exercise for a variety of fitness levels. It is important to adjust the height of the seat so that the leg that is at the bottom of the down-stroke is almost but not completely extended when your foot is on the pedal. If the seat is too low, your leg muscles will feel tired more easily. This will limit your performance. Numerous forms of padded seats are also available with cushions to reduce the strain on your buttocks.

The pedaling speed can vary depending on the fitness level and comfort. As usual, always warm up, stretch and cool down during the cycling session. Begin each exercise by pedaling very slowly at a low level of resistance for 5-10 minutes. This stretches the calves, quadriceps and hamstrings. As the exercise progresses, the resistance can increase as well as the intensity. The duration of the exercise can be increased gradually. Interval training as well as compulsive training are good variations to this particular form of exercise and give you a fresh perspective.

## **STAIR-STEPPING**

Stair-stepping is an excellent form of cardiovascular exercise. Aside from the obvious aerobic benefits, it is also easy on the bones, joints and ligaments. For those people who have orthopedic limitations that limit repetitive pounding of body weight during activities such as running or jogging, this offers a good alternative. Stair steppers are relatively easy to use. For safety reasons, consult a trainer to make sure that you have the right technique. Especially important is to grab the handrail and step onto the pedal. Begin stepping by lifting each foot as if you were walking up the steps while holding on to the hand rail or by pumping your arms back and forth once you feel more comfortable. Do not push the pedal down by simply lifting your feet one after another. As usual, your back should be straight and your abdominal tight. This posture is very important so that you do not create excessive strain on your back muscles. Do not lean over the machine or the handrail. This decreases the work performed and can result in injury.

Step at a comfortable speed that allows you to stay in the middle pedal range. Do not try to extend the pedal all the way down to the full range unless you are setting on or off.

Always warm up, stretch and cool down during the stair-stepping session. Begin each session with a 5-10 minute warm up, followed by intense work out and end with a cool down session. To dismount, stand still and allow the pedal to settle to the floor.

## **ROWING**

Rowing is another excellent cardiovascular and aerobic choice. Rowing machines offer a good alternative for those who have orthopedic problems and are unable to run or jog. Computerized rowing machines also offer a fun way of doing cardiovascular exercises. Sit on the seat of the rowing machine and secure your feet to the ankles in the front part of the machine. With your body leaning slightly forward, move forward on the roller. Join your knees up to your chest. It is important to maintain a good posture during the rowing exercises in order to preserve your muscles. Your head should be up and your arms extended straight in front of you. Push back your legs, straighten your back to an upright position, and pull the handle to your abdomen. Keep your back straight and abdomen tight at all times. Bring yourself forward by pulling with your leg, leaning forward and extending your arms in front of you. A good rate is approximately 20-30 rows per minute.

Always start your rowing session slowly for the warm up, lasting 5-10 minutes. Make sure your posture is proper and that you are increasing the circulation to your legs and your upper arm muscles during the rolling process. After you are fully warmed up, start your intense exercise session. It is also important to cool down towards the end of the session. When you get off the rowing machine, do your stretches as well. The rowing machine can be incorporated as part of a component training program within the anti-aging cardiovascular exercise program. It adds variety to the overall training program and works different parts of the body.

## **OTHER CARDIOVASCULAR EXERCISES**

There are enormous additional cardiovascular exercises such as hiking, rope jumping, cross-country skiing, basketball and tennis. Regardless of what activity you choose, they all have cardiovascular benefits. Activities that do not provide as much cardiovascular benefits include golf, softball and bowling. Regardless of what cardiovascular activities you do, the following guidelines should guide you in what form of exercise to do.

Does the cardiovascular exercise offer a sustained repetitive movement using large muscle groups such as your legs?

Does your activity allow you to continually be active for 30-45 minutes?

Are you able to maintain an intensity of 60-80% of your maximum heart rate?

Can you continue to pursue this activity 3-5 days a week in order to obtain significant benefits?

Don't forget that the key to anti-aging exercise programs is not so much for competitive sports purposes but to exercise your body in such a way as to promote youthfulness, stress reduction as well as increase your longevity. Research now shows that the target aerobic exercise should be of moderate intensity and allow you to burn off 2,000 kilocalories per week at a heart rate of approximately 70-80% of your maximum heart rate. Regardless of what exercise you do, those are the key parameters within which you should formulate your exercise program.

## **HAVE FUN**

Exercise is a key ingredient in weight reduction and can help to achieve optimum health. Exercise not only increases muscle tone but also alters the metabolic rate in our bodies. A fit individual will burn more calories than a less fit one, even at rest.

Exercise need not be a struggle. If you make it fun by choosing an activity you enjoy, you will more easily incorporate it into your daily life and more rapidly enjoy the enormous physiological, psychological and biochemical benefits of exercise. To avoid boredom, you may wish to vary your daily routine. For example, walk one day, cycle the next and perhaps swim another day. If walking is the core of your routine, you can supplement it with recreational activities such as golf or tennis. The point is to do something, to exercise every day.

## **TO BURN 300 CALORIES A DAY**

To burn 300 calories a day, you have to perform aerobics equivalent to 30 minutes of rowing machine, bicycle or swimming; approximately 35 minutes of stationary bike or slow jog; approximately 40 minutes of brisk walk; or approximately 80 minutes of slow walk.

## **TO BURN 500 CALORIES**

To burn 500 calories, you have to do strenuous bicycling for one hour; cross-country skiing for 45 minutes; or jogging 45 minutes at 5 miles per hour.

## **JUST DO IT**

Cardiovascular exercise is an important pillar of any anti-aging exercise program. By following the instructions and precautions outlined here, we hope that you will have a wonderful time enjoying yourself while achieving optimum health. Your greatest challenge, however, is not learning new exercises or proper technique, but to put it to action. Recognizing that heart disease is a leading cause of death, consistent exercise will go a long way in reducing that risk and improving your longevity. Travel with your running shoes, travel with your gym shorts. Whatever opportunity you get, no matter how short the period during the day, take some time to do cardiovascular exercise. A 5-minute session of rope-jumping will make you feel invigorated, especially after a long travel or stressful day. Keep a jump rope in your office and keep one set at home. Including a cardiovascular training into your busy schedule is an adjustment and may be difficult. But if you have already taken the time to read this chapter, chances are you have been motivated to understand that this is the right thing to do and all that is left now is to do it!

# **Course outline**

Business practices for personal training

NAFA

By Tiiu Poldma, Ph.D.

IDC, ARIDNB, IDEC, AERA

This part of the course program follows from the earlier theory and practice components. The ability to bring the theory into practice means developing business skills to develop a business, clientele and sustaining clients with all aspects of personal training.

This part of the course program develops business skills and practices for the personal trainer. Clients need to be recruited and advised, with services provided for the fees charged. This part of the course examines how to go about starting and maintaining a business with basic knowledge of business practices, developing and maintaining clients, and some business strategies to motivate both the business owner and the clients.

The course content includes:

Part I – Business Practices

- General knowledge of business practices and developing different aspects of business, including :
  - o general business types and choices
  - o understanding the basic requirements of setting up a business professionally
  - o developing clientele and understanding how to market the business
  - o strategies for keeping clients and growing the business over time
- Business strategies for small business owners including :
  - o the basic steps to setting up a business
  - o different aspects of business practices
  - o necessary aspects to running a successful business, including basic accounting procedure, legal issues, and keeping the business profitable.

## Part II – Entrepreneurship in personal training

- Understanding the relationship between the personal training and the entrepreneurial aspects of any business enterprise
  - o Key components to being a successful entrepreneur
  - o Healthy living concepts, personal training and entrepreneurship
- Applying theories of body-building, fitness and nutrition to real life business situations
  - o Understanding the business side of being a personal trainer and providing services including fitness, nutrition, weight loss and other services
  - o Motivating the client using the total mind – body experience
- Beginning, developing and sustaining the business
  - o Developing business management strategies

