

# Physical Exercise

*Challenging Your Body for  
Growth and Good Health.*

**“Those who think they have not time for exercise  
will sooner or later have to find time for illness.”**

**Edward Stanley, 15th Earl of Darby.**

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## Introduction

Just as the mind constantly requires challenges to maintain mental health and to achieve growth, the body requires challenge too. Too often in our world of modern convenience and motor vehicles, we forget about our bodies and leave them to slowly, but progressively, deteriorate.

In order to have our bodies serve us well for a long enjoyable life, and a long fulfilling retirement, we must challenge them daily to keep them functional and to keep them growing.

If I were to tell you now that the government was about to legislate that motor vehicle production and importation was to cease immediately, and that the car you have now must last you for the rest of your days, how would your attitude towards its care change?

Well, I hate to be the bearer of bad tidings, but you are not about to get another body. As much as medical science wants to try, it will not happen in this lifetime. What's more, many of the current methods of repair and replacement are not working. Consider bypass surgery. Doctors are quite perplexed by the number of bypass patients who are presenting with all of their angina symptoms back, within 18 months of their bypass surgery.

**Exercise should be addressed in two main areas: Cardiovascular Exercise and Musculo-skeletal Exercise.**

## Cardiovascular Fitness

### **The Physiology:**

When discussing Cardiovascular Fitness, we are really talking about the functional health of The Heart, The Blood Vessels, The Lungs and the Blood Itself.

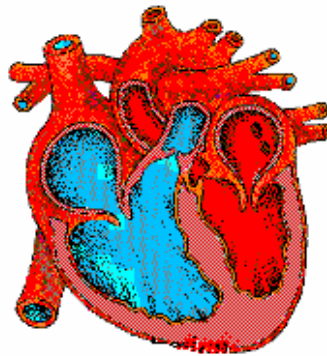
### **A Refresher in Anatomy:**

De-oxygenated Blood, flowing through veins from all parts of the body, enters the right atrium of the heart. As the atria contract, the blood is pushed into the right ventricle. The right ventricle then expels the blood into the pulmonary artery which transports the blood to the lungs. In the lungs, the blood travels through the capillaries and comes into close contact with the alveoli. Oxygen and CO<sub>2</sub> pressure gradients see CO<sub>2</sub> flow out of the blood and O<sub>2</sub> flow in. The Oxygenated blood flows back to the heart, into the left atrium. As the left atrium contracts, the blood is forced into the left ventricle. The blood is then pumped into the aorta and out into the arteries of the body.

## Your Heart

Your Heart is working all day, every day. This means that the blood vessels supplying cardiac muscle with oxygen and nutrients, the coronary arteries, see more consistent blood flow than most other arteries in the body.

If your blood is laden with saturated fats, it is fair to say that fat deposits in your coronary arteries will be more substantial than in other arteries. If one of these arteries becomes blocked, the blood supply to that sector of the heart tissue is stopped, starving it of oxygen and, eventually, killing the tissue.



To reduce the chance of this happening, you can do a couple of things. The first is to reduce the saturated fats in your diet. The second is to exercise your heart. The mere fact that you are exercising means that your heart is working harder than normal. The cardiac muscle is being stressed. During the times between bouts of exercise, a number of changes take place.

The heart works to build itself in preparation for the next bout of exercise. It is a situation of adapt or succumb. The Heart, like most body parts is pretty good at adapting. So, one of its adaptations is to build more capillaries and to build the strength and capacity of the arteries feeding those capillaries. In turn, this has a positive effect in reducing the chances of blockage.

However, I must warn that exercise alone is not sufficient to reduce the risks of coronary heart disease.

**Of course you are aware that, like most things, “If You Don’t Use it, You Lose it!”**

Your heart has a capacity to respond to high energy demands. However, if this capacity is not used on a regular basis, it progressively diminishes to a point where your body does not have the capacity to respond to high energy demands. Even kicking a footy with the kids turns into a physical ordeal.

### What Happens when you Exercise?

As exercise, for example walking, commences, the energy output in the muscles of the legs increases. To sustain the activity, the muscles require an increased supply of oxygen. Changes in blood chemistry such as an increase in CO<sub>2</sub> levels, result in the heart being stimulated to beat faster, along with an increase in your respiration rate.

As exercise continues, Heart Rate and Respiration Rate continue to rise until they reach a point where, combined, they are able to supply enough oxygenated blood to meet the demands of the working muscles.

If you were to break into a jog, your heart rate and respiration rate would begin to rise again, until they reached a point when the oxygen demands of the working muscles were met.

Each time the left ventricle expels blood into the aorta, a volume of blood referred to as the "Stroke Volume" is sent out into circulation. If we multiply the stroke volume by the number of beats per minute, we arrive at a figure referred to as Cardiac Output.

Now, if you were to continue increasing the intensity of your run, your heart rate and respiration rate would progressively increase to meet the ever increasing oxygen demands of the working muscles. Hence, whilst Stroke Volume remains constant, Heart Rate is increasing which means Cardiac Output is increasing, meeting the imposed demands.

Once your Heart Rate rose to a point where it reached approximately 85-90% of its maximum (approx.  $220 - \text{Age}$ ), the ventricles do not have time to fill properly between contractions. Hence, Stroke Volume begins to drop which means Cardiac Output stops rising with the rising Heart Rate. Hence, demands are not being met and so the Heart is stimulated to beat even more rapidly. Stroke Volume drops further and Cardiac Output begins to drop off significantly.

Meanwhile, the working muscles are not getting sufficient O<sub>2</sub>, which means they are forced into anaerobic glycolysis which results in rapid Lactic Acid accumulation and, the rapid onset of fatigue. It hurts.

### The Result of Training

If you were to, on a regular basis (3 to 4 times per week), exercise at a level of intensity where your Heart Rate was maintained at between 60% and 80% of its maximum, for a period of at least 20 minutes (but preferably 40 minutes), the stress on your Heart would result in two major changes.

The first change is an increase in the size of the Atrial and Ventricular cavities. The forced stretching of the cavities by blood being forced into them during exercise means that the cavities actually grow in size, which means they can carry more blood. The second change sees the cardiac muscle improve its own strength and endurance, which means the heart itself is more prepared for heavier work loads, and it has greater strength allowing it to more fully expel blood during each contraction.

The end result is a larger stroke volume, which means the heart needs to beat less times to meet a given Cardiac Output demand. As time goes by, a given workload will produce a lower Heart Rate response, which means you will be able to exercise at a higher level of intensity without a uniform increase in discomfort.

If you were to be monitoring your Resting Heart Rate, you will notice that it will progressively drop over a period of time. Some elite endurance athletes have been known to have Resting Heart Rates of 23 to 24 beats per minute.

### Resting Heart Rate

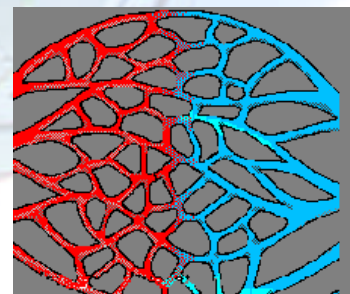
To monitor your true Resting Heart Rate, when you wake in the morning is the best time. Firstly, empty your bladder as a full bladder may be causing a level of circulatory demand. Then sit quietly for a couple of minutes, then take a pulse reading for at least 15 seconds. Multiply the figure by 4 to arrive at your resting beats per minute.

If you monitor your Resting Heart Rate on a regular basis, it can actually tell you a few things. If you wake one morning and find that your Resting Heart Rate is 10 beats up on its normal level, it can tell you that you perhaps are over-training, or your body is in the very first stages on combating a virus, or you are just over tired. Resting Heart Rate can tell you that there is a virus there long before you feel any symptoms.

Remember, Resting Heart Rate will be effected by negative responses to stress, smoking, alcohol, caffeine and any other stimulant or depressant.

### **Your Blood Vessels**

Your Blood Vessels deliver blood to the working muscles, to the organs, and return it to the Heart. Arteries carry the blood away from the heart, down into branches of smaller arteries, and eventually into capillaries where the O<sub>2</sub> is dropped off and CO<sub>2</sub> collected. The capillaries then take the blood back to small veins, into larger veins and then back to the heart.



### Veins

Veins require rhythmic muscle contraction to massage blood back to the heart, especially from down in the legs. The more toned your muscles, the more efficient the action of the muscles in returning venous blood back to the heart.

### Note:

*If you are standing for long periods of time, especially standing still, be aware of the need for muscle contraction to keep venous blood moving. The last thing you need is blood pooling in the legs. This situation may cause quite severe*

*stretching in vein walls around the flowback valves. Further, it may mean that the blood available to your heart for distribution to the brain and vital organs is reduced, leaving you feeling tired and fatigued. Make sure, if you are standing still for long periods, to move your legs about to keep the blood flowing:*

*Try the following on a regular basis:*

- † *A few half squats.*
- † *Raising a bent leg up in front of you a few times..*
- † *Bending your lower leg up behind you a few times.*
- † *Rise up onto your toes a few times.*
- † *Vigorously wiggle your toes for 30 seconds or so.*

### **Your Arteries**

Your arteries are made of smooth muscle. They have the ability to contract and expand in order to increase blood flow to working muscles and reduce blood flow to muscles not doing too much.

To maintain the healthy function of arteries, they need to be put to work, to challenge the smooth muscle artery walls. When you exercise, the arteries leading to the working muscles open up. The more you exercise, the better they become at doing so. The more they open up, the more freely the blood flows to the area.

What's more, the fact that the arteries are opening up, and then perhaps being forced to close in other instances, means that the arterial walls are not remaining constant which will have an effect of loosening any plaque that may have accumulated over time. Exercise definitely plays a significant role in reducing the volume of plaque in the artery walls.

### **You Capillaries**

These microscopic blood vessels do the final job. They actually deliver the blood to the muscle. As a result of exercise, your capillaries expand and grow, finding more points to feed blood to the muscle. Capillary density in working muscles and in the lungs can rise significantly resulting in more efficient blood delivery to the muscles and better O2 saturation of the blood.

### **Your Blood and Exercise**

Your Blood Carries Oxygen to working muscles. The O2 bonds to Haemoglobin in the blood. When the de-oxygenated blood arrives at the lungs, the Haemoglobin is actually saturated by CO2. When the blood flows down into the capillaries in the lungs and come into contact with the alveoli, we find a situation where there is a high O2 pressure in the alveoli, and a low O2 pressure in the blood. Conversely, there is a high CO2 pressure in the blood, and a low CO2 pressure in the alveoli.

This creates a pressure gradient, so the CO<sub>2</sub> flows across the membrane wall into the alveoli, and the O<sub>2</sub> flows across the membrane wall and bonds to the Haemoglobin. Simple.

At the muscle, the reverse happens as there is a high pressure of O<sub>2</sub> in the blood and a high pressure of CO<sub>2</sub> in the muscle cell.

### **Your Blood and Training**

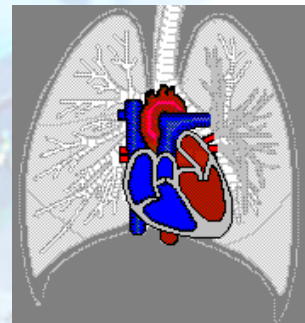
Over a period of time, as a result of aerobic exercise, the Haemoglobin levels in your blood will rise. This means that each unit of blood carries more O<sub>2</sub>. Hence, each Stroke Volume of the heart, whilst increasing over time, is also increasing in the quality of O<sub>2</sub> content.

Further, your blood volume will progressively increase, which means you have a greater amount of blood available to meet the circulatory demand during exercise.

Balances High and Low Density Lipoproteins

### **Your Lungs and Exercise**

Your lungs perform the vital role of transporting O<sub>2</sub> to the blood and expelling waste gases such as CO<sub>2</sub>. The air enters through your nose or mouth, down through the trachea, through the bronchial passages into the alveoli.



As a result of regular exercise, your lungs improve their capacity by bringing more alveoli into function. Further, the constant rush of air under exercise conditions assists the lungs in ridding the body of airway irritants and excess mucous.

Further, the intercostal muscles receive extensive exercise benefit, improving their capacity to open the chest cavity and to close it with force. The end result is an improved overall Vital Lung Capacity, more easeful respiration and better O<sub>2</sub> transport into the blood.

## How Much Exercise?

To Stress Your Cardio-Respiratory System to a level that will stimulate growth and improvement, it is important to be guided by your Heart Rate. If ever you feel distressed, or in pain, stop exercising immediately.

### For Beginners

Following is a simple exercise prescription for beginners.

- † Exercise for 20 to 30 minutes per session.
- † 3 to 4 sessions per week.
- † Keep your Heart Rate between 60% and 75% of your maximum Heart Rate.
- † If you can't talk, you are going too hard.

### For Fitter Individuals

Following is a simple exercise prescription for fitter people, or for beginners who have been exercising regularly for at least 6 weeks.

- † Exercise for 45 to 60 minutes per session.
- † 3 to 4 sessions per week.
- † Keep your Heart Rate between 70% and 85% of your maximum Heart Rate.
- † Listen to your Body.

### Ideal Activities

Following is a range of activities you may wish to pursue for your aerobic exercise.

- † Brisk Walking
- † Jogging
- † Swimming
- † Cycling
- † Steppers

Games are a good means for achieving aerobic fitness if you possess adequate skill levels. Games such as Tennis, Racquetball, Squash, Basketball, Netball and Touch Football are all fantastic. However, if you are unaccustomed to exercise, I would refrain from participation in these activities until you have established a sound fitness base and have been medically cleared to play.

In these games, it is easy to allow your enthusiasm to push you beyond normal pain barriers and find yourself reaching up to 90% of your maximum heart rate. If there happens to be any level of blockage in any of your coronary arteries, this level of demand may be enough to starve part of the myocardium of O<sub>2</sub> for a brief period, perhaps leading to tissue damage.

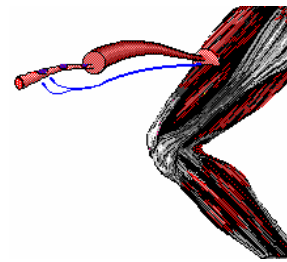
### Caution

A couple of points of caution for you.

1. **Warm-up:** Make sure you start out slowly over the first 5 to 8 minutes to give your body time to “warm-up” and allow your cardiovascular system time to adjust to the exercise demands for blood flow.
2. **Cool Down:** Finish off by winding down slowly over the last 5 to 8 minutes and allow your cardiovascular system to gradually return to a point close to resting state. This helps to remove metabolites from muscle tissue and reduces the chance of blood pooling in the lower extremities.
3. **Supportive Footwear:** Make sure you choose good, supportive footwear if you are going to walk or run. I suggest you buy yourself a pair of Thorlo socks, the most supportive, comfortable and long wearing socks available.
4. **Surfaces:** Be wary of surfaces. If you are walking or jogging in the dark, be careful of undulations and irregularities in footpaths. Don't jog on concrete surfaces if you are not used to jogging. Give your joints time to adjust. Also, be wary of slippery surfaces.
5. **Medical Clearance:** It is important to have medical clearance to exercise if you are over 35 and unaccustomed to regular physical activity. If you have never had a comprehensive medical assessment, I suggest The Epworth Hospital's Health Check Unit. They can be contacted on 9426 6470. Their assessments are, by far, the most comprehensive available in Melbourne.
6. **Weather Conditions:** If it is cold and wet, it is best to wear some rain proof clothing that is light in color. Some jogging suits come with reflective strips on them. If it is hot, make sure you wear a hat, sunglasses and light, protective clothing. Avoid exercising in the hottest part of the day. In summer, it is so much easier to rise early in the morning and do your exercise before most people even start their day.
7. **Water Intake:** When exercising, be aware of the need to replace water. You don't need sugars, unless you are going to be exercising for over 90 minutes.

## Musculo-Skeletal Fitness:

Musculo-skeletal fitness is also very important.



### Muscle Strength and Tone

It is important to challenge all of your muscles to keep them toned and healthy. There has been much compelling research over the past five years linking the role of muscle toning to fat loss. The research indicates that, the more toned the muscles, the more energy they will burn and the more the body will have to mobilise stored fats to fulfill these energy requirements.

### Muscle Flexibility and Suppleness

Supple, flexible muscles are relaxed muscles. Relaxed muscles move easily, don't get sore, rarely get injured and are always healthy. Stretching is a very important part of life. However, most of us don't take time out to stretch out muscles, until the stretching program is a rehabilitation routine prescribed by a physiotherapist.

### Joint Mobility

Joint movement is like muscle tone. You can lose it easily. If your joints stiffen, many negative things can happen. The worst of these is possible constriction of nerve tissue, especially in the spinal column. If pressure is applied to nerve tissue, it can cause all sorts of problems "along the line" in the form of non-specific pain or muscle spasm.

### Yoga

It is very important to keep your body supple, mobile and "easeful". I suggest the best way to do that is to participate in a Yoga class. My advice is to choose a style other than Iyengar Yoga to start with as it is very advanced. However, you can build up to it as you go.



The other alternative is a personal trainer. A good personal trainer will assist you in developing a program to suit yourself, teach the program to you, and then monitor it periodically for you.

It is beyond the scope of this seminar for me to be giving you stretching exercises to do as you require detailed, personalised instruction.

## Sample Programs

### Starting Out Jogging:

|  |                    |
|--|--------------------|
| Week 1&2: Walk 1 Minute, Jog 1 Minutes for 20 minutes  | 3-4 times per week |
| Week 3&4: Walk 1 Minute, Jog 2 Minutes for 20 minutes  | 3-4 times per week |
| Week 5&6: Walk 1 Minute, Jog 3 Minutes for 20 minutes  | 3-4 times per week |
| Week 7&8: Walk 1 Minute, Jog 4 Minutes for 20 minutes  | 3-4 times per week |
| Week 9&10: Walk 1 Minute, Jog 9 Minutes for 20 minutes | 3-4 times per week |
| Week 12&13: Jog 20 minutes                             |                    |

From then on, you can add up to 2 minutes per week to your training if you so desire.

### Starting Out Swimming:

Wear Swim Fins to assist

Note: This program assumes you are swimming in a 25 metre pool.

Warm-up: Swim a combination of strokes, including kicking on your back, for a total of eight to twelve laps.

### Workout:

|  |
|--|
| Week 1: Swim One Lap every 90 secs. Total 20 laps. 3 Sessions/week   |
| Week 2: Swim One Lap every 80 secs. Total 20 laps. 3 Sessions/week   |
| Week 3: Swim One Lap every 70 secs. Total 20 laps. 3 Sessions/week   |
| Week 4: Swim One Lap every 60 secs. Total 20 laps. 3 Sessions/week   |
| Week 5: Swim Two Laps every 90 secs. Total 20 laps. 3 Sessions/week  |
| Week 6: Swim Two Laps every 90 secs. Total 24 laps. 3 Sessions/week  |
| Week 7: Swim Two Laps every 90 secs. Total 28 laps. 3 Sessions/week  |
| Week 8: Swim Two Laps every 80 secs. Total 28 laps. 3 Sessions/week  |
| Week 9: Swim Two Laps every 75 secs. Total 28 laps. 3 Sessions/week  |
| Week 10: Swim Two Laps every 75 secs. Total 32 laps. 3 Sessions/week |

By week 10, including your warm-up, you will be swimming a kilometer.

### Notes:

Make sure you warm-up steadily.

Ensure you are well hydrated before exercising.

Finish the session with a good stretch and some relaxation.