TheElite Training Group track club

Expanding the area of what is possible

In Track & Field Distance Running & Competent Self-Care in medicine and psychology

recovery, restoration, adaptation

TheETG Training Packets

Mission: Expand the area of what is possible for human performance in distance running. One of TheETG methods of achieving that is to proliferate applied science based information by way of –free– packets containing plain language info for “the average joe” seeking to move themselves or others forward

As you continue to acquire and apply more information you continue to expand the area of what is possible.

The functioning of brain cells, muscle cells, blood cells, -all cells- are governed by the laws of nature. The laws of nature -are- the underlying mechanisms of how everything works. The laws of nature that control human cellular function are -not- governed by your chosen belief system or the dogma you have been indoctrinated into, or the dogma you refuse to set aside.

“Nature, to be commanded, must be obeyed.” —[Francis Bacon]

Data-less conclusions founded upon faulty assumptions are the mother of all screw-ups. They lead to human belief systems that quickly get set in stone insuring that new information gets shouted down as pride, ego, and resistance to change supplant data, logic and reason. Put data ahead of dogma. Follow the data -not- the crowd.

“In God we trust…Everyone else must bring data.” —[W.Edwards Deming]

To be a good track coach one must -first- be a good physiologist.
To be a good medical doctor one must -first- be a good physiologist.
To be a good physiologist one must -first- be willing to………..
— put data ahead of dogma, follow the data -not- the crowd
— put science ahead of indoctrinated tradition
— put logic and reason ahead of faulty assumptions
— put mechanisms ahead of correlations and “risk factors”
— put critical thinking and clinical reasoning ahead of a memorized set of “if-then” statements
— read and apply large amounts of published research
— accept outcomes as the judge and jury of your work

You may copy any and all contents of this packet, with exception and exclusion of using such copies for purposes of producing revenue, profit, or any direct or indirect compensation.
Central Nervous System (CNS)
Periferal Nervous System (PNS)
[Brain, Spinal Cord, Periferal Nerves]

Motor Nerves
[To muscles]
Hormone System
Immune System
Blood Flow

Recovery/Adaptation Processes
Use Your Brain

Central Nervous System (CNS)
Periferal Nervous System (PNS)
[Brain, Spinal Cord, Periferal Nerves]

Motor Nerves
[To muscles]

Hormone System

Immune System

Blood Flow

Health Repair

The Brain;
--- Branches out to the body
--- Thus it can control or effect....everything!!!
Stay in an anabolic state
jacuzzi
autogenic Relaxation
down-time
inversion table
epsom salt bath
Recovery, Restoration, Adaptation

Additional things runners can do to improve their level of "Trainability", can be accomplished by addressing the mechanisms of human body... recovery, restoration, and adaptation... to the training that is done.

Following a workout, the recovery, restoration, and adaptation processes begin.

The Recovery process consists of the immune system's response to tissue (ie. nerve, muscle, tendon) damage. Restoration consists of the restoration of muscle glycogen levels. Adaptation consists of the gene transcription and translation processes.

Major Post-Workout Objectives -----

- Increase removal rate of products of nerve/muscle/tendon damage
- Decrease brain activity, and decrease motor nerve impulses to muscles, and facilitate immune system function
- Increase oxygen delivery to nerves/muscles via increased blood flow [without muscular activity, movement, exercise, etc.]
- Increase nerve/muscle repair functions via increased nerve/muscle energy [ATP] production for these functions [without muscular activity, movement, exercise, etc.]
- Increase nutrient delivery (amino acids, glucose) via increased blood flow [without muscular activity, movement, exercise, etc.]

"Recovery"....Restoration, Adaptation ----- 
Brain and Immune cell function is the major mechanism of workout recovery. Anything that enhances brain and/or immune cell function will improve the extent and rate of workout recovery. Anything that impairs brain and/or immune cell function will decrease the extent and rate of recovery.

The immune response serves three purposes;

(1) promotes clearance of damaged tissue;
(2) eliminates bacteria produced by damaged tissue;
(3) prepares the tissue for repair and regeneration.

Immune Cells Effect On Recovery ----- 
The process of workout recovery involves the invasion of damaged tissue by immune cells called neutrophils. Neutrophils come in and remove debris and kill bacteria generated by the damaged tissue (ie. muscle). Other immune cells called macrophages, come in and gobble-up the neutrophils.

Macrophages also work within the nervous system to clean up damage to the covering of nerve fibers (myelin sheaths) which is a major factor in nerve regeneration. Non-Steroidal Anti-Inflammatory Drugs (NSAID's) should be avoided since they have a negative impact on macrophage function.

Activation of Neutrophils & Macrophages ----- 
Damage to the membrane of muscle fibers activates a substance (membrane attack complex) on the membrane which attracts immune cells to the area.

Neutrophils must consume necrotic (damaged) tissue before the process of repair and regeneration can continue. Neutrophils are activated within the first 30 minutes following the workout. These and other immune cells release substances called cytokines that they use to communicate. The cytokine called Interleukin-1B activates macrophages.

Metallo-protein-ase is an enzyme contributing to the degradation of the matrix of damaged tissue (such as muscle fiber membranes) as part of the process of tissue repair following a workout. Immune cells regulate the function of this enzyme, and thus the process of post-workout tissue repair. The enzyme activity and tissue repair is reduced in runners who have reduced immune function due to psychological stress or overtraining.
Vitamin C is most concentrated in immune cells (ie. neutrophils), more than any other tissue in the body. When responding to significant stressors, neutrophil utilization of vitamin C increases enormously. Vitamin C is an antioxidant. Failure to increase intake to meet these demands results in destruction of the cells by free radicals (oxidative damage). Destruction of the cells leads to slower recovery time and impaired adaptations to training.

Other Immune Cell Effects On Recovery -----  
Following the process of cleaning up debris in the area, these immune cells also release cytokines that stimulate the formation of new blood vessels (angiogenesis) since restoring/bringing blood flow to the area is important for repair of the damaged tissue. The immune cells also release Growth Hormone, Insulin-Like Growth Factor-1, and other growth factors and cytokines that affect gene transcription to stimulate repair of muscle/tendon tissue. Tendons and cartilage are comprised of protein called collagen, produced by cells called Fibroblasts.

Fibroblast Growth Factor (FGF) stimulates fibroblast cells to produce collagen. The immune cells affect production of Fibroblast Growth Factor (FGF). They can release a cytokine called Interleukin-4 which enhances FGF production. Over-training suppresses immune function, which will have negative effects on everything mentioned here. The use of Non-Steroidal Anti-Inflammatory Drugs (NSAID’s), and steroids such as nandrolone and stanozolol (popularly used to improve recovery) should be avoided since they will suppress immune function, thereby negatively affecting the recovery process.

Neurotrophins Effect On Recovery -----  
Neurotrophins are substances produced in the central and peripheral nervous system. In relation to the recovery process, neurotrophins control the function of macrophages and act as growth factors and stimulators of the production of anti-oxidants in nerve fibers. Neurotrophins are also produced by muscle as a signal that induces growth, proliferation, and enlargement of the nerve fibers and nerve cells (neurons) connecting with the muscle. There are several neurotrophins; Nerve Growth Factor (NGF), Brain Derived Neurotrophic Factor (BDNF), Neurotrophin 3, Neurotrophin 4/5, and Neurotrophin 6.

Cortisol & Workout Recovery -----  
Tissues such as muscle, nerve, and immune cells have receptors for the stress hormone cortisol. Excessive training as well as psychological stress can elevate cortisol levels, which has negative impact on tissue building functions and enhances tissue degenerative processes.

Glucose levels in the blood serve as a feedback triggering mechanism in the brain where cortisol levels are controlled. Large drops in blood glucose levels during workouts triggers an increased release of cortisol. Thus taking steps to maintain blood glucose levels during the workout can decrease the rise in cortisol induced by the workout, leading to better post workout immune function and recovery processes.

Corticosteroid Binding Globulin (CBG) -----  
Cortisol circulates in the blood either as free cortisol, or cortisol bound to a protein called Cortico-steroid Binding Globulin (CBG). CBG controls access of cortisol to various tissues, since only non-CBG bound cortisol can move into cells and bind to cortisol receptors. CBG is decreased during chronic psychological stress and workouts, thus CBG, rather than solely elevated cortisol levels, can be a mechanism of decreased immune system function and workout recovery in stressed and/or over-trained athletes. It is highly likely that so-called "performance enhancing drugs" such as anabolic steroids do little more than temporarily decrease the effects that cortisol has in over-training induced decreases in training adaptations.

The...."I recover slower than I used to".....statements that aging runners often make is more likely due to their declining immune function, dependent more on their chronic over-training and/or psychological stress, independent of their age and/or aging.
TheETG
Boosting Training Adaptations

--- lite massage
Stimuli for brain cell, immune and nervous system regeneration, and to keep body in an anabolic state. 
Lite massage only, no deep massage, no thumbs or elbows, no digging.

--- Jacuzzi
5 - 10 minutes [98 - 105 degrees F] Provides stimuli for production of nerve growth factor, brain derived neurotrophic factor, isoforms of growth hormone, isoforms of insulin-like growth factor-1, and blood flow for regenerative functions in brain, nerve, immune system, and muscle.

--- Epsom salt bath
5 - 10 minutes warm or hot bath in epsom salts [magnesium absorbed through skin]

--- Down-time eyes closed bed-rest
Eyes closed lay-down time preferably within 7 – 9 hours after you get up in the morning. Splits-up the amount of "up-time" and/or awake-time on a given day by inserting some down-time. Reduce the cumulative total amount of daily activity and stress loads on brain, nervous system, and immune system.

--- Inversion table
A few minutes in an inverted position

--- Autogenic Relaxation [10 minutes]
I first started getting into mind-body medicine shortly after I first started hearing about it in earnest in the late 1970's and early 1980's. 
I started teaching autogenic relaxation to my high school runners in the mid-1980's.

Reduces brain and peripheral nervous system activity, reduce stress hormone [cortisol] levels and/or effects, increase blood flow and oxygenation, increase or normalize levels of substances and growth factors [nerve growth factors, neuro-trophic factors, anabolic hormones, etc] that promote regeneration and recovery functions in brain, nerve, immune system, and muscle.

Autogenic Relaxation: Stage 1
-- Oxygenation [diaphragmatic breathing]…..lay on floor or sit, place one hand on stomach. 
During inhale, make your stomach rise prior to your chest rising.

Autogenic Relaxation: Stage 2
-- Brain and nervous system activity reduction…..close your eyes, let go of thoughts related to daily activities. 
Repeat affirmations several times…."This is my down-time, I am calming and quieting all cells of my body. I am resting."

Autogenic Relaxation: Stage 3
-- Blood flow…..create relaxation, warmth and heaviness in limbs and torso. Repeat the affirmations….."my hands and arms are becoming warmer and heavier. My feet and legs are becoming warmer and heavier. My chest and torso is becoming warmer and heavier. I am feeling more and more quiet, calm, and relaxed."
Jacuzzi = 10 minutes [98 - 105 degrees F]

Provides stimuli for production of nerve growth factor, brain derived neurotrophic factor, isoforms of growth hormone, isoforms of insulin-like growth factor-1, and blood flow for regenerative functions in brain, nerve, immune system, and muscle.
Epsom salt bath

10 minutes hot bath in epsom salts [magnesium absorbed through skin]

"After initial pilot studies, all volunteers took baths (temperatures 50-55°C) and stayed in the bath for 12 minutes."
".....soaking in Epsom salts therefore increases blood magnesium concentrations..."

".....all individuals had significant rises in plasma magnesium and sulfate at a level of 1% Epsom salts. This equates to 1g MgSO4/100ml water; 600g Epsom salts/60 litres, the standard size UK bath taken in this project (~15 US gallons). However, most volunteers had significantly raised Mg/SO levels on baths with 400g MgSO added. Above the 600g/bath level, volunteers complained that the water felt ‘soapy’." 

"The values obtained suggest that most people would find maximal benefit by bathing 2 or 3 times/week, using 500-600g Epsom salts each time."

"Bathing in Epsom salts is a safe and easy way to increase sulfate and magnesium levels in the body."

R.H Waring
Report on Absorption of magnesium sulfate (Epsom salts) across the skin
School of Biosciences, University of Birmingham, United Kingdom
Inversion table

5 to 10 minutes in an inverted position. Opposite positions.....periodically putting yourself into opposition positions from the one's you spend much or most of your time day to day over the course of years and decades is a very good idea either physically and/or physiologically. If you sit for most of the day your back, hips, and knees are in a flexion position, good to get into extension for a few minutes each day. Likewise if you spend much or most of the day in an upright position its a good idea to spend a few minutes each day in a reclined or inverted position either via a yoga pose or inversion table.
As goes the immune system, so goes adaptations to training. Nucleotides improve immune system function.

getting nucleotides via supplementation.....

-- colostrum [PerCoBa]  
www.percoba.com/quality.html

-- IMPACT Advanced Recovery  
www.nestle-nutrition.com/Products/Produc...c2-9599-c92cb4a3d50a

-- ribose supplementation [Jarrow Formulas]  
www.jarrow.com/product/308/Ribose

Ribose supplementation......
Contrary to the hype about ribose supplementation, the major mechanism of action is unlikely to be the providing of cellular energy [a.k.a. ATP] to muscles. Far more likely to simply provide the ribose needed for production of incredibly important things in our cells called nucleotides. Our cells use nucleotides to repair and regenerate themselves via production of mRNA, RNA, and regeneration and repair of DNA.

Nucleotides production improves immune system function.

The human body makes ribose. Like other things that the body makes, there are times of life when supplementation can be pretty important. During times of chronic stress, or for athletes in high intensity training.

Also important for aging populations.

The study below shows that ribose supplementation improves the proliferation of a group of immune system cells, as well as improves their functioning ability.

"Ribose, a critical building block for nucleotides, plays an important role in......transcription, translation....".

"....we hypothesized that when cells are required to proliferate or differentiate, as in an immune response, the requirement for D-ribose may be greater than what could be supplied by the synthetic pathway."

"We hypothesized that providing an exogenous source of D-ribose during cell differentiation will enhance the process of differentiation."

"The expression of a cell surface marker representing maturity (CD11b) significantly increased and a cell surface marker indicative of immaturity (CD117) significantly decreased."

"Functionally, the cells had a greater oxidative burst function dependent on time and dose. The mechanism by which ribose enhances HL-60 cell differentiation is not known; however, as adenosine triphosphate levels did not change, adenosine triphosphate is not thought to be involved."  
"We conclude that in this cell culture model, ribose supplementation enhanced cellular differentiation and function. Thus, ribose might be conditionally essential during time of higher need as in an immune response."

M.Freeman, et. al
Ribose enhances retinoic acid-induced differentiation of HL-60 cells?  
Nutrition Research.....Volume 28 #11.....page 775 - 782

by Dr. Mehmet Oz [a.k.a “Dr. Oz”]
Ribose is a special sugar made in your body that doesn't come from food. Of all the things you can do to combat the effects of knee-dragging fatigue, taking daily a ribose supplement is the one that seems to really turbo-charge some people who have diseases with low energy associated with them. (The only side effect is that some people feel too much energy, if that's possible.) Ribose has also been shown to relieve fatigue, soreness, and stiffness after exercise, and some professional athletes have reported muscular benefits after taking ribose. However, the data are too weak to say it does or doesn't work well, since the studies just haven't been done.

And there is enough good research to recommend ribose for all of us. But if you want to give it a try, start with 500 milligrams three times a day for a week or so until you get used to the taste (or find a smoothie, coffee, or tea to put it in). Then go to 5 grams three times a day for three weeks to get a sense of the effect. Then you can scale back to 5 grams twice a day. By the way, since I know you're wondering: Each 5-gram scoop only contains 20 calories since ribose isn't metabolized as a sugar, so taking it won't increase your chances of becoming mistaken for a Sea World attraction. In fact, since it is a bit sweet, you might think of it as a sugar substitute.
Colostrum

Colostrum is a substance similar to milk that is produced in the breast by humans [women] and animals for use by newborns to aid their physiological development and growth. It contains a number of digestive tract, brain/nervous system, and immune system substances that are basic nutrients and proteins for these areas of function. It also contains a number of basic cell function substances as well as growth factors that are used in normal cellular adaptations and recovery from major stressors and traumas.

When taken by adults as an extremely popular aspect of Preventive Medicine, Nutritional Medicine, and Naturopathic Medicine particularly for those who have nutrient deficits [ie. hospital patients, elderly nursing home residents, high level athletes], or by those who suffer from immune system related maladies or challenges [allergies, common cold, infection, high level athletes in heavy training]colostrum can be a major restorer of normal functioning. From heart disease and cancer, to fibromyalgia and infections, colostrum addresses many of the nutritional components of these maladies.

The major health triad.....digestive tract, brain/nervous system, and immune system, have become the 3 main targets in the modern day practice of Preventive Medicine, Nutritional Medicine, and Naturopathic Medicine. Colostrum is one substance that has the ability to address all 3.

Product suggestion PerCoBa http://www.percoba.com/quality.html

Colostrum & Nutrition Medicine

In the interest of the broad effects of Preventive Medicine and Nutritional Medicine at a time in history when there is a rapid transition underway, headed away from Traditional Medicine and it’s pharmaceuticals and toward Preventive Medicine and Nutritional Medicine and their foundational nutrients approach to human cellular function, the ETG would like to express its opposition to the World Anti-doping Agency [WADA] position [taken earlier this year] on Colostrum. Whether for athletes or the general public, a recommendation to avoid use of a product that benefits long term health is a WADA position that cannot be defended. The original purpose of a "banned list" was to protect the health of athletes, not to "catch the drug cheats", or level a playing field. Coming out against a non-drug product that protects health is nonsensical.

The ETG currently has no plans to avoid use of Colostrum, and to the contrary, recently added it to it’s "Supplements List", shown on the ETG Training Packet page of this website, in "The Food & Supplements" section of the packet.

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Of concern to some [ie. World Anti-Doping Agency [WADA]] is that similar to human Colostrum, colostrum from cows contains Growth Hormone along with its best friend and side-kick, IGF-1. These substances are comprised of proteins. When consumed by mouth, these proteins enter the digestive tract, where they get broken down in the stomach [ie. Digested]. Thus they are no longer Growth Hormone or IGF-1.

When you correct nutritional and other deficits in humans, you see cell function return to normal, and thus if you measure things such as growth hormone levels and/or IGF-1 levels, you likely see an increase. The increase was due to restoring normal cell function, not Growth Hormone ingestion or IGF-1 ingestion. Obviously, this point added to the situation where we know that growth hormone is not a performance enhancing drug [see the ETG Training Packet section titled The Problem With Drug Use & The Problem With Drug Testing ], should remove any cause for concern in using Colostrum to aid one’s health and/or cellular functioning. The original purpose of a banned drug list in sport was to protect the health of athletes. Colostrum is a super-star in ever expanding field of Nutrition Medicine.

Product suggestion PerCoBa Colostrum
We investigated whether supplementation with 60 grams per day of bovine colostrum affects blood levels of insulin-like growth factor-1 (IGF-1) and IGF binding protein-3 in relation to doping testing.

Nine endurance-trained men ingested 60 g/d of bovine colostrum for 4 wk.

After 4 wk urine and blood samples were taken....

Drug testing in a laboratory accredited by the International Olympic Committee did not show any forbidden substance before or after 4 wk of supplementation.

Daily supplementation with 60 g of bovine colostrum for 4 wk does not change blood IGF-1 or IGF binding protein-3 levels and does not elicit positive results on drug tests.

Nutrition.....Volume 18 # 7-8...July-August, 2002....page 566 - 567

H. Kuipers, et al....[Department of Movement Sciences, Maastricht University, The Netherlands] --- Effects of oral bovine colostrum supplementation on serum insulin-like growth factor-1 levels

This study examined the effect of supplementation with concentrated bovine colostrum protein powder (intact) on plasma insulin-like growth factor I (IGF-I) concentrations...

We conclude that supplementation with intact powder did not increase plasma IGF-1 concentrations...after 8 weeks of supplementation

J.D. Buckley, et al [University of South Australia, Adelaide] -----Bovine colostrum supplementation during endurance running training improves recovery, but not performance

IGF-1 is present in breast milk.

Gut.....Volume 51.....2002.....page 748-754

A .G. Cummins, F. M. Thompson [Bazil Hetzel Research Institute and the Department of Gastroenterology and Hepatology, The Queen Elizabeth Hospital, Adelaide, South Australia] ----Effect of breast milk and weaning on epithelial growth of the small intestine in humans

Natural colostrum contains several substances, including IGF-1 which is listed as a prohibited substance (section S2 of the Prohibited List).”

Taking into account the above elements and the fact that there is still scientific uncertainty on the ability for IGF-1 contained in colostrum to influence plasma levels of IGF-1, the WADA List Committee adopted a safe approach and recommends athletes not to take colostrum”.

[World Anti-Doping Agency 2008]

WADA would like to take this opportunity to emphasize that colostrum contains Insulin Growth Factor-1 (IGF-1) a substance prohibited under section S.2 of the 2008 WADA Prohibited List. Even if influence of oral intake of colostrum on plasma concentration of IGF-1 is still a matter of debate within the scientific community, WADA would like to alert that abnormal increase or level of blood circulating IGF-1 would be considered as potentially revealing doping practices (e.g hGH or IGF-1 intake) by athletes.”

WADA wishes to draw your utmost care in the use of colostrum by athletes.”

[March 19, 2008.....Dr Olivier Rabin, Director, Science of the World Anti Doping Agency(WADA)]
Just say no to Ice and other forms of cryotherapy

In sport, in post-workout or post-injury, swelling/inflammation is -not- your enemy, and ice is -not- your friend. Just say no to ice baths and other forms of "cryotherapy". Been against this stuff since I saw the first studies on it in the late 1980's when one of my former high school runners was at University Of Texas where the women's track program was using it. Its now an obsession across many sports, especially college and pro football. Whether its application of an ice pack, bag of ice, pack of frozen vegetables, or a full scale limb or body submersion in an ice bath.....contrary to popular belief, swelling and inflammation is -not- your enemy.

The immune system drives workout "recovery" processes. Doing stuff that screws with that makes no sense. Doing stuff that shuts down local anabolic [tissue building and repair] substances and hormones makes no sense. Doing stuff that impairs recovery and/or adaptations to training and then saying that it improves same, makes no sense.

The human species didn't appear on earth yesterday afternoon. We know something about how human cells function. Don't be do'in this crap for years, sabotaging your own advancement in your sport, and then claim that the reason you decided to take steroids is because that was your only way forward. Be a jock -not- a dumb jock.

Follow the data, not the crowd.

"We evaluated the effect of cold ice-pack application following a brief sprint-interval training on the balance between anabolic mediators [growth hormone, insulin-like growth factor-I, testosterone], catabolic markers (cortisol, IGFBP-1, and circulating pro [Interlukin-6 and IL-1β]- and anti-inflammatory cytokines [IL-1 receptor antagonist]."

"Twelve males, elite junior handball players performed 4 × 250 m treadmill run, at 80% of each individual's maximal speed, followed by a rest period with and without local cold-pack application."

"Local cold-pack application was associated with significant decreases in IL-1β, IL-1ra, IGF-I, and IGFBP-3 and a greater increase of IGFBP-1 during recovery."

"Local ice therapy immediately following sprint-interval training was associated with greater decreases....anabolic hormones supporting some clinical evidence for possible negative effects on athletic performance."

D.Nemet, et al
Effect of local cold-pack application on systemic anabolic and inflammatory response to sprint-interval training: a prospective comparative trial
European Journal of Applied Physiology.....Volume 107 #4....November 2009....page 411 - 417

"Several studies analyzed the effectiveness of cold-water immersion to support recovery after strenuous exercise, but the overall results seem to be conflicting. Most of these studies analyzed only short-term recovery effects, whereas the adaptational aspect has been widely neglected."  

"Therefore, we analyzed the effects of repeated cooling after training sessions on adaptations to strength training."  

"Cooling consisted of 3...4-minute intervals with a 30-second rest period."  The other leg was not cooled."

"Long-term strength training adaptations in trained subjects can be negatively affected by cold-water immersion. However, effects were small, and the practical relevance relative to possible recovery effects needs to be considered in a sports practical setting."

M.Fröhlich, et al
Strength Training Adaptations After Cold-Water Immersion
Journal Of Strength & Conditioning Research.....Volume 28 #9...September 2014...page 2628 – 2633

"When ice is applied to a body part for a prolonged period, nearby lymphatic vessels begin to dramatically increase their permeability (lymphatic vessels are 'dead-end' tubes which ordinarily help carry excess tissue fluids back into the cardiovascular system)."

"As lymphatic permeability is enhanced, large amounts of fluid begin to pour from the lymphatics 'in the wrong direction' (into the injured area), increasing the amount of local swelling and pressure and potentially contributing to greater pain."


"The use of ice or cryotherapy in the management of acute soft tissue injuries is widely accepted and widely practiced. This review was conducted to examine the medical literature to investigate if there is evidence to support an improvement in clinical outcome following the use of ice or cryotherapy."

"Six relevant trials in humans were identified, four of which lacked randomization and blinding. There were two well conducted randomized controlled trials, one showing supportive evidence for the use of a cooling gel and the other not reaching statistical significance."

"Four animal studies showed that modest cooling reduced edema but excessive or prolonged cooling is damaging. There were two systematic reviews, one of which was inconclusive and the other suggested that ice may hasten return to participation."

"There is insufficient evidence to suggest that cryotherapy improves clinical outcome in the management of soft tissue injuries."

Is Ice Right? Does Cryotherapy Improve Outcome for Acute Soft Tissue Injury?
"cold water immersion is widely used by athletes for recovery. This study examined the physiological merit of cold water immersion for recovery from high-intensity exercise by investigating if the placebo effect is responsible for any acute performance or psychological benefits."

"30 males performed an acute high-intensity interval training session, comprised of 4 × 30-seconds sprints, immediately followed by one of the following three 15-min recovery conditions: cold water immersion (10.3°C), thermoneutral water immersion placebo (34.7°C), or thermoneutral water immersion control (34.7°C)."

"**A recovery placebo** administered after an acute high-intensity interval training session....is as effective as cold water immersion. This can be attributed to improved ratings of readiness for exercise, pain, and vigor, suggesting that the commonly hypothesized physiological benefits surrounding cold water immersion are at least partly placebo related."
Ways To Enhance Adaptations To Training

The degree to which runners can improve fitness and performance levels can be enhanced by improving the degree to which their bodies respond to their training. Outside of coaching, and training, there is an area where the runner can find substantial improvement.

In short, there are things runners can do to improve their level of "Trainability".

Adaptations To Training ----- 
Improvements in fitness are due to changes in the body that we refer to as..."Adaptations To Training". Adaptations To Training, are the result of increases in the function and/or number of things that allow you to run faster race times, such as things called mitochondria, and certain pump and channels along nerve and muscle fibers.

The Purpose Of Training: Gene Transcription ----- 
The purpose of training is to turn on a process called, gene transcription, which results in specific "Adaptations To Training". Adaptations To Training, are the result of the production of new proteins comprised of things called, amino acids [protein], that have been placed together in specific order. Genes are a set of instructions of which amino acids are to be placed together to build a specific protein.

A training stimulus [workout] is a chemical signal produced by a workout and received by the genes inside specific cells (ie. nerve cell, muscle etc.). The training stimulus is a signal, turning on the processes of gene transcription and translation.

The signal causes the gene to make copies of itself [gene transcription], which are sent to the builders of new proteins (ribosomes) at construction site. The builders follow the instructions detailing which of 20 amino acids to place together and in what order (translation), to build specific types of proteins. Specific workouts yield specific adaptations, because the training stimulus determines which genes are copied and taken to the builders, thus yielding specific "Adaptations To Training".

There are regulators of the process of gene copying called transcription factors (enhancers, boosters, suppressors). It is the copying process, not the genes themselves, that...most...affects Adaptations To Training. And it is...training...that most affects the copying process.

Enhancing Adaptations To Training: Protein Intake ----- 
Sport Nutrition provides the nutrients that drive Adaptations To Training. For example --- carbo/protein beverages; Ingesting the combination of carbo/protein drink elevates insulin levels in blood (beyond what carbs alone will do). Insulin is perhaps the most powerful anabolic [tissue building] hormone in the body. Insulin stimulates further gene transcription in addition to that achieved by the training stimulus (workout) alone. Thus insulin causes more copies of the genes inside the muscles to be made, and drives the amino acids (that will be used to make the new proteins) out of the blood stream and into the muscles where the ribosomes will use their instructions (copies of the genes) and the amino acids to build new proteins.

Insulin levels are elevated higher by liquid meals than by regular food meals. Taking the drink prior to the training session decreases protein breakdown during and after the workout, and taking the drink after the workout enhances protein synthesis. Protein intake in general is of critical importance. Supplying..."essential" amino acids...for training adaptations should be a high priority. Substantial differences in the magnitude of adaptation to workouts can be seen in high vs. low protein intakes.

Amino Acids For Adaptations To Training ----- 
Perhaps the one thing more important than what you eat, is when you eat it. Following a workout, blood flow to nerve cells and muscles can remain relatively high for about an hour. Gene transcription has already begun during this time and will reach significantly high levels within 2 hours following the workout. Thus, this 1 - 3 hour time period is an incredibly productive time to supply your cells with the amino acids they will need to build new proteins for training adaptations.

Blood flow during this time can be 50 - 70% higher as compared to later on. Transport of amino acids from the digestive tract through the blood stream can be 50 - 100% greater during this time as compared to later on. So this is the importance of "when" you eat.

In addition to taking advantage of high blood flow, and thus high delivery of amino acids to cells, the amino acids themselves increases protein production and decreases protein destruction following the workout. Two things stimulate protein production......the workout, and the amino acids. The effects are additive......hence the additional importance of eating them right after the workout. Supplying the amino acids right after the workout causes major increases in the...[anabolic (tissue building)]....effects of both the workout and the nutrition.
"A combination of amino acids, to increase amino acid availability, and carbohydrates, to stimulate insulin release, should be a potent stimulator of net muscle protein synthesis."

"These results indicate that the response of net muscle protein synthesis to consumption of an Essential Amino Acid-carbohydrate supplement solution immediately before resistance exercise is greater than that when the solution is consumed after exercise."

K.D. Tipton, et al.
Timing Of Amino Acid-Carbohydrate Ingestion Alters Anabolic Responses Of Muscle To Resistance Exercise
American Journal Of Physiology, Endocrinology, & Metabolism... Volume 281....2001....page E197

"The results suggest that Branched-Chain Amino Acids have a protein sparing effect during the recovery after exercise....."

E. Blomstrand, Bengt Saltin
BCAA Intake Affects Protein Metabolism In Muscle After But Not During Exercise
American Journal Of Physiology, Endocrinology, & Metabolism... Volume 281....August 2001....page E365

"...we conclude that Non-essential Amino Acids are not necessary for stimulation of net muscle protein balance and that there is a dose-dependent effect of Essential Amino Acid ingestion on muscle protein synthesis."

E. Borsheim, et al
American Journal Of Physiology, Endocrinology, & Metabolism... Volume 283....2002....page E648

Protein Intake ----- 
One of the things that the past hoopla about Creatine supplements has demonstrated is that many athletes fail to take in enough protein in their diets. Nutritionists have long stated that Americans have too much protein in their diets. But those Americans being referred to are sedentary people...people who do not exercise at anything close to the level of most runners. Their gene transcription and protein turnover (utilization) levels do not approach that of an runner.

It seems clear at this point that runners must supply enough amino acids to match the level of gene transcription their workouts induce. What this level is for any one specific runner is anyone's guess, however one can educatedly guess that an intake of......1.0 to 1.5 grams of protein per kilogram of body weight (1 kilogram = 2.2 pounds)......on the main training days may come close for most non-over-training track and field athletes and road runners.

Supplying "Essential" amino acids [amino acids that the body cannot make in sufficient amounts] for training adaptations is of critical importance. Substantial differences in the magnitude of adaptation to workouts can be seen in high vs. low protein intakes.

A Nitrogen balance test can be done to measure how much protein (nitrogen is in amino acids) goes in.....versus.....how much comes out in the urine. If more comes out than goes in, the person has a negative nitrogen balance. They need to increase their protein intake to match protein disposal. These tests can be potentially useful to give one an idea of the rate and amount of protein intake required to meet their cells demand.
Effects Of Massage On Recovery

The mechanisms of workout recovery can be powerfully addressed through massage.

The brain and nervous system is "hooked-up" directly to the skin and to muscle, and as one sees in research on infants, touch and stroking has powerful, positive effects on brain function, and immune function. The brain directly affects the immune system by way of the release of chemicals [increase in neuro-trophins, decrease in cortisol] that communicate with immune cells, and contribute to cell regeneration processes. The mechanisms of rehab from injury can also be partially addressed through massage.

Stroking/squeezing massage works through nerve and brain, to improve immune function (and/or prevent a decline). Post-workout relaxation causes a decrease in the stress hormone, cortisol. Cortisol can down-regulate immune cell number and activity. It can also compete with testosterone for muscle binding sites and negatively affect muscle protein synthesis necessary for adaptations to training.

Stroking/squeezing massage also works through nerve and brain to increase neuro-trophin levels affecting recovery and "Adaptations To Training" within the central and peripheral [arms & legs] nervous systems.

Massage that causes pain is likely to increase cortisol levels. Thus deep massage to remove "knots" or scar tissue from muscle should never be used....as a method of "relaxation" induced workout recovery.

Stroking/squeezing massage can affect injury rehab as well. Most soft tissue (tendonitis, muscle pulls) injuries consists of micro-tears in tendon or muscle. Tendon is comprised of a protein called collagen. Collagen is produced by cells called fibroblasts. When collagen production by fibroblast cells to repair injured tissue is enhanced, rehab is enhanced. Massage can stimulate tissue healing by creating direct physical pressure on fibroblast cells. The more pressure applied (ie. deep massage), the greater the production of fibroblast cells.

Many massage therapists, athletic trainers, physical therapists, often go too far with deep massage. Deep massage that causes large amounts of pain and discomfort is likely to result in increased production the stress hormone called cortisol. This hormone may have little effect on fibroblast cell production, but will decrease their activity, decreasing collagen (new tissue) production and have weakening effects on collagen fibers similar to cortisone shots, and non-steroidal anti-inflammatory drugs [NSAID's].

Things that are well known to increase fibroblast cell production of collagen to heal tendon tissue;
-- exposure of the injured tissue to pressure massage, thus stimulating fibroblasts
-- exposure to mechanical loads (ie. high weight strength training)
-- exposure to mechanical stimuli by sound waves (ie. ultra-sound treatment by a physical therapist) within the first 3 days of injury.
-- exposure to electrical stimuli by small electrical currents (ie. electric-stim treatment by a physical therapist.
-- exposure to magnetic fields produced by magnets

Thus deep massage that causes the runner to cringe in pain, or brings the patient to tears on the massage table, should never be used. The objective should be put the runner's body in a state where it can heal......itself...........rather than for the person giving the massage to work on the premise that he/she is going to........"dig in there and get this knot out".........!

Full tissue repair cannot occur in a timely manner with rest alone. Massage (ie. on Achilles tendon, hamstring, knee, quadriceps, etc.) and stretching is an insufficient stimulus to get fibroblasts to produce enough collagen to withstand training loads. One must train the tissue to endure the training loads placed on it...and massage or ultra-sound, by themselves, is not sufficient to accomplish this task. To induce healing, there must be a frequently applied, direct signal (via strength training) that turns on and/or increases fibroblast. Low volume (low number reps and sets), high intensity work is the most potent stimulus.
Hydration & Re-hydration

Stay hydrated throughout each day by consuming about eight [8] 8 ounce [240ml] of water.....in addition to.....whatever fluids you consume with meals, etc. The easiest way to do this is to fill a 2 quart pitcher with water and a few pinches of salt just prior to bedtime. Consume it across the night, next day, and evenning, prior to bedtime when you fill it again.

Intake of moderate amounts of plain water may suppress thirst drive before adequate amounts of fluids have been ingested. Part of the job of the stomach and intestines is to prevent flooding the blood stream with fluids/solids in ratios that will dramatically change the ratio of fluids to solid already in the blood. If they allow too much fluid in, they risk making the blood so thin that blood pressure gets too low, and thus cannot be pumped to the brain. If they allow too much solids in, the blood may get too thick. Thus, the stomach and intestines like it when you ingest thing that are similar to the osmality [ratio of fluids to solids] in the blood.

Significantly more fluid is absorbed from carbo/electrolyte (sodium) beverages (~90-95%) than plain water (~50-60%). Carbohydrates in fluid stimulates sodium and water absorption. Sodium is essential for glucose transport from the small intestine into the blood stream. Fluid containing protein stimulates water and sodium absorption independently of glucose.

Fluid loss during a workout cannot be prevented by pre-workout fluid ingestion. Fluids must be ingested during the workout, at a rate of 240ml (8oz) per 10 minutes, with a pinch of salt [to increase absorption] put in each cup. Significantly more fluid is absorbed from carbo/electrolyte (sodium) beverages (~90-95%) than plain water (~50-60%).

Maximal stomach emptying rate of fluid into the small intestine = 33 - 38ml (1/7 cup) per minute. Fluid absorption rate from the small intestine into the blood stream = 25ml(1/10 cup) per minute. Intake of fluids containing 15 - 20 grams of carbohydrate per 240ml (8oz) may be best during a workout/race.

There are negative effects of any amount of dehydration. You need to drink enough to match sweat rate. However, even in well hydrated conditions, heat production at high rates due to high intensity exercise can far exceed heat loss rates (sweat rates). Thus heat accumulation type performance deficits can occur prior to dehydration.

Elevation in core temperature tells brain to turn on sweating. An increase in osmality [ratio of solids to fluids due to loss of fluids] of blood turn on thirst drive. Once there is a significant decrease (20%) in plasma volume (the part of the blood that is mainly water), drinking will have no effect (reduction) on body temperature.

Glycogen depletion is higher during exercise where you fail to drink, than if you do drink. As you get hot, adrenalin levels increase, thus increasing glycogen use. In the heat, though you may be training at a lower intensity, glycogen depletion can still be quite high. Power output decreases with dehydration (as much as 20% loss of power output) either because of glycogen depletion or an inability to use it. Dehydration can increase cortisol levels, thus decrease training adaptations and decreased immune system function.
dehydration can suppress training adaptations via increase in cortisol and decrease in anabolic hormones........

"Hypohydration (decreased total body water) exacerbates the catabolic hormonal response to endurance exercise......"

"The purpose of this study was to examine the effect of hydration state on the endocrine and metabolic responses to resistance exercise."

"Hypohydration significantly 1) increased circulating concentrations of cortisol and norepinephrine, 2) attenuated the testosterone response to exercise, and 3) altered carbohydrate and lipid metabolism. These results suggest that hypohydration can modify the hormonal and metabolic response to resistance exercise...."

D.A.Judelson, et al
Effect of hydration state on resistance exercise-induced endocrine markers of anabolism, catabolism, and metabolism
Journal Of Applied Physiology.....Volume 105 #3....September 2008....page 815 - 824
The term "over-training" means different things to different people. In running, most people in the sport define it in such a way as to relate to a running injury.

That's the common way people think of it. However, the more common manner in which it manifests itself is in suppressing one's body from gaining fitness, thus suppressing improvements in performance level.

**There are --2-- separate consequences of "Over-training"**

1. The one where you incur a running injury

2. The one where your body enters into the physiological state where your anabolic system [a.k.a tissue building] is suppressed to some significant degree and thus your ability to acquire training adaptations and move forward in fitness level is suppressed. This can be referred to generally as "Physiological Over-training", or being in an "over-trained state".

**Physiological over-training, or being in an "over-trained state" is something one can measure. It often comes in the form of cortisol [stress hormone] production, which suppresses anabolic [tissue building] hormones and other hormone production [ie. testosterone, estrogen, growth hormone, thyroid hormone, and overall adrenal gland function], and competes with anabolic hormones for binding sites on tissues such as muscle. It reduces protein production, such as muscle protein, blood proteins [ie. Red Blood Cells, Immune system cells, etc]. This is a state where even though you are -not- injured, and even though you are training fully, your fitness level does -not- move forward, and may even reverse.**

Again, this is a measurable state. You can measure cortisol levels. You can measure red blood cell and EPO production ability. You can measure muscle protein synthesis. You can measure immune system activity. You can measure adrenal gland function. You can measure certain aspects of brain activity.

Regardless of what type of training program you believe in and follow [mileage oriented, or velocity oriented], its helpful if one's body can stay in an anabolic state such that it can adapt to one's training, thus moving forward in fitness, leading to increases in performance level.

That's major challenge and the major objective when designing any training program.

If your body can't adapt, you can't move forward in fitness level. If your body can't move forward in fitness level, it can't move forward in performance level.

Much of sport is about moving forward in performance.
Over-training Embedded In The Design Of A Low Volume Training Program

If you grew up in the sport, you have been indoctrinated in the mileage oriented belief system. Even if/when you become a believer in velocity oriented training and attempt to make the shift away from mileage oriented training, the mileage oriented belief system isn't something that you can just press a button and delete all of its influence from your brain.

When you move to a velocity oriented belief system, the reality will be that you're a mileage oriented person trying to design a low mileage training program.

That may impact the design of your training program in that the shorter workouts will tempt you to think that you don't need much in the way of rest. You'll believe that programming in 2 or 3 days off between workouts will certainly be unnecessary and will result in loss of fitness. You'll believe this because you have been indoctrinated in the mileage oriented belief system and you're a mileage oriented person trying to design a low mileage training program.

The reality is that the faster you train, the more rest you'll need regardless of how short the distance covered is in any given workout.

The mileage oriented influence will have you trying to design a training program that crams as many workouts into a short period of time as possible. If you go down that path, over-training will be the result. Having grown up in the sport and thus been indoctrinated into the polar opposite mindset, it may take multiple extreme states of overtraining to force you into a different mindset.

The term “over-training” does -not- mean injury, but rather the physiological state where your anabolic system is suppressed to some significant degree and thus your ability to adapt to your training and move forward in fitness level and performance level is suppressed.

Once you choose [in your approach to designing a training structure] to focus less on the number of training days and more on the number of rest days, the body will work as it should, and your fitness level will move forward.

The faster your goal paces, the more rest days you'll need, even if your workouts are very short.

The slower you train, the fewer days you'll need off, which is likely why a mileage oriented runner is able to train every day running over 100 miles per week, not getting over-trained until he/she starts training faster.
Blood Chemistry Profile

It is possible to use blood tests to periodically monitor various aspects of train-ability, mainly in the area of attempting to make sure over-training. The measures listed below may prove helpful in that area:

Plasma Glutamine ----
- shows level amino acid glutamine in the blood, an indirect indicator of immune status
- compare to levels during Training Preparation period, and other early periods
- levels significantly below early period levels may indicate immuno-suppression, and reduced ability to adapt to further training

Lymphocyte to Neutrophil Ratio ----
- measure of immune function
- looking for levels between .75-.80
- low ratio may indicate over stressed immune systems and reduced ability adapt to further training

Blood Urea ----
- indirect measure of glycogen depleted status
- looking for levels between 25-30mg% (women), 36-42% (men)
- take morning following the day of the workout, and again 24 hours later
- high levels may indicate protein breakdown for energy production due to muscle and liver glycogen depletion

Serrum Ferritin ----
- shows level of iron stored in the body
- looking for levels above 50ng/ml
- levels below 12ng/ml indicate near full depletion

Transferin Saturation Percentage ----
- transferin is the protein which transports iron in the blood
- looking for saturation levels around 35%
- levels below 16% indicate bone marrow iron stores near full depletion

Hemoglobin ----
- measure of hemoglobin in red blood cells
- looking for levels above 12g/dl

Free Erythrocyte Protoporphyrin (FEP) ----
- Protoporphyrin. is the precursor of hemoglobin
- looking for levels around 30ug/dl
- levels above 100ug/dl may indicate reduction in hemoglobin production

Mean Corpuscular Volume (MCV) ----
- measure of the average size of red blood cells
- looking for levels between 85fl - 95fl
- levels above 95fl may indicate destruction of smaller/older cells via foot strike hemolysis
The Role Of pH

The body's pH level is a critical aspect of the ability of cells to adapt to stress, prevent and/or recover from illness or injury, adapt to exercise and sport training, etc.

The environment in which your cells operate can change day to day, and for many if not most Americans, get into a level that is well below optimal. Keeping your body's pH level in an optimal range is to put the environment inside your body in a state where it can quickly repair itself, build tissue, adapt to and recover from high level stressors, slow aging, boost the immune system, prevent illness, etc.

To put your body in a high state of health you must not only ingest protein in your diet, provide yourself with rest, relaxation, and sleep, but you must also provide the food/nutrients that put and keep your body's pH level in the necessary range, and consume the essential gene level nutrients that assist the body to repair itself.

Life Long Status: Choose Foods That You Like Or Can Tolerate

Creating the best environment inside your body is helpful over the long term. The use of the pH paper can help you use trial and error to get your diet to a point where things are approaching the ballpark of being optimal and staying that way for most of the day. Generally, most vegetables are alkalizing foods.

Choose alkalizing foods that you like. What you're out to do is to establish the efficacy of your diet and supplement intake as it impacts the status of the environment inside your body that your cells operate in.

For a list of foods that can help you get some idea of what foods can make your pH more alkaline see a general list; www.energiseforlife.com/list_of_alkaline_foods.php

Testing Your pH If you'd like to test your urine pH, you can buy pH paper for about $10.00

Keep in mind that you are looking at the pH of urine. How you choose to do that is up to you. You can do the "stream of flow" method of placing a strip of pH paper in a given position. Or you can choose a less potentially messy method by using a dixie cup to collect a small amount, then dipping the pH strip in to cup.

Many Americans are reported to be between 5.5 - 5.8. For them the paper won't change color. You'd like it to turn green to be 6.8 - 7.0 range both in the morning and in the evening. Keep in mind that even though you're looking at urine pH, what you're really out to measure is the efficacy of your diet and supplement intake, and thusly, the status of the environment inside your body that your cells operate in.
The ETG menu's 4 vegetables; Broccoli, cucumber, carrot, Romano tomato

Placing mechanical or physical stress [ie. cutting them, then chewing them] activates plant chemicals contained in them, increasing their impact on brain cells, immune system, and other cells in the body.

Green leaf vegetables contain substances called iso-thio-cya-nates. Green leaf vegetables contain one of the most important isothiocyanates, called Sul-for a-phane. These substances can activate specific genes in our cells. Those specific genes are for anti-oxidant enzymes and detoxifying enzymes, most of them referred to collectively as Phase 2 enzymes. The substance has the ability to bind to the promoter area of anti-oxidant genes, causing production of anti-oxidant and detoxifying enzymes. This is believed to be among the main mechanisms by which certain vegetables have the ability to prevent cancer and heart disease. Aside from supplying anti-oxidants in the vegetables themselves they have this ability to cause cells in our body to produce other anti-oxidants as well.

"Sulforaphane, one of the most important isothiocyanates in the human diet, present in cruciferous vegetables, is known to have chemopreventive activities in different tissues."

"The observed Sulforaphane-induced upregulation of phase II enzymes was accompanied by a significant increase in nuclear erythroid 2 p45-related factor 2 expression and correlated with a significant increase in total antioxidant capacity....."

M. Malaguti, et al
Sulforaphane treatment protects skeletal muscle against damage induced by exhaustive exercise in rats
Journal Of Applied Physiology.......Volume 107.......August 2009.......page1028

"When tomatoes and broccoli are eaten together, we see an additive effect. We think it's because different bioactive compounds in each food work on different anti-cancer pathways..."
[John Erdman, Professor of Food Science, University of Illinois]

The ETG menu's 4 mixed berries strawberry, blueberry, raspberry, blackberry

Mixed berries to supply additional anti-oxidants and micro-nutrients.

"Regular strawberry consumption augmented plasma antioxidant activity and decreased lipid peroxidation suggests preventive potential of these fruits against oxidative stress-dependent disorders. Blood phagocytes are important source of oxidants that may contribute to systemic oxidative stress. We examined the effect of strawberry consumption on the luminol enhanced whole blood chemiluminescence reflecting oxidants generation by circulating phagocytes in healthy subjects."

"Strawberry consumption decreased median resting luminol enhanced whole blood chemiluminescence and this effect was more evident after the 1st course (by 38.2%) than after the the 2nd one (18.7%), while fMLP-induced luminol enhanced whole blood chemiluminescence was constant."

"The decrease in resting luminol enhanced whole blood chemiluminescence suggests that regular strawberry consumption may suppress baseline formation of oxidants by circulating phagocytes. This may decrease the risk of systemic imbalance between oxidants and anti-oxidants and be one of mechanisms of health-promoting effect of these fruits consumption."

P. Bialasiewicz, et al
Addition of Strawberries to the Usual Diet Decreases Resting Chemiluminescence of Fasting Blood in Healthy Subjects—Possible Health-Promoting Effect of These Fruits Consumption
Journal of the American College of Nutrition.....Volume 33 #4.......July 2014.......pages 274 - 287
**Vitamin D** is a major player in the function of the immune system. Generally speaking, having low levels tends to lead to out of control immune cells attacking some part of the body that you'd prefer to be left alone. Called a "vitamin", it is a hormone that regulates lots of stuff in the body, the immune system being one of them.

As Americans, our excessive use of sun screens is creating problems, since sun light causes the skin to produce vitamin D.

The study shown below focuses on its role in Multiple Sclerosis, which is a situation where out of control immune system cells attack the nervous system, gradually killing off your cells along your nerve fibers, reducing and/or destroying nerve function.

The study was published in 2006, so a lot has been learned since then. The question is no longer "can low vitamin D levels lead to something bad". The answer is yes. The question now is, how come some people get MS, while others get rheumatoid arthritis, while yet others get some other immune system related malady.

Like all issues related to problems involving immune system function, there is a **chronic stress** component to these issues that go along with and/or lead to the nutrient deficiency issues that may exacerbate a problem.

Vitamin D supplements should be in the form of D3 [ie. vitamin D3].

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Journal Of The American Medical Association.....Volume 296 #23.....December 20, 2006
K.L.Munger, et al

Serum 25-Hydroxyvitamin D Levels and Risk Of Multiple Sclerosis

"Epidemiological and experimental evidence suggests that high levels of vitamin D, a potent immunomodulator, may decrease the risk of multiple sclerosis."

"…..the risk of multiple sclerosis significantly decreased with increasing levels of 25-hydroxyvitamin D."

"The results of our study suggest that high circulating levels of vitamin D are associated with a lower risk of multiple sclerosis."

"Prevailing thought is that MS is an autoimmune disorder whereby an unknown agent or agents triggers a T cell–mediated inflammatory attack, causing demyelination of central nervous system tissue. A striking feature of the global distribution of MS is a multifold increase in incidence with increasing latitude, both north and south of the equator."

"…..the change in MS risk with migration among people of common ancestry strongly supports a role for environmental factors. One potential factor may be vitamin D, a potent immunomodulator that in its hormonal form can prevent experimental autoimmune encephalomyelitis (EAE), an animal model of MS."

"Because food provides little vitamin D, the major source for most people is through skin exposure to sunlight. At latitudes of 42° or more (eg, Boston, Mass), in winter most UV-B radiation is absorbed by the atmosphere, and even prolonged sun exposure is insufficient to generate vitamin D. As a result, seasonal vitamin D deficiency is common."

"A protective effect of vitamin D on MS is supported by the reduced MS risk associated with sun exposure and use of vitamin D supplements."

"In this large prospective study, we found that the risk of MS decreased with increasing serum levels of 25-hydroxyvitamin D."

"Although this association was not seen among blacks, their smaller sample size and substantially lower 25-hydroxyvitamin D levels may have reduced the power to detect an association in this group."

"Our results converge with a growing body of evidence supporting a protective role for vitamin D in MS development."

"Of interest, regulatory T cells have been shown to be suppressed in individuals with MS."

"If sufficient 1,25-dihydroxyvitamin D is produced, it may exert paracrine effects on surrounding T lymphocytes, thereby regulating the tissue-specific immune responses. Some support for this hypothesis comes from recent experiments showing that mice fed diets high in vitamin D had significantly fewer clinical and pathological signs of EAE than mice fed a vitamin D–deficient diet. Central nervous system levels of 1,25-dihydroxyvitamin D, but not blood levels, were higher in supplemented mice than in vitamin D–deficient mice and correlated inversely with disease severity."

"…..our previous finding of a lower MS risk among women taking vitamin D supplements supports a specific role for vitamin D."

"These results suggest that vitamin D levels earlier in life may be critical in conferring protection for MS and our finding of a strong protective effect of 25-hydroxyvitamin D levels of 100 nmol/L or higher before age 20 years supports this view. Vitamin D supplementation in infancy seems to exert a strong protective effect against the autoimmune disease type 1 diabetes, and vitamin D levels in early childhood could also have an impact on the risk of MS. Although there are no data on vitamin D levels earlier in life and risk of MS, the strong inverse association between MS risk and 25-hydroxyvitamin D levels at ages 16 to 19 years suggests that levels in late adolescence are likely to be important."

"Almost half of white and two thirds of black adults in the United States have 25-hydroxyvitamin D levels below 70 nmol/L. Although levels above 25 nmol/L have traditionally been considered normal and almost everyone in this study had measurements above this level, much higher levels may be required for bone mineralization and prevention of fractures. According to a recent review, the best serum 25-hydroxyvitamin D concentrations are between 90 and 100 nmol/L. Adolescents have somewhat higher levels than adults, but few have levels higher than that associated with a reduced risk of MS in our study. If the association reported here reflects a true protective effect of vitamin D, increasing the vitamin D levels of adolescents and young adults could result in an important reduction in MS incidence."

"Such an increase could be achieved by using vitamin D supplements. Although the current Institute of Medicine adequate intake of vitamin D is 200 U/d for adults younger than 50 years, and the highest dose that is considered safe is 2000 U/d, adverse effects have been reported only at intakes several-fold higher."
Running In The Heat: 
Applied Physiology

Elevation in core temperature tells brain to turn on sweating.

An increase in osmality (ratio of solids to fluids due to loss of fluids through sweating) of blood turns on thirst drive. Fluid loss during a workout cannot be prevented by pre-run fluid ingestion. The kidney will simply excrete the excess as urine into the bladder. You must be well hydrated before the run begins, and drink during the run to maintain hydration status. You need to drink enough to match sweat rate. If sweat rate exceeds the rate of fluid intake, dehydration will take place, your perception of the effort of your run will increase, in spite of the fact that the pace may be the same or slower. Sweat rate may generally be around 8oz or 250ml [one measuring cup] per 10 - 15 minutes. Fluids should be ingested during the run, at that rate, [preferably with a pinch of salt put in each cup to increase absorption].

Fluid Absorption ----
--- What you ingest, moves from the stomach, to the intestines, to the blood stream.
--- Maximal stomach emptying rate of fluid into the small intestine = 33 - 38ml (about 1/7 of a cup) per minute.
--- Fluid absorption rate from the small intestine into the blood stream = 25ml(1/10 cup) per minute.
--- Intake of fluids containing 15 - 20 grams of carbohydrate per 250ml (8oz) may be best during a run.

Significantly more fluid is absorbed from carbo/electrolyte (sodium) beverages (~90-95%) than plain water (~50-60%) Carbohydrates in fluid stimulates sodium and water absorption. Sodium is essential for glucose transport from the small intestine into the blood stream. Fluids containing protein stimulate water and sodium absorption independently of glucose. Intake of moderate amounts of plain water may suppress thirst drive before adequate amounts of fluids have been ingested. Part of the job of the stomach and intestines is to prevent flooding the blood stream with fluids/solids in ratios that will dramatically change the ratio of fluids to solids already in the blood. If they allow too much fluid in, they risk making the blood so thin that blood pressure gets too low, and thus cannot be pumped to the brain. If they allow too many solids in, the blood may get too thick. Thus, the stomach and intestines like it when you ingest things that are similar to the osmality [ratio of fluids to solids] in the blood.

Effects Of Getting Hot ----
Glycogen depletion is higher during exercise where you fail to drink, than if you do drink. As you get hot, adrenalin levels increase, thus increasing glycogen use. In the heat, though you may be training at a lower intensity, glycogen depletion can still be quite high. Power output decreases with dehydration (as much as 20% loss of power output) either because of glycogen depletion or an inability to use it. Dehydration can increase cortisol levels, thus decrease training adaptations and decreased immune system function. Generally, there are negative effects of any amount of dehydration. Once there is a significant decrease (20%) in plasma volume (the part of the blood that is mainly water — you sweat it out), drinking will have no effect (no ability to reduce) on body temperature. Even in well hydrated conditions, heat production at high rates due to high intensity exercise can far exceed heat loss rates (sweat rates). Thus heat accumulation type performance deficits can occur prior to dehydration.

General Hydration ----
Stay hydrated throughout each day by consuming about eight [8] 8 ounce [240ml] of water....in addition to....whatever fluids you consume with meals, etc. The easiest way to do this is to fill a 2 quart pitcher with water and a few pinches of salt just prior to bedtime. Consume it across the night, next day, and evening, prior to bedtime when you fill it again.

Mechanisms Of "Feeling Drained" With Prolonged Summer Sun Exposure ----
Most runners are familiar with the state of feeling drained of energy after sitting and/or running in the summer sun for a significant period of time. Two potential mechanisms of "feeling drained" are dehydration combined with depletion of nerve and muscle glycogen, and the immune response that follows damage to tissue under the outer layer of skin.

Dehydration & Depletion of Nerve and Muscle Glycogen ----
Glucose is the only form of sugar (from the carbohydrates eaten) that nerve and muscle can use as a fuel for ATP production. Following a meal or ingestion of a sports drink, glucose is stored (in nerve and muscle) as a bunch of glucose hooked together. A bunch of glucose hooked together is called Glycogen. The increase in temperature caused by prolonged sun exposure when sitting and/or running in the summer sun may increase the rate of glycogen breakdown and lead to depletion. This situation combined with gradual dehydration through sweat, can potentially be responsible for "feeling drained". The brain is sensitive to changes in glycogen and hydration levels. Perception of effort in sport events increases as hydration and glycogen status decrease.

Damage To Tissue Under The Outer Layer Of Skin ----
Ultraviolet rays from the sun, penetrate the skin and cause an elevation of an immune system substance called Interleukin-1. This substance has effects on the nervous system, which can produce a feeling of having a lack of energy. It is one of the substances that generally makes one feel sluggish during a cold or flu. Elevations of Interleukin-1 caused by UV light from prolonged summer sun exposure sitting and/or running may be a mechanism of "feeling drained".
Mechanisms of Skin Aging & Wrinkles
People probably did not purposely "lay out" 3000 years ago in order to get a tan. They were most likely more aware of their exposure to the sun and took functional steps to prevent obvious skin damage. It is well established now that ultraviolet rays from the sun, penetrate the skin and cause an elevation of the enzyme called matrix metallo-proteinase. This enzyme causes the breakdown of collagen, the protein that comprises skin tissue. Collagen fibers give skin its strength and resiliency. Damage to these fibers has been demonstrated to be the major mechanism of skin aging and wrinkles. Generally, in sun damaged skin, you will find less collagen than in healthy skin. There are inhibitors of this enzyme. One of them is produced inside the body, another, Retinoid acid derived from vitamin A (or beta carotene), can be placed on the skin. Sun exposure turns on the genes of both the enzyme and the inhibitors of the enzyme, thus allowing collagen breakdown to occur but in a regulated manner. Placing retinoic acid on the skin prior to sun exposure can inhibit the production of the enzyme during sun exposure. Certain dosages and frequencies of application of these types of formulations have also been shown to allow the damage done to collagen to be reversed, thus leading to a reduction of skin wrinkles.

Vampire-ism Not Necessary
Skin is the largest organ of the human body. Damaging it leads to obvious health problems. Avoiding the sun however, can be at least as destructive to health as purposely baking oneself in it.

Vitamin D is a carrier of calcium. It's production is a result of exposure to ultraviolet rays from the sun. Going to extremes to limit sun exposure, can result in reduced production of Vitamin D. This will result in the absorption of less calcium from the diet, which can impair functions of many tissues and can lead to osteoporosis (loss of bone mass).

"Laying Out"
Even when "laying out" every other day, excessive sun exposure can create a 300% elevation of the metallo-proteinase enzyme that remains elevated everyday, for many days. The major problem is that the damage that has been done may not be repaired fully to the layers of skin underneath the outer layer. This is the manner by which wrinkles begin to appear.

When the rate of damage exceeds the rate of repair of any tissue in the body, some kind of problem will inevitably result.

The Nervous system is "hooked up" to the skin, and it appears as though stress is also a cause of skin damage. Either the production of cortisol (stress hormone), and/or the reduction of the release of Neurotrophins, can lead to skin wrinkling. Cortisol may decrease the function of the fibroblast cells that produce collagen (new skin tissue) following damage or normal turnover (humans do shed the outer layer of their skin as a normal process). Cortisol may also increase the production of the metallo-proteinase enzyme. Cortisol induced immune suppression may decrease the growth promoting functions that immune cells engage in within the skin. The decrease of neuro-trophin production caused by stress may result in a decrease in the functioning of fibroblasts, or decrease the production of the inhibitor of the metalloproteinase enzyme. These things collectively can explain why people "look older" when they are highly stressed over a prolonged period of time.

Sun Damage Prevention
Reducing stress, and limiting the rate of your sun exposure such that it never exceeds the rate of repair, are the most effective ways to prevent long term skin damage and wrinkling.

The fact that ultraviolet rays from the sun turn on the gene for melanin (skin pigment), inerently means that our skin has a mechanism by which it can adapt to sun exposure in a protective manner. Thus it seems obvious that this situation is just like training any other tissue (ie muscle, tendon, bone) of the body. When the rate of application of the training load exceeds the rate of adaptation of the body, problems will result.

In this case, when the rate of sun exposure, exceeds the rate of melanin production and skin repair, problems will result. Just as it would be unwise to go to the weight room and lift weights non-stop for 1 to 3 hours, it is also unwise to "lay out" (or sun and/or run) in the sun nonstop for 1 to 3 hours. Brief exposures in interval form of spaced out over several days should achieve the same "look" without the severe skin damage and long term wrinkling.

Sunscreen
Oxybenzone is used to make sunscreens, especially the high "sun protection factors" (SPF). It has recently been demonstrated that the oxy-benz zone is absorbed through the skin, and gets into the blood stream of humans who use sunscreens. As one might guess, it isn't toxic immediately (acutely). However, there have been no studies looking at long term toxicity. Urine samples have shown that it does make its way into the blood stream and is excreted in urine about 48 hours later. About 1 - 2% of the oxy-benzone applied to the skin when putting on the sunscreen gets absorbed into the body. It may be a matter of time before health problems that already exist get traced back to this. The liver and kidney are the first organs to examine since they must process and excrete the stuff, however, some substances common in sunscreens are already known to cause cell proliferation in cancer cells that are sensitive to estrogen, as with breast cancer cells.
The story

"Plants Powering People.....10 years from now, we will have migrated to a much more plant-based food system."

[Jeff Dunn, CEO Bolthouse Farms]

Since the early 1990's TheETG club owner Marshall Burt has been consuming combination protein-carbo beverages to contribute to elevated post-workout gene transcription and translation. Brands with artificial ingredients, colors, sweetners, etc, with low or no micronutrient content. In 2014 he discovered Bolthouse Farms Protein Plus [mango] which became TheETG pre-workout, workout, and post-workout beverage. Provides protein, micronutrients, carbo's, etc. As one of -the- most science oriented track clubs in the world, we advocate use of products and services that are consistent with TheETG mission, TheETG applied human performance information, and TheETG applied health sciences information.

"....liquid carbohydrate plus essential amino acid ingestion maximises the anabolic response......"  

"....aid in upregulating gene expression of proteins necessary for improving bioenergetic pathways. The impact of this on subsequent training sessions should not be dismissed and is an important part of improving performance."

H.P.Cintineo, et al....Effects of Protein Supplementation on Performance and Recovery in Resistance and Endurance Training
Frontiers In Nutrition: Sport And Exercise Nutrition -- September 11, 2018
So called "performance enhancing drugs" are prescription drugs.

Some examples of the effectiveness of prescription drugs in sport............

"The drug erythropoietin, often called EPO......a new systemic review of existing research reveals that there is no scientific evidence that it does enhance performance, but there is evidence that using it in sport could place a user's health and life at risk."

EPO [erythropoietin] doping in elite cycling: No evidence of benefit, but risk of harm
Science Daily......December 5, 2012.

"...there is no scientific basis from which to conclude that rHuEPO has performance-enhancing properties in elite cyclists." The use of rHuEPO in cycling is rife but scientifically unsupported by evidence, and its use in sports is medical malpractice.
J.A.Heuberger, et al
Erythropoietin doping in cycling: lack of evidence for efficacy and a negative risk-benefit.
British Journal Of Clinical Pharmacology......Volume 75 #6....June 2013...page 1406

"The over-exaggeration of the effects of growth hormone in muscle building is effectively promoting its abuse...."
"...there is the question of disinformation on rhGH....Part of this problem may, paradoxically, derive from the anti-doping authorities themselves. By ignoring the evidence the rhGH does not work in normal healthy subjects, the athletic establishment could be accused of effectively promoting its use."

"We must tell athletes the truth: growth hormone does not 'work' or at least not as they think it does and that its is associated with all kinds of immediate and long term hazards------everything from decreased performance to cancer."
"...none of us scientists, doctors, coaches, or sports bodies should continue to suggest that this dangerous doping practice works."
M.J. Rennie
British Journal Of Sports Medicine.....Volume 37 #2....April 2003....pages 100-103

"Testosterone prohormones such as androstenedione, androstenediol, and dehydroepiandrosterone (DHEA) have been heavily marketed as testosterone-enhancing and muscle-building nutritional supplements for the past decade."

"Contrary to marketing claims, research to date indicates that the use of prohormone nutritional supplements (DHEA, androstenedione, androstenediol, and other steroid hormone supplements) does not produce either anabolic or ergogenic effects in men. Moreover, the use of prohormone nutritional supplements may raise the risk for negative health consequences."

G.A.Brown, et al
Testosterone Prohormone Supplements.
Medicine & Science in Sports & Exercise.....Volume 38 #8....August 2006.....pg 1367-1537

So called "performance enhancing drugs" are prescription drugs.

Some examples of the effectiveness of prescription drugs in American medicine & health care............

"Most drugs are only effective for a small percentage of people who take them."
Michael Leavitt [U.S. Secretary of Health & Human Services 2005 - 2009]

".....the benefits that US health care currently deliver may not outweigh the aggregate health harm it imparts."
Journal Of The American Medical Association...Volume 302 #1...July 1, 2009...page 89 - 91

"It is estimated that more than 700,000 individuals are seen in hospital emergency departments for adverse drug events each year in the United States."
[Centers For Disease Control....2015]

"106,000 deaths/year from non-error, adverse effects of medications"
B. Starfield
Is US Health Really the Best in the World
Journal Of The American Medical Association.....Volume 284 #4.....July 26, 2000.....page 483 - 485

".....1.5 million U.S. residents are harmed or killed each year because of medication errors, according to an Institute of Medicine report."
Nature Medicine.....Volume 12 #9.....September 2006.....pg 984 - 985.....News In Brief
Pursue becoming a Master Of Sport