

# **Heart Rate Monitors and Cardio Exercise**

The why and how of setting up an effective cardio exercise program

For more information contact [www.heartmonitors.com](http://www.heartmonitors.com) 888-418-2377

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Your heart is the most important muscle in your body. In fact, it serves as a barometer for the rest of your body, telling you how hard you are loading your body, e.g. during daily tasks or exercising. Like any muscle, it needs to be exercised. Exercising at the right level of intensity is important in order to ensure a healthy and efficient heart. Your heart is a living pump that circulates blood, rich in oxygen from breathing, from your lungs to your trunk and lower extremities. The condition of the heart varies between people, but even your own heart rate will vary greatly due to the influence of such factors as:

- Intensity of physical activity, e.g. exercise
- Level of fitness
- Emotions, stress
- Onset of a illness, fatigue, heat, altitude
- Consumption of stimulants, e.g. coffee or alcohol.

When you have a strong heart, you feel active, healthy and energetic. At the same time this will reduce the risk of coronary heart diseases and problems connected with aging. The stress level during daily tasks will decrease and you will be able to work more effectively. To achieve all these benefits of regular aerobic

## Longevity and Aging

Exercise, even after age 50, can add healthy and active years to one's life. Studies continue to show that it is never too late to start exercising and that even small improvements in physical fitness can significantly lower the risk of death. Simply walking regularly can prolong life in the elderly. Moderately fit people, even if they smoke or have high blood pressure, have a lower mortality rate than the least fit. Resistance training is important for the elderly, because it is the only form of exercise that can slow and even reverse the decline in muscle mass, bone density, and strength. Adding workouts that focus on speed and agility may be even more protective for older people. Flexibility exercises help reduce the stiffness and loss of balance that accompanies aging.

## Weight Loss

Exercise burns calories and can help individuals fight obesity. If caloric intake remains constant, regular workouts lead to weight loss. Be forewarned, however, that the pounds won't melt off magically. It takes 35 miles of walking or jogging to consume the calories in one pound of fat. Effective weight loss means a long-term commitment to a regular program of vigorous exercise. One recent study indicated that for obese patients, a few daily sessions for as short as 10 minutes each was effective in helping the patients adhere to an exercise program. Abdominal crunches may help replace abdominal fat with muscle. To perform this exercise, the individual lies on the back with the head and shoulders raised; he or she contracts the stomach muscles, curling the torso slightly forward. Abdominal fat is a particular danger to the heart, although it is unknown whether doing crunches will specifically protect against heart disease. Swimming is less effective than walking or cycling in reducing body fat, but overall regular aerobic exercise is a good way to shed pounds. Contrary to popular belief, exercise does not increase appetite in people who want to lose weight; oddly enough, however, exercise improves appetite in people who are already lean. People should be warned that without dieting, weight loss may be minimal with exercise alone, because dense muscle mass replaces fat as the body gets more fit. Nonetheless, a fit body will look more toned and be healthier.

## Psychological and Emotional Benefits

Aerobic exercise is linked with improved mental vigor, including reaction time, acuity, and math skills. Exercising may even enhance creativity and imagination. According to one study, older people who are physically fit respond to mental challenges just as quickly as unfit young adults. (Stretching and weight training appear to have no such effects.) Both aerobic and nonaerobic workouts have been shown to reduce depression. According to one study, exercise was as effective for improving mood in people with clinical depression as some common forms of psychotherapy. Either brief periods of intense training or prolonged aerobic workouts can raise levels of important chemicals in the brain, such as endorphins, adrenaline, serotonin, and dopamine, that produce feelings of pleasure, causing the so-called runner's high. One study found that teenagers who were active in sports have a much better sense of well being than their sedentary peers; the more vigorously they exercised, the better was their emotional health. In one study, regular brisk walking cut in half the incidence of sleep disturbances in people who suffer from them. It should be noted that exercise in the evening, however, can *cause* sleep disturbances. Rhythmic aerobic and yoga exercises may be particularly helpful for combating stress, anxiety, and sleeplessness.

overall fitness for people of all ages. The newly revised Dietary Guidelines for Americans emphasizes the importance of physical activity for both **weight control and health**. Weight maintenance rather than weight loss should be the primary focus. The new guidelines challenge some of the conventional dietary guidelines for healthy Americans. Key messages include:

**Weight maintenance is the first step in achieving a healthy weight and reducing obesity**

- ?? No weight gain with age
- ?? Healthy weight ranges are the same for women and men

The Guidelines encourage people to increase physical activity and reduce sedentary activity in order to maintain or lose weight, recommending a minimum of 30 minutes of moderate to intense physical exercise every day. They also recognize the link between weight gain and health risks (i.e. premature death) for adults. And they acknowledge that the **distribution of fat in the body** affects the risks associated with obesity, identifying exercise as one of the few factors that reduces central body fat.

Planning an exercise program should be based on personal goals as well as on individual capabilities. The most important element is to **think long-term** and make exercise a permanent part of your life.

Moderately Intense Activities:

- ?? Brisk Walking (3-4 mph)
- ?? Cycling (10 mph)
- ?? Swimming or calisthenics
- ?? Racket sports or table tennis
- ?? Golf (without cart)
- ?? Housecleaning, general\*
- ?? Raking leaves\*
- ?? Dancing\*
- ?? Playing actively with children\*

\*Considered moderate only if they are performed at an intensity comparable to brisk walking.

You can't change your genes, your age or your gender, so there are some parts of the metabolic equation that will stay constant no matter what you do. But with a few changes in your exercise and eating habits, you can boost your metabolism by up to 10 percent, according to researcher R. Scott Van Zant, Ph.D., of Northern Arizona University's Department of Health, Physical Education, Exercise Science and Nutrition.

If that doesn't seem like much, consider this: If a 150-pound woman changed her exercise habits and converted 10 percent of her body fat to muscle, she would be able to consume 300 extra calories a day without gaining weight. Looked at another way, the right change in your metabolism could mean you can eat three chocolate chip cookies every day, without gaining weight.

replace it with muscle, which means a combination of heart-pumping aerobic activity and muscle-building weight workouts.

The best way to increase your metabolic rate is to decrease the amount of FAT you're carrying and replace it with muscle, which means a combination of heart-pumping aerobic activity and muscle-building weight workouts.

Aerobic activity can be anything from a session on a Stairmaster to a pickup game of basketball. The point is to have fun and get your heart pumping for at least 20 minutes, at least three times a week. Strength training requires a little more care and planning, and should be done on days when you're not doing a full-scale aerobic workout (a ten-minute warmup before weight training is fine).

A great way to lose weight and burn calories is to use a [heart rate monitor](#). A heartmonitor helps you exercise at the optimum heart rate to burn calories and bodyfat.

If you've never tried weight training, here are a few tips to get you started.

- ?? **Get some help:** Basic weight training isn't hard, but even a single one-on-one session with an exercise physiologist/trainer can help make your workout safer and more efficient. Most YMCAs have staff trainers with reliable credentials. Or if you prefer working out at home, get a basic weight-training book, such as *Strong Women Stay Young*, by Miriam Nelson, Ph.D. (Bantam Books), or an instructional videotape.
- ?? **Start small:** The goal of weight training is to gently put stress on your muscles, not tear them to shreds. Start with weights that you can lift easily, without having to contort yourself into strange and potentially dangerous positions. Increase weight only when you can easily do 12 repetitions in good form, and then only in small (such as two pound) increments.
- ?? **Go slowly:** Yanking a weight up and down doesn't work muscles efficiently, and it increases the likelihood that you'll hurt yourself. Use a slow, smooth movement, raising the weight on a count of five, and lowering it on another count of five. Pay attention to how your muscles feel as you do this: a slight burning sensation is okay; searing pain is not. If it hurts, stop.
- ?? **Time it right:** Although many researchers have tried to pin down the right time for doing various exercises, no one has come up with a definitive answer. So be active when it's convenient for you. If you want to do bicep curls at 2 A.M., go ahead. Just make sure you're awake enough to maintain good form.
- ?? **Give yourself a break:** Be sure to take a day off between weight-training sessions, to give your body time to build new muscle tissue.

To meet the body's daily energy and nutritional needs while minimizing risk for chronic disease, adults should get 45 percent to 65 percent of their calories from carbohydrates, 20 percent to 35 percent from fat, and 10 to 35 percent from protein, says the newest report on recommendations for healthy eating from the National Academies' Institute of Medicine. To maintain cardiovascular health at a maximal level, regardless of weight, adults and children also should spend a total of at least one hour each day in moderately intense physical activity, which is double the daily goal set by the 1996 Surgeon General's

Because carbohydrates, fat, and protein all serve as energy sources and can substitute for one another to some extent to meet caloric needs, the recommended ranges for consuming these nutrients should be useful and flexible for dietary planning. Earlier guidelines called for diets with 50 percent or more of carbohydrate and 30 percent or less of fat; protein intake recommendations remain unchanged. The new acceptable ranges for children are similar to those for adults, except that infants and younger children need a slightly higher proportion of fat -- 25 percent to 40 percent of their caloric intake, said the panel that wrote the report.

"We established ranges for fat, carbohydrates, and protein because they must be considered together," says panel chair Joanne Lupton, professor of nutrition, Texas A&M University, College Station. "Studies show that when people eat very low levels of fat combined with very high levels of carbohydrates, high-density lipoprotein cholesterol concentration, or "good cholesterol," decreases. Conversely, high-fat diets can lead to obesity and its complications if caloric intake is increased as well, which is often the case. We believe these ranges will help people make healthy and more realistic choices based on their own food preferences."

The report stresses the importance of balancing diet with exercise, recommending total calories to be consumed by individuals of given heights, weights, and genders for each of four different levels of physical activity. For example, a 30-year-old woman who is 5 feet 5 inches tall and weighs 111 to 150 pounds should consume between 1,800 and 2,000 calories per day if she lives a sedentary lifestyle. However, if she is a very active person, her recommended total caloric intake increases to 2,500 to 2,800 calories per day. If her lifestyle fits the moderately active category as defined in the report, which is the minimum level of activity to decrease risk of chronic disease, she should eat between 2,200 and 2,500 calories per day. Using grams for the recommended ranges of intake, she should consume 55 to 97 grams of fat and 285 to 375 grams of carbohydrates per day.

The new one-hour-a-day-total exercise goal stems from studies of how much energy is expended on average each day by individuals who maintain a healthy weight. Energy expenditure is cumulative, including both low-intensity activities of daily life, such as stair-climbing and housecleaning, and more vigorous exercise like swimming and cycling. Someone in a largely sedentary occupation can achieve the new exercise goal by engaging in a moderate-intensity activity, such as walking at 4 miles per hour, for a total of 60 minutes every day, or engaging in a high-intensity activity, such as jogging for 20 to 30 minutes four to seven days per week.

## Diabetes

Diabetes, particularly type 2, is reaching epidemic proportions throughout the world as more and more cultures adopt Western dietary habits. Aerobic exercise is proving to have significant and particular benefits for people with both type 1 and type 2 diabetes; it increases sensitivity to insulin, lowers blood pressure, improves cholesterol levels, and decreases body fat. Regular exercise, even of moderate intensity, improves insulin sensitivity. In fact, studies of older people who engage in regular, moderate, aerobic exercise (e.g., brisk walking, biking) lower their risk for diabetes even if they don't lose weight. Anyone on insulin or who has complications from diabetes must take special precautions before embarking on a

## Effects on Bones and Joints

**Osteoarthritis.** Exercise helps to reduce pain and stiffness, and increases flexibility, muscle strength, endurance, and well being. Exercising also helps people reduce their weight and maintain weight loss. Osteoarthritis patients should avoid high-impact sports such as jogging, tennis, and racquetball. The three types of exercise that are best for people with arthritis are range of motion, strengthening (or resistance), and aerobic exercises. Strengthening exercises include isometric exercises (pushing or pulling against static resistance) and stretching exercises to build strength and flexibility without unduly stressing the joints. These exercises may be particularly important if leg muscle weakness turns out to be a cause of osteoarthritis, as some research suggests. Low-impact aerobics also help stabilize and support the joints and may even reduce inflammation in some joints. Cycling and walking are beneficial, and swimming or exercising in water is highly recommended for people with arthritis. One study compared a group of patients who embarked on an aerobic and resistance exercise program with a group that received patient education; the exercising group developed less disability and pain and showed a better ability to perform physical tasks. Patients should strive for short but frequent exercise sessions guided by physical therapists or certified instructors.

**Osteoporosis.** Exercise is very important for slowing the progression of osteoporosis. Women should begin exercising before adolescence, since bone mass increases during puberty and reaches its peak between ages 20 and 30. Weight bearing exercise, which applies tension to muscle and bone, encourages the body to compensate for the added stress by increasing bone density by as much as 2% to 8% a year. High-impact weight-bearing exercises, such as step aerobics, are very protective for premenopausal women. These exercises, however, increase the risk for osteoporotic fractures in elderly patients, who would benefit most from regular, brisk, long walks. Even moderate exercise (as little as an hour a week) helps reduce the risk for fracture, but everyone who is in good health should aim for more. Careful weight training is beneficial as well for older women. Low-impact exercises that improve balance and strength, particularly yoga and T'ai Chi, have been found to decrease the risk of falling; in one study, T'ai Chi reduced the risk by almost half.

**Back Problems.** One of the most common complaints of modern men and women, lower-back pain, afflicts up to 80% of all Americans. Sedentary living, obesity, poor posture, badly designed furniture, and stress all contribute to back pain. An appropriate exercise program focusing on flexibility and strengthening the muscles in the abdomen may help prevent back problems. Yoga stretching is beneficial and can be incorporated into the warm-up and cool-down periods. The best exercises for athletes with bad backs include swimming, walking, and cross-country skiing. High-impact sports, including aerobic dance and downhill skiing, should be avoided. Exercises that strengthen the abdominal muscles such as partial sit-ups, which maintain the back's normal curve and help support the body's weight, can alleviate stress on the lower back. However, the classic full sit-up (raising your head and shoulders off the floor up to your knees) may aggravate back pain and should be avoided by anyone at risk for lower back problems.

## Lung Disease

Depending on the type of lung disease, exercise may improve lung capacity and the ability to transport oxygen to muscles, organs, and all areas of the body. Exercise training will also help some patients with

breathlessness.

## Cancer

A number of studies have indicated that regular, even moderate, exercise reduces the risk of colon cancer. Moderate exercise may also help reduce the risk for prostate cancer and possibly for breast cancer. A recent study of 100,000 nurses, however, suggested that the benefits of exercise on breast health may be greater or lesser at different times in a woman's life, depending on her menstrual status and estrogen levels. For example, the study found no added protection against from exercise in young adulthood (when the disease is uncommon in any case). Cancers related to obesity are less likely to occur if exercise is used to keep body weight and body fat within US Dept of Health recommended ratios.

## Effects on Colds and Flu

Although offering no evidence of improved immunity from exercise, one study reported that people who exercised as little as once a week in employee fitness programs averaged nearly five fewer sick days annually than those who did not participate in such programs. The immediate effect of exercise on the immune system is uncertain. High-intensity or endurance exercises might actually suppress the immune system while they are performed. Some highly trained athletes, for instance, report being susceptible to colds after strenuous events. A recent study suggested that in people who already have colds, exercise has no effect on the illness -- severity or duration of the infection. People should avoid strenuous physical activity when they have high fevers or widespread viral illnesses, however.

## Central Nervous System Diseases

People with multiple sclerosis, Parkinson's disease, and Alzheimer's disease should be encouraged to exercise. Specialized exercise programs that improve mobility are particularly valuable for Parkinson's patients. Patients with neurological disorders who exercise experience less spasticity as well as reduction in -- and even reversal of -- muscle atrophy. In addition, the psychological benefits of exercise are extremely important in managing these disorders. Exercise machines, aquatic exercises, and walking are particularly useful.

## Pregnancy

Healthy women with normal pregnancies should exercise at least three times a week, being careful to warm up, cool down, and drink plenty of liquids. Many prenatal calisthenics programs are available. Experts advise, in general, that when exercising, the expectant mother's pulse rate should not exceed 70% to 75% of the maximum heart rate or more than 150 beats per minute. Fit women who have exercised regularly before pregnancy, however, may work out more intensively as long as no discomfort occurs. According to a new study, vigorous exercise may improve the chances for a timely delivery. Overly strenuous exercise during pregnancy is *not* advocated, however, for women who did not exercise intensely before becoming pregnant. And all pregnant women should avoid high-impact, jerky, and jarring exercises, such as aerobic dancing, which can weaken the pelvic floor muscles that support the uterus. During exercise, women should monitor their temperature to avoid overheating -- a side effect that can

and miscarriage.) Swimming may be the best option for most pregnant women. It involves no impact, overheating is unlikely, and swimming face down promotes optimum blood flow to the uterus. Walking is also highly beneficial. To strengthen pelvic muscles, women should perform Kegel exercises at least 6 times a day, which involve contracting the muscles around the vagina and urethra for 3 seconds 12 to 15 times in a row.

## **Gastrointestinal Problems**

Older people who exercise moderately may have a lower risk for severe gastrointestinal bleeding. Experts suggest that moderate exercise might even reduce the risk for some intestinal disorders, including ulcers, irritable bowel syndrome, indigestion, and diverticulosis.

## **Leg Cramps**

Exercise can even improve pain from clogged arteries in the legs, a condition called intermittent claudication. The best approach in such cases is to walk until pain develops; then rest until pain resolves before resuming walking. In six-month studies, people had tripled the amount of time they could walk before the onset of pain.

**Exercise and Diabetes** Studies showed that, no matter what the activity is, increased activity is related to improved insulin sensitivity,' says Elizabeth Mayer-Davis of the of the University of South Carolina, lead author of a study on exercise and diabetes.

“This is good news. It means that if nothing else, walking can improve your health. You don't have to go to a gym unless you want to,” she added.

Insulin sensitivity involves the body's ability to store food for energy. When the body can not use its own insulin effectively, insulin resistance -- and possibly diabetes -- develops.

The findings, published in this week's Journal of the American Medical Association, were based on research done on 1,400 women from the ages of 40 to 69, some of whom had normal blood sugar levels and others of whom had a mild form of diabetes.

“Earlier research showed that vigorous physical activity, such as running, could improve insulin sensitivity,” said Mayer-Davis. “But we were not sure what impact, if any, moderate physical activity would have in improving the body's use of insulin.”

Moderate physical activity includes walking briskly, climbing stairs, gardening and doing many household chores.

The study found that even moderate physical activity led to better insulin sensitivity. Mayer-Davis said the finding is important because people with diabetes are two to four times more likely to develop heart disease, and 75 percent of diabetics die of heart disease.

she said. "These are guidelines that already have been established by the (U.S.) Centers for Disease Control and Prevention and the American College of Sports Medicine ... any kind of physical activity is a good thing."

**Exercise and Fighting Depression** The millions of Americans stricken each year by debilitating depression may want to consider running away from their problem -- or walking, swimming or dancing it away.

"What the studies are showing is that exercise seems to be at least as effective as standard antidepressant medications in reducing symptoms in patients with major depression," said researcher James Blumenthal, a professor of medical psychology at Duke University in Durham, N.C.

According to Blumenthal, studies suggest that exercise, such as workouts at the gym or a daily jog, can be effective in beating the blues, and that "duration of exercise didn't seem to matter -- what seemed to matter most was whether people were exercising or not."

Blumenthal was lead author on a much-publicized study released five years ago that found that just 10 months of regular, moderate exercise outperformed a leading antidepressant (Zoloft) in easing symptoms in young adults diagnosed with moderate to severe depression.

And another study released earlier this year, by researchers at the University of Texas Southwestern Medical Center at Dallas, found that 30-minute aerobic workouts done three to five times a week cut depressive symptoms by 50 percent in young adults.

Theories abound as to how revving up the body helps uncloud the mind.

Robert E. Thayer is a professor of psychology at California State University, Long Beach, and the author of *Calm Energy: How People Regulate Mood with Food and Exercise*. He said that while workouts probably affect key brain chemicals like serotonin and dopamine, physical activity may also trigger positive changes in other areas, too.

"Depression is a condition characterized by low energy and moderate tension, something I call 'tense tiredness,'" he said. But exercise has a clear "mood effect" that seems to ease that anxious but lethargic state, he said.

According to Thayer, moderate exercise -- a brisk 10-minute walk, for example -- results in a boosting of energy, although it may not be quite enough to relieve stress.

"More intense exercise -- the amount you'd engage in with a 45-minute aerobic workout -- does give a primary mood effect of reducing tension. It might also leave you with a little less energy because you'd be tired, of course," he said. "However, there's also some indication from the research that there's a 'rebound' effect an hour or so later, in terms of [increased] energy."

Blumenthal pointed to the more lasting psychological boost regular workouts can bring. "People who

great sense of accomplishment," he said.

Still, the experts acknowledged that truly depressed individuals often find it tough to jump into an exercise routine.

"Why do people *not* do the thing that's perhaps the most important thing for them to do?" said Thayer. "It's because a drop in energy is such a central component of depression -- you just don't have the energy to do the exercise."

He said the key to breaking that cycle is to start small.

"Thinking about going to the gym and doing all the stuff that's involved with that can be overwhelming for a depressed person," Thayer pointed out. "But if you think 'Hey, maybe I'll just walk down the street 30 yards or so, at a leisurely pace,' that's a start. And it turns out that your body becomes activated then -- you have more of an incentive to walk farther, to do more."

Loved ones can play a key role, too, urging a depressed friend or family member to join in with them as they work out. "Social support, peer pressure, family support -- all of that can be helpful, certainly in getting people to maintain exercise," Blumenthal said.

No one is saying that exercise is always a substitute for drug therapy, especially for the severely depressed. "But we also know that these drugs aren't effective for everyone -- about a third of people aren't going to get better with medication," Blumenthal said.

For those patients, exercise may prove a viable, worry-free alternative -- with one great fringe benefit.

"In addition to its mental health benefits, there are some clear cardiovascular benefits to exercise which we don't see with antidepressant drugs, of course," Blumenthal noted. So, he said, what keeps the mind fit strengthens the body, too. "You're feeding two birds with one hand."

There are a number of different factors that affect the control and response of heart rate. But, what controls the beat of the heart?

### Neural and Hormonal Affects

There are two different factors involved in heart rate management: intrinsic and extrinsic controls. Intrinsic regulation of heart rate is the result of the unique nature of cardiac tissue – it is self-regulating and maintains its own rhythm without direction. Extrinsic controls are those that come from both hormonal responses as well as the commands from the nervous system: the central nervous system and the autonomic nervous system. Extrinsic regulation can cause the heart rate to change rapidly because of chemicals that circulate in the blood or by direct action of nerves that go to the heart.

A good example of this is to measure heart rate changes when certain words or emotions are said or felt without a muscle contracting. Say the words, "we are going to have a surprise test today" and watch heart

heart rate jump during a car chase or action thriller. There is no cardiovascular or cardiorespiratory change as a result of this change in heart rate; it's simply the affect on the heart of chemicals and nerves responding to an external experience.

The cardiovascular control center for the body is located in the ventrolateral medulla. Here heart rate slows if activated by the cardioinhibitory center in the medulla or speeds up if activated by the cardioaccelerator.

From this site, the two channels of the autonomic nervous system originate the sympathetic and parasympathetic components. The sympathetic components increase heart rate by releasing the neural hormone catecholamines - epinephrine and norepinephrine. These hormones are cardioaccelerators. Acceleration of the heart rate is called tachycardia.

The parasympathetic nervous system located in the brain stem and upper or sacral portion of the spinal cord slows heart rate. The parasympathetic components decrease heart rate. These neurons release the neurohormone acetylcholine, which inhibits heart rate. The slowing of heart rate is called bradycardia.

The combination of the neural and chemical components regulates heart rate and other heart functions. When you begin to exercise in heart zones 1-3, heart rate increases because parasympathetic (cardioinhibitory) stimulation stops. During more strenuous exercise, heart zones 3-5, the heart rate increase occurs by direct activation of the sympathetic cardioaccelerator nerves.

Exercise excites the relationship between the sympathetic accelerators and the parasympathetic depressor neurons. This change in the balance in their activity called tonic activity leads to more involvement of the vagus nerves. The vagus nerves carry about 80% of the parasympathetic fibers, those responsible for slowing heart rate. With increased vagal dominance, heart rate values change and slow. One of the training effects is the slowing of resting and ambient heart rates. This is the result of the effect of fitness on the tonic activity and the favoring of greater activity by the vagus nerves to slow heart rate. These adaptations following zone 1-3 or aerobic training occur to those who are sedentary and begin an exercise program as well as those who maintain one. This is one of the benefits of training, a significant resting bradycardia.

The central nervous system plays the greatest role in control over heart rate during exercise. When you start a movement pattern, the central nervous system sends impulses through the cardiovascular center in the medulla. There is a coordinated and quick response of both the heart and the blood vessels to change blood pressure, tissue perfusion to respond to the requirements.

A good example of the central command involvement is with anticipatory heart rate. Before an event begins, if the individual anticipates with excitement and enthusiasm the event, heart rate increases dramatically without any muscular involvement. Anticipatory heart rate or your heart rate immediately before exercising in one experiment averaged 148 bpm when the announcer started giving starting commands to a group of sprinters. In this experiment, heart rates increased 140% in anticipation of the starting of this 60-yard dash. In fact, the body that the body increases heart rate in anticipation is good because it provides for the rapid mobilization of its bodily reserves by revving the body's engine. Research shows that the longer the event, the lower the anticipatory heart rate changes.

Heart rate is affected by external stresses on the body such as heat, humidity, cold, wind, and altitude and air quality. With each stress, the human heart is affected and different compensatory changes occur, one of those being adjustment in the beat of the heart. Triathletes racing at the Hawaiian Ironman face most of these conditions simultaneously while racing in one of the most strenuous events in the world. As a result, a heart rate monitor can help provide them with key information on how their body is responding to the conditions and the duration of this high intensity racing throughout the event.

The following chart shows the affects on heart rate of certain environmental stresses:

Type of Stress	Specific Stress	Heart Rate Changes	Explanation
Thermal Stress	Heat gain*	Elevated	Changes in heart rate are the result of changes in the core body temperature. Dressing appropriately is the most important consideration to maintain the
	Heat loss	Lowered	Thermoregulation adjustments result in improved exercise capacity to heat exposure but minimally to cold stress. This generally takes about 10 days. Shivering
Humidity	Dry Air	Elevated	The water content in the ambient air affects the amount of water lost through sweating. In dry air, sweating can be profuse and decrease in blood volume from dehydration
	Highly moist air	Elevated	Exercising in high humidity challenges the thermoregulatory system because the large sweat loss contributes little to evaporative cooling. Sweat does not cool the skin;

			evaporation of sweat cools the skin. Heart rate response is to increase blood flow to the skin for sweating therefore increasing heart rate.
Wind	Wind Chill	Lowered and Elevated	Wind caused by physical movement or air movement magnifies heat loss as the warmer insulating air on the skin is continually replaced by cooler, ambient air. Wind causes heat to decrease and hence heart rate to stay lower. Wind chill factor is an index that shows the effect of wind velocities on bare skin for different temperatures.
Altitude	High	Lowered maximum and training heart rates	There is a progressive reduction in the amount of oxygen and its partial pressure as altitude increases. As a result, the heart beats faster to compensate for less oxygen per breath. Maximum heart rate drops with increases in altitude approximately one beat per 1,000 feet of gain. There is some relief from the acclimatization process, which result in improved tolerance to altitude hypoxia.

\* Same response to thermic effect of food

## 2. Internal Body Changes

Almost any substance taken into the body affects the equilibrium of the organism. Heart rate is one of the quickest changes that occur as a direct reflection of this change that results in disequilibrium. For example, beta blockers (Inderal, Propranolol, Lopressor, etc.) cause bradycardia or the heart rate to drop. Similarly, the antiarrhythmic agents (Cardioquin, Procaine, Quinidine, etc.) given to patients to improve cardiac function also causes a decrease in heart rate. Pulmonary bronchodilator drugs such as the sympathomimetics (Isoproterenol, Ephedrine, Bronkosol, etc.) cause tachycardia or increase in heart rate values. Drugs that act as stimulants such as caffeine, nicotine, methamphetamines, cocaine, PCP cause tachycardia and drugs that are depressants, barbiturates, tranquilizers, alcohol and quaaludes cause bradycardia. Some drugs like inhalants can cause either a quickening or depressing of heart rate and respiration.

Other changes can cause changes in heart rate. Lack of sleep, irritability, rapid changes in blood

and raise resting and exercising heart rates. Emotions play a large role in heart rate response. Anger, fear, and anxiety cause tachycardia while depression usually results in lowering of heart rate. Feelings of love, compassion, happiness usually result in bradycardia. Emotional stress causes heart rate to stay elevated.

### 3. Fitness Level

The fitter you are the less often your heart contracts thus saving heartbeats. Getting fitter is like putting money into your saving account, it's putting heartbeats into your physiological saving account. Through the phenomenon of the training effect, ambient and resting heart rates drop, by as much as 20-30 bpm. When extended over a lifetime, this can equate to hundreds of millions of heartbeats.

The athlete's heart as the fit cardiac muscle is sometimes referred to is different than the sedentary individuals cardiac pump. There are structural and dimensional changes to the hearts of athletes, which reflect the specific training demands. The effects of getting a fit heart leads to cardiac hypertrophy, a muscle adaptation as a result of increased work capacity. That is, there is a moderate increase in heart size and anatomies regardless of age as the result of an aerobic and anaerobic training program.

Here's a list of changes that happen to the fit, athletic heart muscles:

Improved cardiac output      Lower resting and ambient heart rates

Increased stroke volume      Enlarged ventricular chamber

Thickening of the heart walls      Improved coronary blood flow

Improved mitochondria mass      Increase number of respiratory enzymes in the myocardium

#### Protection from the degenerative process of heart disease

The state of fatigue or rest of the individual also affects heart rate. If a student is physically tired from over-exercising there is a decline in physiological performance. Overtraining is a complex series of conditions which can include nutrient-fatigue, muscle-fatigue, and neuromuscular-fatigue. Heart rate is affected differently by different kinds of fatigue.

Heart rate is not affected by body composition. It's not affected by body type. It is affected by heart size with smaller hearts typically having higher resting and ambient heart rates.

### 4. Genetics

The genes that you inherited are responsible for much in our lives. They too affect heart rates. It appears that the effect of your genetic makeup accounts for about 50% of the value of your

are favorable that you will as well.

## 5. Mode of Exercise

Many factors affect maximum and training heart rates. The type of exercise is singularly one of the most significant. Maximum heart rate is mode specific. Anaerobic threshold heart rates are also mode specific. The greater the quantity of muscle mass that is used for the exercise, the higher the training heart rates attained. The highest heart rate numbers are those from sports which use both lower and upper muscle groups simultaneously such as cross country skiing. The lowest are those in which the body is in a horizontal position or in cool temperatures such as swimming.

Heart rate and changes in heart rate are affected by many factors. Each can result in heart rate variability depending multiple factors that might be simultaneously interacting. For example, a student might be on medication, fatigued, doing a different form of exercise, after not sleeping, just eating a big complex carbohydrate meal, suffering from stress, deconditioned, living at altitude, in high relative humidity, and it's the day before their birthday and they just returned from a long trip. In combination, these factors can make a big day-to-day variation in heart rate.

That's even more of a reason to use a heart rate monitor. It's a management tool. The heart muscle takes all of these situations and conditions into account when it sets the frequency of the beat. Both the heart muscle and the heart monitor are powerful – use them both, together.

### Heart Rate Monitors to Exercise Safely and Effectively

measure your cardiovascular and physiological stress during training sessions and during daily living. They provide you with an accurate gauge of the intensity of an exercise, as this will be reflected in your heart rate. The harder you exercise, the higher the heart rate. Because hard work alone does not guarantee better results, it is important to exercise within your personal target heart rate zones.

### TARGET HEART RATE ZONES

Whatever your goals - improving your overall health, weight management or winning athletic competitions - you can eliminate guesswork by exercising within a specific target heart rate zone. You can exercise effectively within a target zones only if you know how fast your heart is beating throughout your workout. And now, wireless electronic heart rate monitors make heart rate monitoring easy and fun to do.

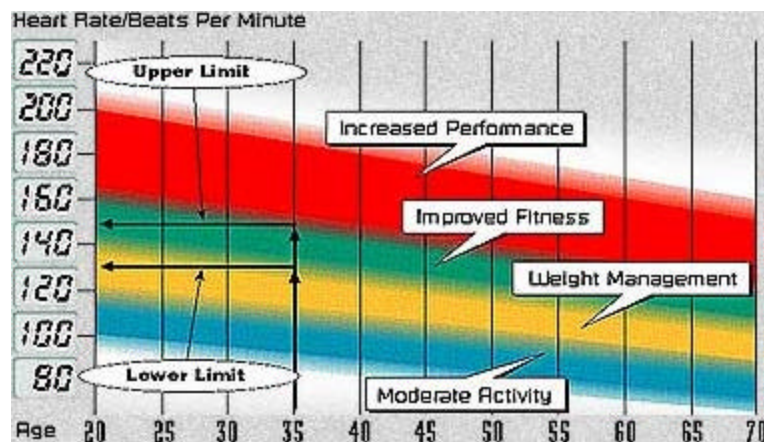
Determine your own exercise targets and choose an exercise prescription:

	Moderate	Weight	Aerobic Training	Improved	Increased
Intensity level	light	light-moderate	moderate-heavy	heavy	heavy-maximal
Percentage of	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100

Max HR			
Exercise duration	30 min - 1 h (even up to 2 hrs)		depends on training programme etc.
Exercise frequency	3-5 times a week (even daily)		depends on training programme etc.
During exercise	slight or no breathlessness and sweating	some breathlessness and sweating	obvious breathlessness and sweating
Exercise goal	to improve general wellness and cardiovascular health	to improve fitness	to increase endurance capacity and fitness performance
Recommended target group	beginners, sedentary, overweight, rehabilitators.	persons who exercise regularly	persons who are already exercising and have no health problems

It is strongly recommended that people take a medically supervised fitness test to determine their maximum heart rate and ideal exercise training zones. If that is not possible, then the chart below will can serve as a rough starting point for a fitness program. Some individuals will find that the zones are too hard, others may find them to easy.

The following Target Range Chart gives a rough approximation of your target zone.



1. Locate your age.
2. Locate the target which you have just determined. Each target is shaded differently.
3. Read up from your age to the target you have chosen.
4. Draw a straight line to the left from the upper edge of the target and you will find the Upper Limit of your Target Zone.

5. Then draw another straight line to the left from the lower edge of the target and you will find the Lower Limit for your Target Zone.
6. You have now defined your Target Zone. As you exercise, make sure that your heart rate stays within the Target Zone (between the Lower Limit and the Upper Limit) to get the maximum benefit out of your workout.

When determining the correct intensity level on Target Heart Rate Zone for a workout you should bear in mind the following factors which may influence the result and cause it to differ from that given in the chart for an average exerciser:

- ?? current fitness level and general level of physical activity
- ?? normal individual resting heart rate

To know your exact intensity level, you should consult your doctor or trainer. In any case, you should consult a doctor before starting any strenuous exercise program.

### **Heart Rate Training & Exercise Basics**

**Heart rate** - Heart rate is the number of heart beats per minute; the number of times per minute that the heart contracts.

**Average heart rate** - The average overall of all heart rate activity measured during an exercise period. Many heart rate monitors display average HR after an exercise session.

**Recovery heart rate?** This is the number of beats your heart rate will decrease immediately after an exercise session. For example, you exercise for a 1/2 hour at 155. Two minutes after you stop exercising, your heart rate decreases to 105. The 105 BPM would be your recovery heart rate. It is used to evaluate your fitness level after exercise. A two minute is the usual time frame to calculate heart rate recovery time.

If you are doing “interval training” you will notice that your recovery time becomes slower as you become more fatigued.

As the weeks go by, your heart rate will “recover” more quickly as you become more fit. Keep track of your recovery times to measure your improvement in fitness.

**Resting heart rate** - Resting heart rate (Resting HR) is the number of beats in one minute when you are at complete rest. Your resting heart rate indicates your basic fitness level. The more well-conditioned your body, the less effort and fewer beats per minute it takes your heart to pump blood to your body at rest. Best to test for resting heart rate the same way every time. Example, laying down on your back for two minutes when you feel rested and healthy and calm and you haven’t had caffeine.

**Determine Morning Resting Heart Rate (MRH)** Immediately after awakening and before you get out of bed, measure your heart rate using your heart rate monitor or from the palpating pulse from artery, counting the beats for 15 seconds and multiplying by four. You can sleep with your heart rate monitor on

didn't sleep well, or you're feeling stressed, you might have a slightly elevated resting heart rate. Take these measurements for five consecutive days and find the average. This average is your actual resting heart rate. Resting heart rate is dependent on your living habits and a number of factors such as quality of sleep, stress level, and eating habits.

**What is maximum heart rate** - Maximum Heart Rate (Max HR) is the highest number of times your heart can contract in one minute. Max HR is the most useful tool to be used in determining training intensities, because it can be individually measured or predicted.

**How to determine maximum heart rate**- You can define your maximum heart rate by:

- 1) having it measured in an exercise test
- 2) using age-predicted maximum heart rate formulas.

#### 1) Measured Max HR

The most accurate way of determining your individual maximum heart rate is to have it clinically tested (usually by treadmill stress testing) by a cardiologist or exercise physiologist. You can also measure it in field conditions supervised by an experienced coach. If you are over the age of 35, overweight, have been sedentary for several years, or have a history of heart disease in your family, clinical testing is recommended.

2) Predicted Maximum HR - There is a mathematical formula that allows you to predict your Max HR with some accuracy. It is called the "age-adjusted formula". The age-adjusted Max HR formula can come in very handy when you're not prepared to pay for the physician-supervised stress test. BUT – the age predicted formula is not as accurate as a maximum heart rate test.

WOMEN:  $226 - \text{your age} = \text{age-adjusted Max HR}$

MEN:  $220 - \text{your age} = \text{age-adjusted Max HR}$

If you are a 30-year-old woman, your age-adjusted maximum heart rate is  $226 - 30 \text{ years} = 196 \text{ bpm}$  (beats per minute).

These formulas apply only to adults. The generally accepted error in age-predicted formulas is  $\pm 10-15$  beats per minute, which is due to different inherited genetic characteristics and exercise training.

You should remember that there may be some discrepancy when using the age-adjusted formula, especially for people who have been fit for many years or older people. The formula will give you a ballpark estimate to work from, but if you want to exercise/train at your most effective levels, your Max HR should be measured.

**What is the heart rate reserve** - Heart Rate Reserve is the difference between your Maximum Heart Rate and your Resting Heart Rate. If your maximum heart rate is 196 bpm (beats per minute) and your resting heart rate 63 bpm, your heart rate reserve is  $196 \text{ bpm} - 63 \text{ bpm} = 133 \text{ bpm}$ .

The greater the difference, the larger your heart rate reserve and the greater your range of potential training heart rate intensities.

**What is safety heart rate** - This is the heart rate that is prescribed for beginning exercises - whether a walker, runner, swimmer, snow shoer, or a participant in any aerobic activity. It is also the term used in some cardiac rehabilitation programs in which physicians prescribe moderate, supervised training for recovering heart attack patients. This range is usually 60% (or less) of the maximum heart rate and represents the least amount of stress you can place on your heart and still receive a beneficial exercise effect.

**What is Max VO2 heart rate?** This is the heart rate at which you hit your maximal oxygen uptake effort. On the average, you hit your Max VO2 HR at 95% of your Max HR.

**What is the anaerobic threshold?** The physiological point during exercise at which muscles start using up more oxygen than the body can transport, i.e. muscle work produces more lactic acid/lactate than the body can process.

**Q: What is biofeedback?** Visual/numerical information on what is happening inside the body, for instance heart rate.

**Q: What does ECG stand for?** It stands for electrocardiogram which is a unit that is used in the medical community to measure and analyze heart rate. The heart rate monitors that read the electrical signal of the heart have about the same accuracy rating as the ECG machine.

**Q: What is the “target zone”?** A target zone is a heart rate range that guides your workout by keeping your intensity level between an upper and lower heart rate limit. There are various target zones that are suggested for an individual to follow that correspond with a specific exercise goal. IE: Improved Fitness Zone 70-80% of Max Heart Rate.

Ideal For	Benefit Desired	Intensity Level (% Maximum heart rate)
Light Exercise	Maintain Healthy Heart/Get Fit	50% - 60%
Weight Management	Lose Weight/ Burn Fat	60% - 70%
Aerobic Base Building	Increase Stamina Aerobic Endurance	70% - 80%
Optimal Conditioning	Maintain Excellent Fitness Condition	80% - 90%
Elite Athlete	Maintain Superb Athletic Condition	90% - 100%

For example, if you want to Lose Weight/Burn Fat: do your favorite exercise at 60%-70% of your maximum heart rate, based on your age, for at least 30 minutes a day, three times a week. To program your Heart Rate Monitor into your Ideal Weight Management Zone, use the Target Heart Rate Chart above.

Select which level of condition represents your current physical condition and locate the Lower and Upper Heart Rate Zones for your age from the Target Heart Rate Chart.

### Factors that determine your optimum exercise heart rate

- a) Your personal maximum heart rate   b) Your current fitness level   c) Your fitness goals

Once you determine your maximum heart rate and current fitness level, achieving your goals is a matter of exercising at the ideal heart rates, for the right amount of minutes per day, and per week.

#### Determining Maximum Heart Rate

*Max HR Test*- Maximum heart rate is genetically determined and declines with age in only relatively sedentary individuals. Max HR cannot be accurately predicted by formula (such as  $220 - \text{age}$ ). A treadmill test with a cardiologist or exercise physiologist is ideal for obtaining your Max HR.

*Sub Max HR Test*- You don't have to push yourself to peak capacity to find your Max HR. A close approximation of Max HR can be obtained by doing a "sub maximum test". A certified exercise professional can help you with the "sub Max test"

**Remember-** consult your physician to make sure you can take these tests safely.

## Using a Heart Rate Monitor

### Train Effectively - Use the Target Zones

If you are a beginner with the goal of improving overall fitness, losing weight or reducing stress, exercise in the healthy heart zone which is 50-60 percent of your maximum heart rate.

1. If you already exercise regularly but are aiming to lose body fat, exercise in the weight management zone which is 60-70 percent of maximum heart rate. Build up to a work out of an hour of continuous exercise.
2. If your goal is to improve aerobic capacity or athletic performance, exercise in the aerobic zone which is 70-80 percent of maximum heart rate.
3. Competitive athletes may need to add interval training sessions during the week in the anaerobic threshold heart rate zone, which is 80-90

percent of maximum. This high intensity exercise helps train muscles to handle lactic acid.

However, train sparingly at these upper limits. Exercising regularly at a heart rate intensity that is too high does not produce additional aerobic benefits and increases the possibility of an athletic injury. Interval training and anaerobic threshold workouts require a high degree of fitness, and is not necessary for general fitness training.

Once you determine your individual training zones, you can easily programme them into your Cardiosport monitor. Your monitor will notify you with a beep if you are exercising above or below the pre-programmed zones. Many Cardiosport models record heart rate at selectable intervals. You can then evaluate your exercise after each session and adjust your intensity if needed. Recording heart rate also allows you to monitor your fitness improvements over time.

#### Tips on Effective Training:

- Warm up & cool down. Always do a slow warm up of 5-10 minutes, followed by some gentle stretching. Then gradually climb into the target range you have set. End every workout with a 5-10 minute cool down, again followed by some gentle stretching. The importance of this can not be over emphasized. Studies have shown that people who warm up and cool down adequately have fewer athletic injuries.

- **Type of Exercise.** Choose activities that use large muscle groups and which are continuous in nature. Some good examples are walking, swimming, running, aerobic dance, stair climbing machines, ski machines, treadmills, cycling or exercise bikes. Feel free to include more than one activity - cycle one day, swim the next, and do aerobics on the third. This is called Cross Training and helps exercise all muscle groups, reduces boredom and keeps motivation high.

- **Frequency of exercise.** Exercise in the target range that you have set at least 3-5 times per week, with no more than 48 hours between sessions. Even on 'rest days' gentle exercise such as a leisurely walk can be beneficial.

- **Intensity of exercise.** Select an exercise intensity zone that is both within your capability and in which you can achieve consistency. Studies show that people who exercise at too high an intensity, especially in the initial stages of their program, drop out sooner, have more injuries, and tend to develop a negative impression towards exercise in general. If necessary start in a low exercise intensity zone and build up.

- **Time exercising.** Aim for 20-60 minutes of continuous exercise in your

target zone each session. Less than 20 minutes if you are just getting started.

### **Getting Motivated! Key reasons to Exercise**

- ♥ Improves Bone Calcium
- ♥ Improves Blood High Density Cholesterol
- ♥ Improves Handling Of Excess Heat
- ♥ Increases Hemoglobin
- ♥ Improves Resistance To Cold
- ♥ Decreases Blood Tri- glycerides
- ♥ Emotional Lift
- ♥ Decreases Blood Pressure
- ♥ Decreases Insulin Requirement
- ♥ Increases Glycogen Storage
- ♥ Less Conversion Of Sugar To Fat
- ♥ Increases Stroke Volume of Heart
- ♥ Decreases Resting Heart Rate
- ♥ Avoid Senility-Increases Oxygen Delivery To Brain
- ♥ Oxygen Pickup In The Lungs
- ♥ Increases Fat Burning Enzymes
- ♥ Fat Deposits Release Fatty Acids Better
- ♥ Better Control Of Hunger
- ♥ Decreases Body Fat
- ♥ Decreases Stress (Attitude)
- ♥ Increases Ability To Handle Stress (Biochemical)
- ♥ Increases Muscle Mass

- ♥ Easier To Exercise
- ♥ Increases Aerobic Threshold
- ♥ Higher Level Of Exercise Possible
- ♥ More Calories Burned
- ♥ More Fat Calories Burned
- ♥ More Calories Required At Rest
- ♥ Decreases Load On The Heart
- ♥ Decreases Muscle Dependence On Sugar
- ♥ Decreases Incidence of Hypoglycemia

## SET GOALS (and OBJECTIVES)

Goal setting is the art that makes everything else possible. It adds aim to energy, focuses effort and, for some, structures time. Surveys show that *people who plan ahead* are much more successful over the long term than those who plunge in without knowing where they're going or how they'll get there. You wouldn't take a long road trip without a map so it makes good sense to have a compass (and road map) for your fitness objectives.

### Goals Should Be Smart

**S = Specific.** Saying, "I'll go to exercise class," is not a specific goal. I have a clearer picture when I write, "Next week I will attend step class at 9:30 a.m. Monday, Wednesday, and Friday."

**M = Measurable.** Set goals that are measurable in quality or quantity. Measuring body fat percentage, hip to waist ratio or journaling and record keeping of diet intake or workouts achieved or increases in heart rate reserve are powerful and motivating tools to assuring a new habit becomes a long term behavior. Instead, make plans for an individual workout that nurtures you. Many folks find they're more committed to measurable goals if they report to a friend or colleague willing to help monitor their progress.

**A = Attainable.** In the enthusiasm of the moment we often make promises that are difficult to keep when enthusiasm wanes. If you're looking for a magic bullet the chances are you'll end up shooting yourself in the foot. Realizing that change doesn't happen overnight will help you set realistic goals you can achieve. It's the **SMALL** changes that

are the key to permanent lifestyle change. For example, if you are trying to lose weight you should avoid the painful rebound of crash dieting by planning to lose no more than one or two pounds a week.

**R = Realistic.** Goals should be reflective of your values and compatible with your lifestyle. If not they can be the source of distress. Success is about learning how to customize your activities to find the right fit for you. For example, if you don't enjoy working out with others it's unrealistic to join an aerobic exercise class. I enjoy being with people most of the time, but have learned that my new heart rate monitor based exercise program is much more fun when I stride out on my own where I can manage my pace without distraction and return with a sense of accomplishment in addition to the satisfaction of another completed workout.

**T = Timely.** It's not smart to plan too many changes at once-it's too threatening to your internal sense of balance. Before you begin be certain you can identify other areas of your life that might be stressful and prevent you from "doing what you want to do". For example, although a workout can be an important stress reducer if it makes your schedule more unmanageable you may have to postpone a new weight training program or fitness class until it's more in keeping with a balanced lifestyle.

### **Write Down Your Goals**

It's important to put your goals in writing. Written goals are a tangible sign of a promise that you intend to keep. They can remind you of that promise when time is short or if other priorities become pressing. *Written goals will also help you track your progress*, make your accomplishments more obvious and help you identify problem areas that need more attention. Sadly, only 5% of Americans write down goals and objectives, but 95% of those who do succeed. (A survey of Fortune 500 executives indicates that they may be successful because they write down their goals and objectives)

### **Identify Supporters And Saboteurs**

Some of us can be the lone ranger, but most people need coaches, cheerleaders and people whose belief in and support of us reminds us of our commitment to change. The friendship and support of others will make it easier for you pass through the sometimes difficult transition from old to new behaviors. I know *folks who have taken responsibility for themselves* and embarked on a changed lifestyle only to discover that most beloved friends and family members feel they are being imposed upon. So, identify the people who will nurture you and help you maintain your well-being, as well as those (even your loved ones) who don't see your point of view. Those supporters will help you maintain your commitment during periods of stress

### **Plan for the Unexpected**

Lack of time is the most frequently mentioned reason for discontinuing a fitness program. Life is filled with surprises so include strategies that assure you will make time for

maintaining your commitment in the face of changing schedules, unexpected mini-crisis and external forces like long meetings, extra traffic, changes in car pools--you know what I mean!!

### Affirm Your Behavior

Affirmations are powerful. Many people find that repeating certain sayings to themselves helps them accept things. They discover they are **programming their sub-conscious** to new beliefs. Affirmations should be positive such as "I am," "I have" as opposed to "I would like" or "I will try". Remind yourself daily, "I am a healthy person making changes in my lifestyle so I can live in the most healthy way."

### Reward Your Success

Set up a reward system so you can reward yourself for changed behaviors. Each of us have different values for measuring success. Yours should be structured to satisfy you, not others. That reward should make you hum from head to toe! Good examples include extra time for yourself with a favorite book, a manicure or pedicure, a trip with a special friend or relative or a class or lecture or play that stimulates your mind. Avoid rewards related to food and drink that may be sabotaging in the long run.

Negotiating the path to new behaviors can be fulfilling and rewarding if we can hang in there for the weeks to months necessary to make new behaviors lifestyle habits. Then you are ready to actualize new potentials.