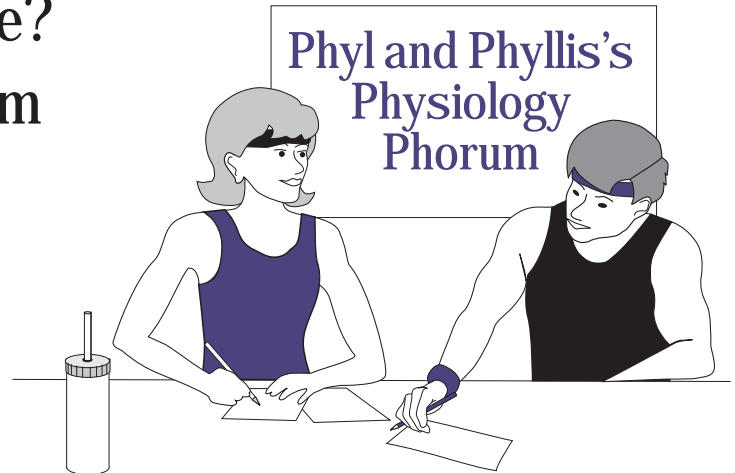


What is heart rate?  
What is resting heart rate?  
How do I know my maximum  
heart rate?



Heart rate is the number of times the heart beats per minute. Resting heart rate is the number of times the heart beats when a person is not physically active. Normal resting heart rates range from sixty to eighty beats per minute. The heart muscle has its own electrical system that rhythmically and continuously creates its own beat. This system and the heart muscle itself are influenced by autonomic nerves. They are also influenced by the action of adrenalin or epinephrine. The heart rate can be slowed or increased depending on the needs of the tissues as they perform particular activities.

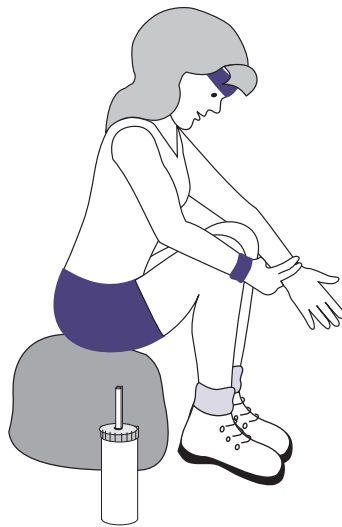
Theoretically, maximum heart rate is related to an individual's age. At birth, the heart can beat as fast as 220 beats per minute. Each year thereafter, the maximum heart rate declines by one beat. At age twenty, for example, the maximum heart rate should be 200 beats per minute. Each person, however, has his or her own maximum heart rate. It can vary by as much as ten to fifteen beats per minute from one person to another of the same age.

# Heart Rate

1 pulse at carotid artery



2 pulse at radial artery



3 pulse with heart monitors

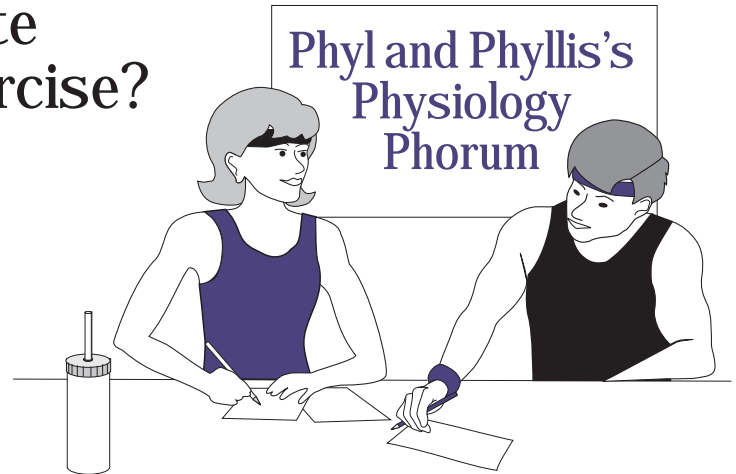


Heart rate can be measured by taking one's pulse at either the carotid artery located on the side of the neck, or at the radial artery located at the wrist on the thumb side. There are also electronic heart monitors that can be used to measure heart rate during activity.

What is cardiovascular exercise?

What should my heart rate be during this type of exercise?

What is perceived rate of exertion (RPE)?



During cardiovascular exercise, the heart must pump blood to large muscles in the body, when a person is moving in a rhythical pattern continuously for a period of time. The duration depends on an individual's ability to sustain an activity. Walking, jogging, running, swimming, Rollerblading, cycling, and dancing are examples of cardiovascular exercise.

How much cardiovascular exercise one needs depends upon individual goals. However, the American College of Sports Medicine (ACSM) and the American Council on Exercise (ACE) recommend 20 to 60 minutes of cardiovascular activity from three to five days per week. It is important to note that a cardiovascular activity need not be performed all at one time, but in fact, can be accumulated over multiple sessions. The duration and intensity of exercise depend on the fitness level of the individual performing them. Individuals striving for weight loss should exercise for 60 minutes or longer at a low to moderate intensity at least five days a week. Higher fitness goals require the performance of activities at a higher intensity. Athletes with specific performance goals must work at intensities that mimic their sport. Most importantly, cardiovascular activities should be enjoyable, varied, and suited to an individual's lifestyle and goals.

Heart rate during cardiovascular exercise is related to the specific energy requirements of different activities. It takes a specific amount of energy (in the form of ATP) for a particular body to perform a given activity. For example, less ATP is required to walk four miles per hour than to run seven miles per hour. Red blood cells must load up appropriate quantities of oxygen to send to tissues performing that activity. The heart must then pump oxygen-laden red blood cells to these tissue cells rapidly enough to deliver the required oxygen.

In the tissue cell mitochondria, oxygen is required to make ATP. ATP is used to fuel the activity. Heart rates vary from person to person and depend on the intensity and energy requirements of a given activity.

There are many different formulas that are used to determine heart rate ranges for different activities. While heart rate is a reliable and accurate estimate of intensity, there are some limitations to using it. There are factors that can affect heart rate other than the energy requirements of an activity itself.

Heart rates can be increased by hot and humid temperatures. They can also be affected by an individual's skill levels, body mechanics, and experience performing particular activities. Some medications may alter heart rate in such a way that its measurement might not be a reliable indicator of the intensity of an exercise. Lack of sleep, stress level, and even how a person feels on a given day can change his or her heart rate.

For these reasons, other methods were developed and are frequently used to monitor the intensity of cardiovascular activity. One such method is called the Borg scale of perceived rate of exertion (RPE). Borg's scale uses numbers ranging from six to twenty, in which six represents no exertion and twenty represents maximal effort.

The numbers permit individuals to describe how difficult an activity feels to them. For example, an activity that causes a great deal of sweating, labored breathing, and muscle fatigue might be perceived as

“very hard.” That would be given a rating of 18 on the Borg scale. Movement that feels effortless may be perceived as “fairly light” and given a rating of 11. Both scenarios would require an adjustment to a more appropriate intensity.

Paying close attention to how one feels while performing a given activity allows for such an adjustment. For example, by speeding up, adding a grade, or increasing the size of movement, an activity can intensify from fairly light (11) to somewhat hard (13). In order to achieve the important benefits of cardiovascular activity, ACSM and ACE recommend 60 to 85 percent of maximum heart rate or ratings of 13 to 15 on the Borg scale.

However, novices should begin a cardiovascular program wisely, beginning at lower levels and gradually progressing to higher levels over time. Progress will depend on the individual's age, fitness level, starting goals, and other factors such as time constraints and lifestyle. Appropriate health screening is highly recommended before starting any exercise program.

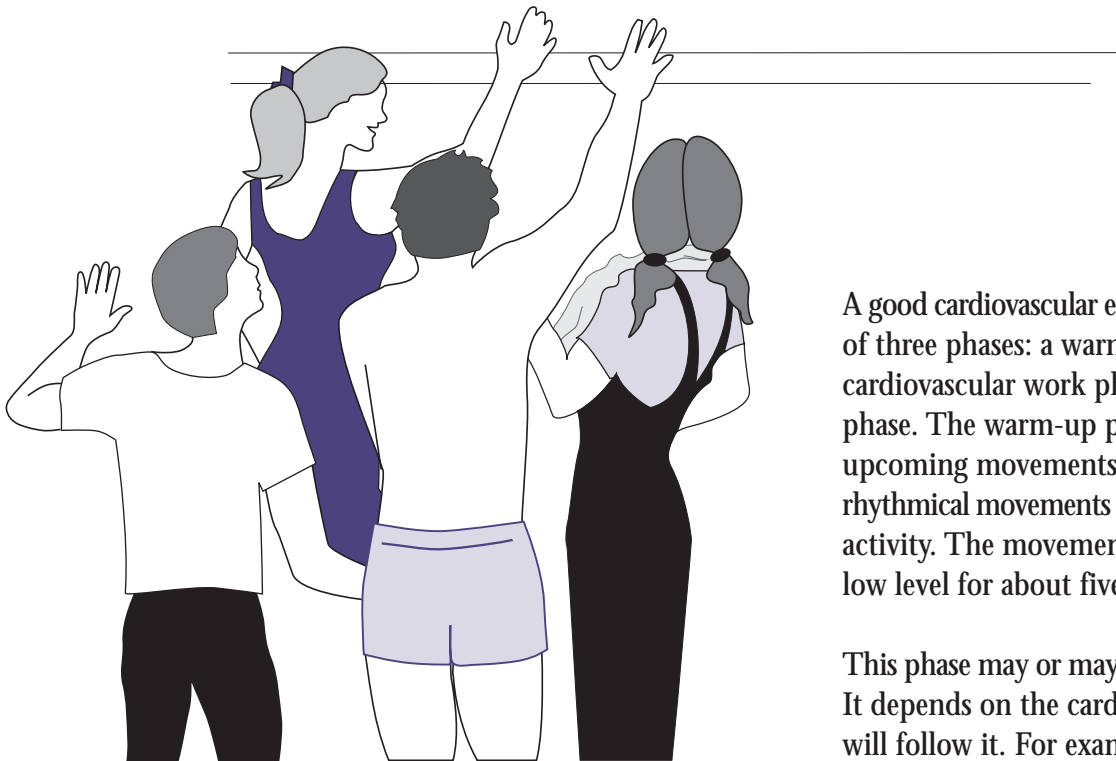
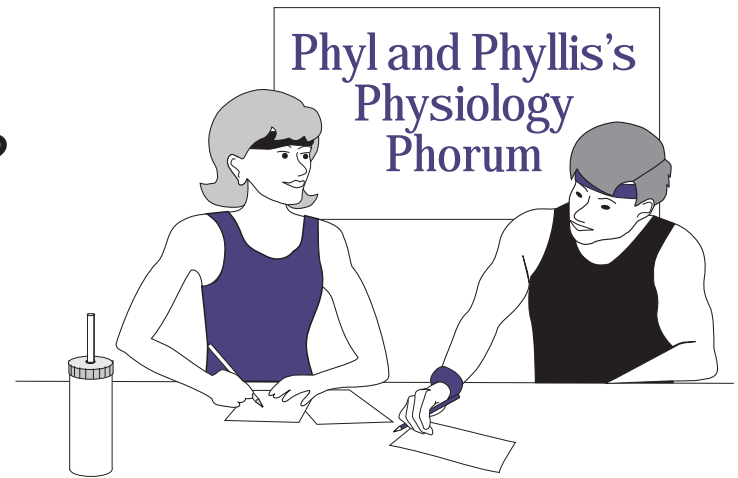
A beginner may work at slightly less than 60 percent of his or her maximum heart rate (11 on the scale). An avid exerciser may regularly perform at 80 to 90 percent of his or her maximum heart rate (15 to 16 on the scale). A non-athlete should try to exercise consistently, performing different and challenging activities at varying levels each week. Heart rate ranges and RPEs should simply be used as guidelines.

Perceived Rate of Exertion (Borg Scale)	Percent of V02 Max
6	
7 very, very light	
8	
9 very light	
10	42%
11 fairly light	
12	56%
13 somewhat hard	
14	70%
15 hard	
16	83%
17 very hard	
18	88%
19 very, very hard	
20	100%

What are the components of a good cardiovascular exercise program?

What is aerobic capacity?

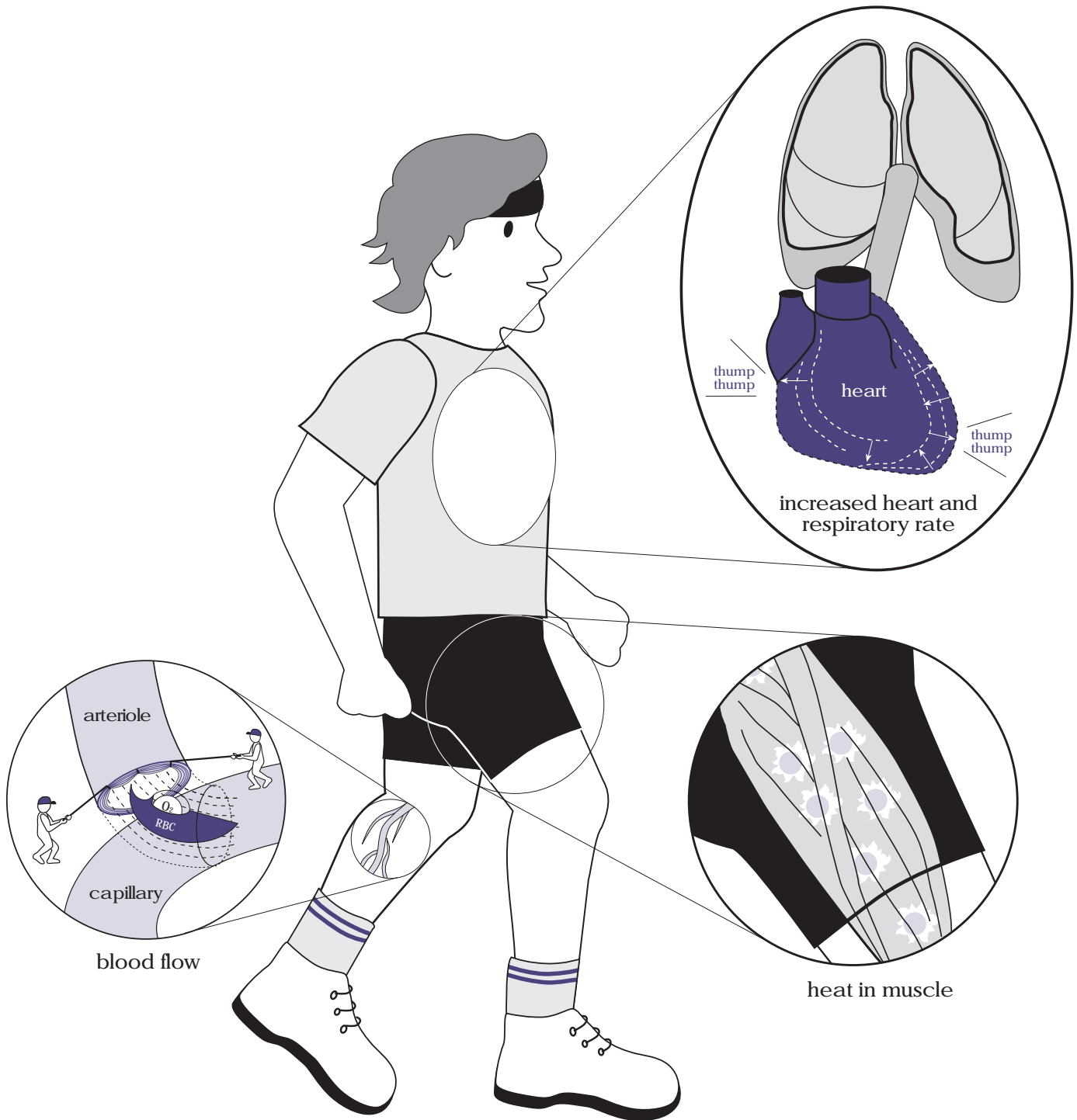
How do I know if I've improved my aerobic capacity?



A good cardiovascular exercise program consists of three phases: a warm-up phase, a cardiovascular work phase, and a cool-down phase. The warm-up phase introduces the upcoming movements. It consists of large, rhythmic movements similar to the upcoming activity. The movements are performed at a low level for about five minutes.

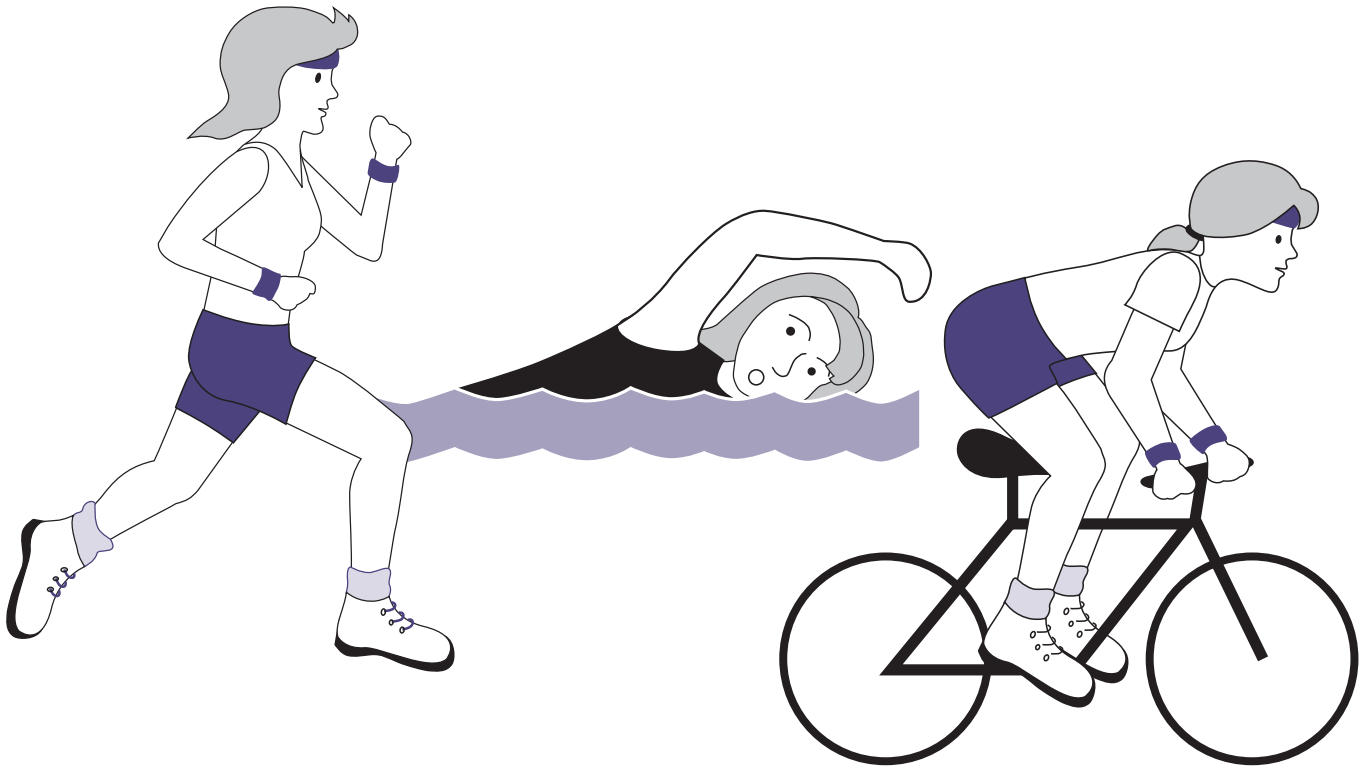
This phase may or may not include stretching. It depends on the cardiovascular activity that will follow it. For example, if the activity is one that involves a great deal of quick or sudden stretching of muscles, such as running or dancing, it may be a good idea to introduce a type of stretching called dynamic stretching, in the warm-up phase. If it will help in the smoother, safer performance of the cardiovascular activity that will follow, a time-efficient dynamic stretching routine preceding that activity is worthwhile. Otherwise, stretching can be performed following the cardiovascular work in the cool-down phase.

# Warm-Up



The warm-up phase allows the heart rate and respiratory rate to increase gradually. It helps the skeletal and muscular systems process and coordinate the information sent to and from the central nervous system. It allows the muscles to begin work gradually, receiving blood, nutrients, and oxygen from the blood vessels. As the muscles begin to work, heat is produced, warming both the muscle tissue itself and the fluid surrounding joints. This allows for smoother movement.

## Work Phase



The cardiovascular work phase consists of an activity that is sustained at a particular intensity or variety of intensities for a desired duration. Both the duration and the intensity depend on individual goals. Walking, jogging, running, biking, hiking, swimming, and dancing are all cardiovascular activities. Beginners may only be able to sustain a brisk walk for twenty minutes. An athletic individual may run for an hour or more.

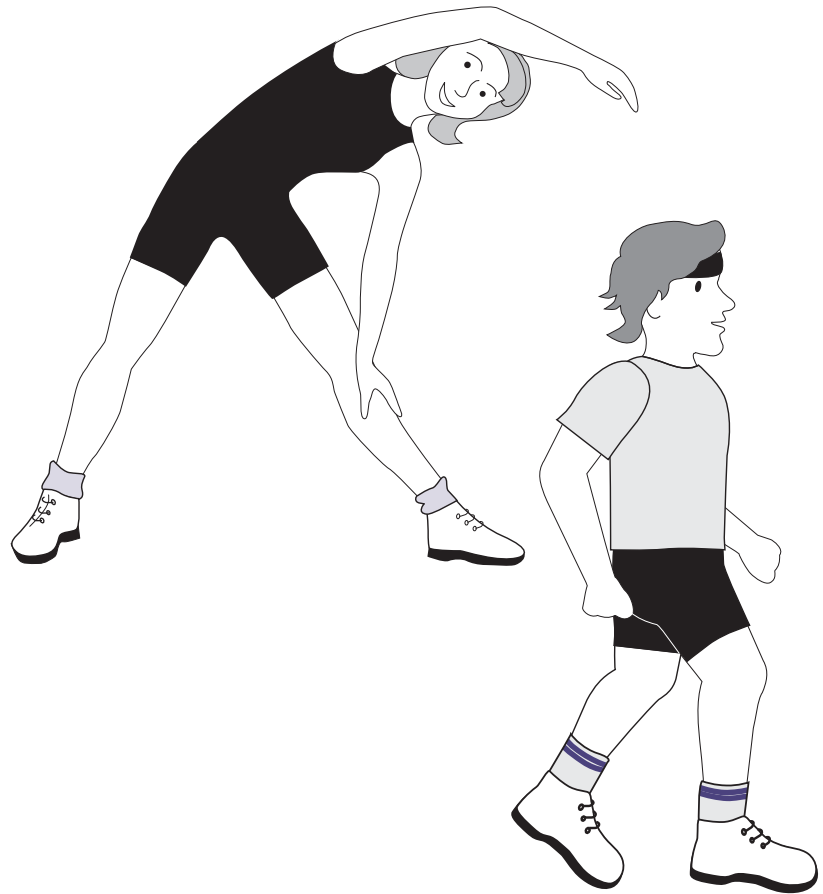
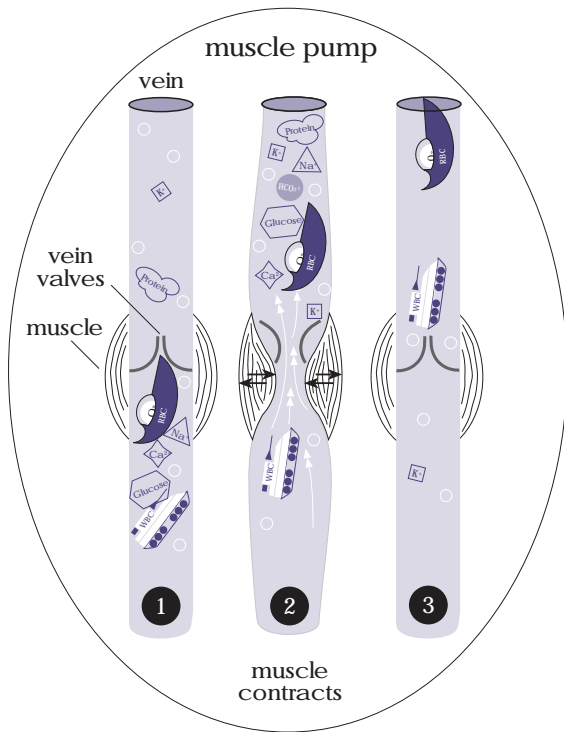
Performing different cardiovascular activities during the course of a week provides an individual with variety. It also allows for cardiovascular training that uses different movement patterns. This rotation of different activities is called cross-training. Cross-training helps to prevent overuse injuries in muscle and connective tissues. It allows all of the activities to seem "fresh" to the nervous and muscular systems as well.

During the cardiovascular work phase, the heart pumps blood through the arterial system to working muscles. Blood returns by way of the venous system. When muscles rhythmically contract, they compress the veins in the same rhythmical pattern. This rhythmical contraction of the moving muscles helps to pump blood in the veins back up to the heart. This rhythmical contraction also pushes waste products from working muscles out of the muscle into the venous system.

Veins are equipped with a system of one-way valves. The valves both promote the blood flow back to the heart and prevent a back-flow. After the cardiovascular work period, the rapidly beating heart must return gradually to its resting rate. A cool-down period is therefore essential.



# Cool-Down



The return of blood by way of the veins to the heart occurs as rapidly or as slowly as the working muscles contract. The heart rate adjusts to the speed of venous return of blood. Gradual slowing of movement allows for gradual slowing of blood return as well as gradual slowing of heart rate. The waste produced by the working muscles continues to leave the muscles as long as they contract. Blood and waste products pool in the working muscles if movement is suddenly halted.

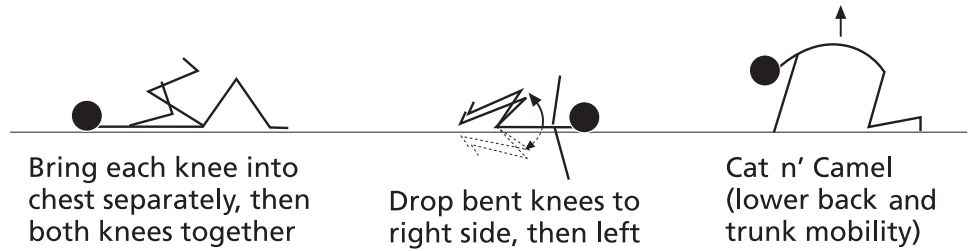
A five-minute cool-down period prevents pooling of blood and waste products in muscles. A static stretching program may follow the cool-down period. Static stretches are those that are held for fifteen to thirty seconds. Appropriate static stretches may help return muscles and other connective tissues to their normal resting length. This may help to improve the flexibility in areas of chronic tightness, such as the lower back, front of the hips, the back of the thighs and back of the calves. It may also help to improve range of motion in performing tasks of daily living and sports, posture and maintenance of proper body alignment. Some activities emphasize the use of some muscle groups not used in other activities. Running, biking, swimming, walking, and dancing each require distinct movement patterns. Different activities may be followed by different stretching routines.



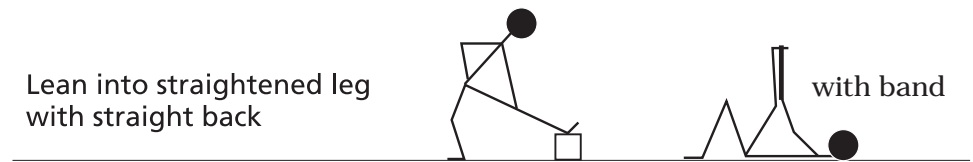
# Sample Stretches

BASIC STATIC STRETCHES: Gently hold for 15 to 30 seconds

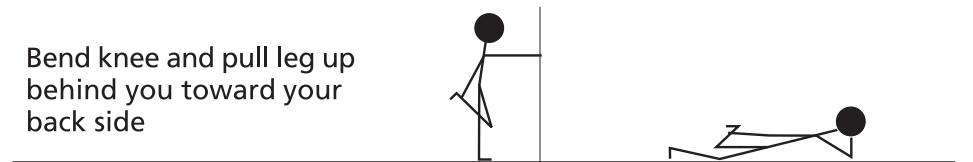
BACK  
(Lower back)



HAMSTRINGS  
(Back of thigh)



QUADRICEPS  
(Front of thigh and front of hip)



A more important benefit of regular participation in cardiovascular exercise is reduction of the risk of cardiovascular and other diseases. Another is increased aerobic capacity. Aerobic capacity is the maximum amount of oxygen utilized by the body per minute per body weight. Regular cardiovascular exercise improves capillary function at the lung alveolus so that more oxygen is picked up by red blood cells. Exercise improves the function of the heart, creating a stronger pump that allows for greater quantities of blood to be pumped with each beat. The heart can then beat fewer times and can spend more time resting and filling with blood.

With increased aerobic capacity, more blood vessels branch out closer to the cells that they serve. Inside the cell, more mitochondria are made to handle the increased ATP demands of consistently active tissue. More oxygen is therefore brought into cells at a faster rate. This means the cell is better equipped to utilize fat to make ATP. The body becomes a better fat burner.

# Sample Stretches

BASIC STATIC STRETCHES: Gently hold for 15 to 30 seconds

## CALVES

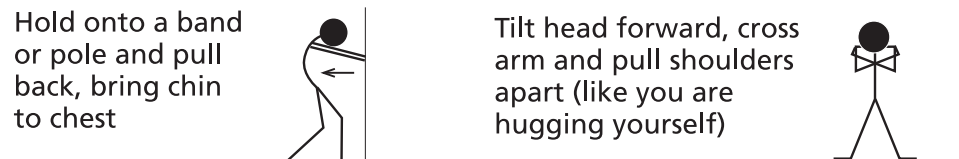
1. Gastrocnemius (surface muscles)
2. Soleus (underneath muscles)



## CHEST AND FRONT OF SHOULDER

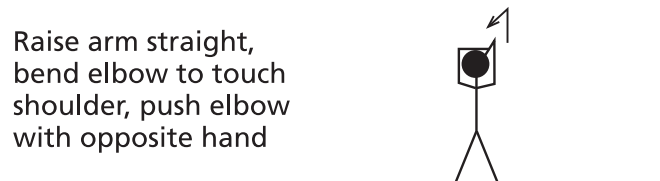


## UPPER BACK AND BACK OF SHOULDER



## TRICEPS AND BACK (Lats\*)

\* Latissimus dorsi



Improvement in aerobic capacity, practically speaking, is reflected in the greater ease with which activities are performed. Tasks of daily living require less effort. For example, we no longer become winded or fatigued walking up and down stairs, to and from a train station, or to a bus stop. We can rush through an airport to a distant gate to catch a plane. We can dance longer at weddings or other celebrations. Participation in regular cardiovascular exercise prevents disease, improves aerobic capacity, creates a leaner and healthier body, and generally improves quality of life. It is essential therefore that one follow the ACSM and ACE guidelines and integrate a cardiovascular exercise program into daily life. The following are some tips for planning a cardiovascular exercise program. The five-day “lifestyle-integrated” program below illustrates how one might plan a week of cardiovascular activities for the family.

## Tips for Planning a Cardiovascular Exercise Program

- Set achievable, realistic, long-term and short-term goals while following ACSM and ACE guidelines.
- Be consistent; schedule cardiovascular activity into your day like any other appointment and keep it.
- Add elements of change and challenge. For your cardiovascular routine to remain effective, progress over time and cross-train (regularly change the equipment and/or activity to prevent overuse injuries).
- Make it enjoyable; if you don't particularly like the cardiovascular activity itself, connect it with activities you do enjoy, i.e., reading, listening to music, watching your favorite television shows or visiting with or phoning friends and family members.

## A Five-Day Lifestyle-Integrated Family Cardiovascular Exercise Program\*

- Sunday ... 60-minute, 6-to10-mile family bike ride to and from a specified destination
- Monday ... 30-minute brisk walk on a treadmill (gym or home) to the evening news or favorite CD; one can perform higher level intervals using increased speed or grade during commercials, or every other song on the CD
- Tuesday ... Off
- Wednesday ... 2.5-mile walk to and from dinner at neighborhood restaurant
- Thursday ... 30-minute jog on treadmill (gym or home) to favorite television program
- Friday ... Off
- Saturday ... 60-minute cross-training; outdoors or indoors
- Outdoors – walk, jog, run, bike, rollerblade  
Indoors – aerobics, step, cardio-kickboxing, dance or spinning, walk, jog, run, cycle, or elliptical trainer

\*Before participating in any exercise make sure to be cleared by your family physician.  
Carry a bottle of water with you and be sure to tell a responsible person where you are going if you are exercising alone.