“Exercise increases blood clotting, and so can increase the risk of strokes and heart attacks. Some doctors have been reporting increase incidence of flat feet, varicose veins, and prolapsed uterus among runners. Walking is a better form of exercise. Many health conscious people become hypothyroid with a synergistic program of undercooked vegetables, legumes instead of animal proteins, oils instead of butter, carotene instead of vitamin A, and breathless exercise instead of stimulating life.” ~ Ray Peat PhD

Exercise and Nutrition

Exercise today is different than the exercise of our ancestors. Our ancestors for one had a much higher exposure to sunlight and they did not have chronic exposure to dioxins, estrogen, mercury, fluoride, radiation and PUFA’s. These anti-metabolic stressors of today are creating a hypo-metabolic society that, when coupled with exercise, may have an aging affect.

According to Ray Peat PhD: “Estrogen promotes vascular permeability by a variety of mechanisms. Serotonin, histamine, lactic acid, and various cytokines and prostaglandins contribute to the leakage stimulated by estrogen, trauma, irradiation, poisoning, oxygen deprivation, and other factors that can induce shock. Even exercise, mental stress, and aging can increase the tendency of capillaries to leak.”

The new school of thought regarding exercise is to decrease energy (calorie) intake, while increasing energy (calorie) demand with breathless exercise. This causes a hypo-metabolic state. (http://www.youtube.com/watch?v=sYwAeF9eYcg&list=UUUVugU7Uod4PBxuie2xMngOQ&index=1&feature=plcp).

According to Ray Peat PhD: “Stress and starvation lead to a relative reliance on the fats stored in the tissues, and the mobilization of these as circulating free fatty acids contributes to a slowing of metabolism and a shift away from the use of glucose for energy. This is adaptive in the short term, since relatively little glucose
is stored in the tissues (as glycogen), and the proteins making up the body would be rapidly consumed for energy, if it were not for the reduced energy demands resulting from the effects of the free fatty acids.”

Inducing the stress response causes an increased production of adrenaline and cortisol, leading to lipid peroxidation and decreased glucose oxidation.

According to Ray Peat PhD, *The idea of the “oxygen debt” produced by exercise or stress as being equivalent to the accumulation of lactic acid is far from accurate, but it’s true that activity increases the need for oxygen, and also increases the tendency to accumulate lactic acid, which can then be disposed of over an extended time, with the consumption of oxygen. This relationship between work and lactic acidemia and oxygen deficit led to the term “lactate paradox” to describe the lower production of lactic acid during maximal work at high altitude when people are adapted to the altitude. Carbon dioxide, retained through the Haldane effect, accounts for the lactate paradox, by inhibiting cellular excitation and sustaining oxidative metabolism to consume lactate efficiently.*

Most people in society and health professionals currently view weight gain as a symptom of too little activity and think by increasing exercise frequency (with very little thought into exercise variables) is the most logical path to success. *Dianna Schwarzbien MD states that you must get healthy to lose weight, not lose weight to get healthy!* Weight gain is not an exercise deficiency; it is the end result of being in a hypo-metabolic state.

When in a hypo-metabolic state, it is easy to over train. Exercise is a stress put on the body. Exercise induces inflammation, which lowers the metabolic rate.

**Growth Hormone**

According to Ray Peat PhD, *the name “growth hormone” is misleading; stress produces somatic growth, in a process called “hormesis.” Exercise produces muscle edema, to a degree similar to that produced by GH; edema stimulates growth, but GH effect isn’t limited to bone and muscle. Estrogen can produce increased GH, and increases its production in stress.*
1. Nitric Oxide is a pro-aging free radical induced by estrogen that releases GH, producing edema.

2. GH and prolactin have similar qualities and are members of the same family of proteins.

3. GH acts like adrenaline by mobilizing FFA from storage.

4. GH antagonizes insulin and inhibits glucose oxidation.

5. GH causes, along with estrogen, the leaking of albumin out of the blood and into the urine.

6. GH can be anti-thyroid through blocking carbohydrate metabolism.

7. GH blocks progesterone production.

8. GH, along with adrenaline, cortisol and prolactin, all increase at night.

Most of the inflammatory markers that are released during exercise prepare the body for the emergency state. At the same time cells are put into a stressed state. This stressed state makes it hard for our cells to keep up. If this state continues for a long period of time symptoms may appear like water retention, muscle atrophy, increased anxiety, trouble sleeping, constipation, altered menstrual cycles, infertility.

Ray Peat PhD “Stress uses progesterone and can cause menstrual periods to stop. Girls who begin regular exercise (such as dancing) before puberty have later sexual development. Athletic training is known to slow the pulse. Cortisone, produced by stress, inhibits the thyroid gland. (When the thyroid is low, less oxygen is needed, so this is a useful adaptation for increasing endurance.) These hormonal changes are now known to produce sterility in both men and women. Sometimes progesterone seems to be chronically deficiency (leading to slight-though possibly prolonged-menstruation, or amenorrhea), in women who exercise hard. Since
progesterone can be converted into cortisone to handle stress, this would explain why well trained athletes (who need lots of cortisone) so often miss periods. It seems to be a simple over-consumption of progesterone, which is probably a reasonable biological adaptation, preventing pregnancy during times of stress.”

**How does exercise affect metabolism?**

Efficient cellular respiration allows the body to cope with stress. The resiliency of your body depends on the energy production at the cell level, from the use of glucose, thyroid hormones and the end production of ATP, CO2 and water.

In a hypo-metabolic state (estrogen dominant, thyroid conversion issues, liver dysfunction) cells are not respiring properly and with the addition of exercise this hypo-metabolic state worsens. Exercise increases energy demands on the body by increasing blood glucose production to fuel the body during a workout. When the consumption of carbs, proteins and fats are inadequate or there is the inability to store or convert glycogen during times of exercise, the body begins to break itself down (muscle tissue) to provide the necessary energy.

Ray Peat PhD “Since fat has a very low rate of metabolism, people who lose muscle by fasting are going to have increasing difficulty in losing weight, since they will have less active tissue to consume fat. Building up muscle and lymph tissue for optimal health – even if it initially causes a slight weight gain – will make reducing easier by increasing mass of metabolically active tissue. In the resting state, muscles consume mainly fats, so maintaining relatively large muscles is important for preventing the accumulation of fats.”

Exercise may suppress the production of T3. This may be caused by the decrease in blood sugar, increase in FFA, and the rise of adrenaline and cortisol. T3 levels can be restored following exercise. In a hypothyroid state T3 levels remain suppressed. Stress/exercise trick the body into believing that T3 is not needed as an adaptive response to the prolonged stress. This can be seen by taking your pulse and temperature 30min following exercise.
Ray Peat PhD “I’m not sure who introduced the term “aerobic” to describe the state of anaerobic metabolism that develops during stressful exercise, but it has had many harmful repercussions. In experiments, T3 production is stopped very quickly by even “sub-aerobic” exercise, probably because of the combination of a decrease of blood glucose and an increase in free fatty acids. In a healthy person, rest will tend to restore the normal level of T3, but there is evidence that even very good athletes remain in a hypothyroid state even at rest. A chronic increase of lactic acid and cortisol indicates that something is wrong. The “slender muscles” of endurance runners are signs of a catabolic state, that has been demonstrated even in the heart muscle. A slow heartbeat very strongly suggests hypothyroidism. Hypothyroid people, who are likely to produce lactic acid even at rest, are especially susceptible to the harmful effects of “aerobic” exercise. The good effect some people feel from exercise is probably the result of raising the body temperature; a warm bath will do the same for people with low body temperature.”

Most hypothyroid/estrogen dominant people are prone to having decreased blood volume with increased viscous blood. During exercise, this actually increases, increasing the risk of CVD.

Exercise increases edema like compounds like estrogen and GH, and these will increase both vascular leakiness and leakiness in the intestine. The end result is increased endotoxin production and absorption from the intestine into portal circulation, further affecting cellular respiration. Refer to the Research Links PDF on the member’s page for research on Endotoxin.

Exercise increases the body’s demand for oxygen. Exercise also causes the body to increase lactic acid production. Hypothyroid people already produce excess lactic acid; exercise can be a harmful trigger in producing more and therefore adding more stress to the overall physiological load.

Ray Peat PhD “This is where the issue of cell water comes in. Carbon dioxide, produced by oxidative cell metabolism, is associated with the high-energy state of the cell. When something interferes with oxidative metabolism, lactic acid is produced instead of carbon dioxide. If the cell stays very long in this low oxygen
state, it swells, taking up water. (The fatigued muscle, for example, can take up so much water in a short time that it weighs 20% more than before it began working so intensely that its energy needs far exceeded the availability of oxygen. This swelling is what causes the soreness and tightness of intense exercise. The swelling persists long after the liver has cleared the lactic acid from the blood.) This swelling from taking up water is involved in one type of “edema,” and in inflammation, or activation of the cells by hormones, as well as by simple oxygen deprivation.

Since lactic acid is produced by the breakdown of glucose, a high level of lactate in the blood means that a large amount of sugar is being consumed; in response, the body mobilizes free fatty acids as an additional source of energy. An increase of free fatty acids suppresses the oxidation of glucose. (This is called the Randle effect, glucose-fatty acid cycle, substrate-competition cycle, etc.) Women, with higher estrogen and growth hormone, usually have more free fatty acids than men, and during exercise oxidize a higher proportion of fatty acids than men do. This fatty acid exposure “decreases glucose tolerance,” and undoubtedly explains women’s higher incidence of diabetes. While most fatty acids inhibit the oxidation of glucose without immediately inhibiting glycolysis, palmitic acid is unusual, in its inhibition of glycolysis and lactate production without inhibiting oxidation. I assume that this largely has to do with its important function in cardiolipin and cytochrome oxidase.”

The bottom line is: thyroid hormone is the basic anti-stress hormone because it is required for the conversion of cholesterol to pregnenolone and all other steroidal hormones. When thyroid hormone levels are low from being in a hypo-metabolic state and with the addition of exercise, the anti-stress, protective and anabolic hormones are diminished. This leads to weight gain and the inability to loose fat, muscle loss or the inability to gain muscle and the perpetuation of disease!
Train smarter, not harder. ~ Paul Chek, HHP

1. Start exercising slowly and monitor temperature and pulse 30min after working out. If your pulse is above 85bpm and temperature is low, a hyper-adrenaline state exists and the workout was counterproductive.
2. Choose the right type of exercise for the level of healing.
3. Choose the right exercise frequency to meet mental, emotional, physical and physiological needs.
4. Try to exercise outside or go for a walk.
5. When exercising, it should feel good from beginning to end! Exercise should not be breathless.
6. An exercise program should meet the demands of the life a person lives and prepare them for their daily activities.
7. Workouts should be short and more anaerobic vs. breathless and aerobic. Workout time should be no more than 30-45min. Stop exercising when overall performance and/or energy decreases.
8. Take rests between sets to restore cellular ATP.
9. Optimal times to workout are between 10am and 3pm secondary to your body’s hormonal rhythms. Exercise is less stressful when the body is most resilient.....less stressful to the body!
10. Always perform a warm up and cool down prior to exercise.
11. Never workout late at night. The ability to do so with uninterrupted sleep cycles indicates a well-established stress to the hormonal system! Exercise depletes glycogen used to balance blood sugar while sleeping and promotes hyperventilation (excessive loss of CO2), which will suppress thyroid hormone synthesis and decrease reproduction hormones that promote good sleep quality.

12. Always think about pre, during and post workout nutrition to meet cellular needs. **SIP** on a shake of OJ, gelatin, salt and carbonated water or eat marshmallows while working out. Remember the body’s primary source of cellular energy is glucose! This regulates blood sugar, while modulating stress. *According to John Ivy PhD., when you consume carbohydrates with a protein, you will be able to spare muscle glycogen, blunt a rise in cortisol and prepare your body for faster recovery following a workout.*

**Energy Expenditure (Pre and During Workout):**

The goal during working out is to release sufficient ATP (energy) to drive muscle contraction. As you know, our cells through anaerobic an aerobic respiration, are able to produce ATP. The aerobic energy system is much more efficient at producing ATP, but takes much longer to produce ATP where the anaerobic cellular systems (Creatine Phosphate and Glycolytic) produce ATP very fast, but unfortunately one of its byproducts, lactic acid, is produced in higher concentrations secondary to lack of O2 (anaerobic) at the cell level. This not only interferes with muscle contraction, but cellular respiration, thyroid hormone production leading to inflammation. The importance of sipping on the right amount of OJ and gelatin for you during a workout will:

a. increase nutrient delivery to the muscles and spare muscle glycogen
b. limit immune system suppression through blunting cortisol
c. minimize muscle damage, thyroid hormone suppression and lower TSH
d. set a nutritional stage for faster recovery through regulating cell metabolism
e. the addition of a protein to a carbohydrate promotes metabolism of the ingested protein and lessens the demand for amino acid release from the muscles

f. “During exercise, the addition of fructose to glucose increases oxidation of carbohydrate by about 50% (Jentjens and Jeukendrup, 2005).” Ray Peat PhD.

**Energy Replenishment (Post Workout):**

According to John Ivy PhD, sugar is far more effective than protein in preventing protein degradation in the muscle. Most research shows that 30-45 min post workout your muscle machinery, in the presence of the right type and amount of carbohydrates and protein, can initiate repair of damaged muscle and replenish glycogen stores. Right after exercise, your cells are VERY sensitive to insulin, which if paired with the right carbohydrate to protein ratio, can be used to our anabolic advantage. Consuming OJ and gelatin post workout will:

- Prevent depletion of muscle and liver glycogen, which can increase endurance
- Will regulate blood sugar, which will regulate thyroid and cellular metabolism, thus decreasing fatigue
- Will blunt a rise in cortisol and indirectly push you into a more anabolic state
- Gelatin contains glycine and has been shown to facilitate that action of insulin in lowering and regulating blood sugar
- Will increase the elimination of metabolic wastes such as lactic acid
- Will initiate repair and regeneration of muscle proteins
- Will reduce damage to the immune system

h. Fat is NOT a primary source of fuel for the cell, as most is stored in adipose tissue and not readily available for fueling of muscles. In order for it to be used it must be broken down into fatty acids, which are inflammatory. Anytime the body has to break something down, it uses more energy than it produces. In this process the body will try to use fats, when carbohydrates/sugar are not available. But this process is catabolic.
Supplements, ONLY when needed:

1. *The use of Niacin amide, by lowering free fatty acids and regulating the redox system, supporting sugar oxidation, is useful in the whole spectrum of metabolic degenerative diseases. Niacin amide, used in moderate doses, can safely help to restrain the excessive production of free fatty acids, and also helps to limit the wasteful conversion of glucose into fat. There is evidence that diabetics are chronically deficient in niacin.* **Excess fatty acids in the blood probably divert tryptophan from niacin synthesis into serotonin synthesis.** Ray Peat, PhD  
   - Niacinimide also reduces IL-6 and parathyroid hormone (PTH)  
   - Ray Peat recommends as little as 100mg per day as an effective treatment to reduce FFA in the blood

2. Calcium from eggshells down regulates PTH (which indirectly inhibits estrogen, prolactin and serotonin), will decrease the loss of Mg, increases cellular CO2 and reduces inflammation.

3. Salt helps to down regulate adrenaline and aldosterone, increases albumin levels to help regulate blood volume, increases CO2 production, reduces vascular leakiness, reduces serotonin, reduces prolactin and increases overall cellular metabolism.

4. Eat a raw carrot with your meal prior to exercise to decrease estrogen and endotoxin production. ([http://www.ajcn.org/content/32/9/1889.abstract](http://www.ajcn.org/content/32/9/1889.abstract))

5. When exercise is performed take an Epsom salt baths prior to bed on those days. Start with 2 cups of Epsom salts and slowly work up by adding a cup per week to find a dose that works for best for each person. (please read that first sentence and see if this is right) Some people do well with 4 cups and some people with 4lbs. Healing is person specific! Start by staying in the tub for 15min and work up to 30 minutes. It is important, while in the bath, to SIP on pulp free OJ and salt. Heat can stimulate adrenaline and OJ/salt can help to modulate this. Epson salt baths can be used to reduce inflammation. Magnesium is easily absorbed through the skin and
with people in a hypo-metabolic state, sometimes this is much more efficient for use than taking supplements. Remember, broth, tropical fruits, chocolate, coffee, OJ, etc all have large amounts of magnesium in them as well.

- Mg works synergistically with progesterone, reduces muscle contractions and hypertonicity of muscles by displacing Ca from our cells, restrains blood clotting, sustains blood sugar, down regulates histamine and reduces inflammation, increases Mg uptake in the cells to assist with cellular respiration and the conversion of cholesterol, restrains insulin in excess, decreases vascular leakiness through serotonin inhibition, stabilizes nerve function through down regulation of Ca within the cell, reduces BP by down regulating estrogen and cortisol, required for protein and carbohydrate metabolism, etc.

6. Aspirin ([http://raypeat.com/articles/aging/aspirin-brain-cancer.shtml](http://raypeat.com/articles/aging/aspirin-brain-cancer.shtml)) is a natural anti-inflammatory that can be used pre and post workout. Always take aspirin with food and never on an empty stomach. As well, always pairing Vitamin K2 with aspirin in high doses to assist in regulating the viscosity of your blood. **We are not medical doctors and we are not advocating the use of aspirin. This is for the sole purpose of education. Please do your own research and education before putting something in your body! If you are on medications, please consult your physician prior to taking aspirin.**

- Aspirin rapidly breaks down into acetic and salicylic acid, which is protective to the intestine and other organs.
- Estrogen increases with inflammation and increases COX-2. Vitamin E and aspirin work together to inhibit COX-2 and oppose estrogen.
- Antioxidant and protects against lipid peroxidation
- Stimulates mitochondrial respiration
- Inhibits abnormal cell division and promotes normal cell division
- Reduces clotting of the blood
- Activates glycolysis and increase CO2
• Prevents toxicity of dopamine, glutamate and toxic free radicals
• Increases uterine circulation
• Aromatase inhibitor: Ray Peat PhD, PUFA’s stimulate the expression of aromatase (testosterone being converted to estrogen). Aspirin opposes estrogen by inhibiting COX-2.
• Improves Ca absorption in bone along with Vitamin K2 by protecting the arteries against calcification
• Inhibits IL-6, which is a large factor in heart disease, breast and liver cancer, as well as suppressing the thyroid and increasing prolactin and estrogen.
• Prevents lipid peroxidation
• **RULES:** Stop or lower your dose if you get ringing in the ears, always take with Vitamin K2 and if you have chronic GI issues dissolve the aspirin in hot water and drink. According to Ray Peat PhD, Aspirin is antagonistic to vitamin K; from one to ten milligrams of K1 or K2 would help to prevent it; also, endotoxin from intestinal irritation can cause ear ringing; milk and raw carrots help to protect against endotoxin.

7. Ray Peat PhD, “Exercise physiologists, without mentioning functional systems, have recently discovered some principles that extend the discoveries of Meerson and Anokhin. They found that “concentric” contraction, that is, causing the muscle to contract against resistance, improves the muscle’s function, without injuring it. (Walking up a mountain causes concentric contractions to dominate in the leg muscles. Walking down the mountain injures the muscles, by stretching them, forcing them to elongate while bearing a load; they call that eccentric contraction.) Old people, who had extensively damaged mitochondrial DNA, were given a program of concentric exercise, and as their muscles adapted to the new activity, their mitochondrial DNA was found to have become normal. Exercise, like aging, obesity, and diabetes, increases the levels of circulating free fatty acids and lactate. But ordinary activity of an integral sort, activates the systems in an organized way, increasing carbon dioxide and circulation and efficiency. Different types of exercise have been identified as destructive or reparative to the
mitochondria; “concentric” muscular work is said to be restorative to the mitochondria. As I understand it, this means contraction with a load, and relaxation without a load. The heart’s contraction follows this principle, and this could explain the observation that heart mitochondria don’t change in the course of ordinary aging.”