



TheElite Training Group track club

## Expanding the area of what is possible

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

[www.theetgtrackclub.com](http://www.theetgtrackclub.com)

# Genetics -vs- Training

### TheETG Training Packets

**Mission:** Expand the area of what is possible for human performance in distance running. TheETG's primary method of achieving that is to proliferate applied science based information by way of \$free packets containing plain language info for anyone seeking to move themselves or others forward in these areas.

**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, -not- your chosen belief system.

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.

**Put data ahead of dogma. Follow the data -not- the crowd.**

".....cellular development must be governed by a variety of factors outside the scope of genetic inheritance. "

B.L.Stauffer -- Epigenetics: An Emerging Player In Health And Disease  
Journal Of Applied Physiology.....Volume 109 #1.....July 2010.....page 230 -231

"....elite athletes are still made and not born, though perhaps some may be made elite in one discipline more easily than others."

A. Jones, et al -- Human Performance: A Role For The ACE Genotype?  
Exercise & Sport Sciences Reviews -- Volume 30 #4 -- October 2002 -- page 184

"Scientifically speaking, altitude training has no effect."

Dr. Nikolai Nordsborg -- University of Copenhagen

"...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

"Many of these compounds in a highly-trained individual do absolutely nothing from the point of view of enhancing performance....."

"...Athletes think if it's on a list, it works."  
S.Devi -- Overhaul of global anti-doping system needed -- Lancet — Volume 387 #10034 — May 28, 2016 — page 2188

"...investigate the effects of supposedly enhancing drugs in sport. If, as is expected, many substances in current use are found to be ineffective it will help keep our athletes safe and improve confidence in sporting results."

Adam Cohen -- Centre for Human Drug Research in Leiden -- The Netherlands

**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.

# **“Nature....to be commanded, must be obeyed.”**

Francis Bacon

---

Everything works in accordance with the laws of nature. The laws of nature are the underlying mechanisms of how things work.

Science identifies and describes the laws of nature. Problems may occur with the interpretation and application of science, rather than with science itself. The laws of nature apply to everything, thus science applies to everything.

The functioning of brain cells, muscle cells, blood cells...all cells...are governed by the laws of nature. Purposely do things in a manner that is consistent with the laws of nature makes improvement faster, easier.....and certain.

- \* The....."science doesn't explain everything".....argument cannot be inserted each time one's comfort zone is challenged.
  - \* The....."it's genetic"....or "individuality".....argument cannot be inserted each time one cannot explain something.
  - \* The Laws of Nature that control human cellular function are not governed by one's chosen belief system.
- 

**“As we learn to abide by the laws of this creation, we learn how to use those laws to our own good.....As we use these talents, we learn how to work with, and eventually understand, the laws and overcome the limitations of this life”.**

Betty Eadie (Embraced By The Light)

---

**“I don't know that there is any magic level of interest in science that people ought to have. But the more they understand, the more they will be able to control their destiny and achieve their other aims.”**

Stephen Hawking

---

**“As you become involved in continuing education, you increase your knowledge base and you increase your options.”**

Stephen Covey

---

**“Society's future depends on a citizenry that can think and reason creatively and deliberately; develop sound judgements of information, and understand and contend effectively with rapid and constant change.**

1983 National Report On Education

---

**“Nothing is given automatically. Neither knowledge, nor self-confidence, nor inner-serenity, nor the right way to use your mind. Every value you need or want has to be discovered, learned, and acquired.”**

Ayn Rand

**The plasticity, adaptability  
of the human body is  
*aided, empowered and enhanced*  
by gene function  
-not- limited by it.**

# Muscles

**"slow twitch and fast twitch" .....it ain't genetic**

"These data show a reduction in calf muscle mass and performance along with a slow-to-fast fiber type transition in the gastrocnemius and soleus muscles, which are all qualities associated with unloading in humans."

**S.Trappe, et al**

**Exercise in space: human skeletal muscle after 6 months aboard the International Space Station  
Journal Of Applied Physiology.....Volume 106 #4....April 2009....page 1159**

# Limitations On Improvement

Unless you are missing a gene for something important, genes do not place a limit or ceiling on what performance level of you can progress to in your life time.

For the vast majority of the people on this planet, there are no “genetic” limitations or ceilings on running performance level.

Limitations on performance -do- exist.

They just aren't "genetic".

Since performance in all running events from 100 meters to the Marathon is dependent upon **the brain/nervous system's ability to produce and maintain a high muscle power output** [which is the determining factor of running velocity].....**the eventual loss of brain cells [neurons] that control muscle power output** is the what limits or places a ceiling on running performance.

## **Genetic Limitations...vs....Genetic “Differences”-----**

A debate about genetic ---limitations--- is...not...a debate about genetic “differences”. Eye color does not limit or place a ceiling on one’s level of running performance. The fact that eye color can change over time suggests that it too, isn’t necessarily “limited” by one’s genes.

"Evidence now exists that one of the major factors leading to the structural and functional changes in human muscle with aging is the progressive degeneration of the nervous system....."

"It is evident from the literature that increasing age has a pronounced effect on the motor unit, in particular the lower motor neuron. As a consequence, the muscle fibers innervated by these neurons will also be affected."

".....normal aging can be referred to as a slowly progressive neurogenic process, and the degeneration of the nervous system is considered as a major factor underlying the reductions in muscle mass and strength that occur with advancing age."

Jan Lexell

Evidence for Nervous System Degeneration with Advancing Age

The Journal of Nutrition.....Volume 127 #5.....May 1997.....page 1011S-1013S

We need to take care with assuming that the word “success” is the same as the phrase “I know what I’m doing”.

We have an unfortunate tendency in sport to assume that the limits of human performance are located in the same ballpark of where the top athletes at a given point in history, happen to be performing.

I don’t think this facilitates the pursuit of training protocols that develop fitness levels capable of approaching those limits, even if we assume that such limits exist in the manner and context that many of us have a tendency to believe that they do.

## **“White men can’t jump”-----**

The sport of Track & Field has demonstrated that such a saying likely applies only to American basketball. A large number of the top high jumpers in the world over the last 30 years, male and female, are white, primarily from eastern European countries [Ukraine, Russia, Bulgaria, etc] and Germany [east and west].

If we’re going to claim that, based on world rankings, etc, black Africans have a **“genetic”** advantage in distance running as compared to whites.....we must also say that, based on world rankings, etc, white Europeans have a **“genetic”** advantage in jumping as compared to blacks.

# Genetics vs. Training: The Winner is.....Training!

Improvements in fitness are due to changes in the body that are referred to as "adaptations to training". Increases in various functions in nerve and muscle fibers that improve performance are "adaptations to training". These "adaptations to training" are the result of the body's production (synthesis) of various proteins, a process that was induced by a series of workouts (training stimuli). This process of protein synthesis is caused by the workouts' stimulation of certain genes. Specific training stimuli induce specific adaptations. Thus in sport, we can no longer look at genetics as a "set in stone" concept related to the "gifts" of some athletes, and the limitations of others. The plasticity/adaptability of the human body is.....aided, empowered and enhanced by gene function.....-not- limited by it. Limitations on performance do exist. They just aren't "genetic".

---

"Whatever the data may conclude, elite athletes are still made not born, though perhaps some may be made elite in one discipline more easily than others."

A.Jones, H.E.Montgomery, D.R. Woods  
Human Performance: A Role For The ACE Genotype?

Exercise & Sport Sciences Reviews.....Volume 30 #4..... October 2002.....page 184 -190

---

## **Codes [genes].....And Translating The Codes [genes] -----**

The proteins the body produces, the production of which is induced by a series of workouts [training stimuli].....are comprised of things called amino acids, that have been placed together in a specific order that is required to form certain proteins. The protein foods you eat are comprised of these various types of amino acids (there are approx. 20 amino acids). Genes are.....codes or instructions.....of which amino acids are to be placed together to build a specific protein. The things that put amino acids together are called ribosomes, and are located inside cells. Workouts cause copies of the genes [mRNA] to be made. The protein builders [ribosomes] receive a copy of the codes/instructions [the genes....mRNA] of which amino acids are to be placed together to build specific proteins. This process is called gene transcription [copying] and translation [de-coding].

## **It's The Training.....Not The Genes -----**

The purpose of a workout is to "turn-on" the gene transcription and translation process that leads to "adaptations to training".

A training stimulus is a chemical signal produced by a workout that is received by the genes inside specific cells (ie. nerve cell, muscle, blood, etc.). This causes the gene to make copies of itself (a process called gene transcription), and the copies (called mRNA) are sent to the builders of new proteins (ribosomes) at the construction site inside the cell. 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. Physiology research has identified most of the types of proteins (adaptations to training) that are necessary to yield optimal performance in Track & Field running events (ie, mitochondria, sodium/potassium pumps, sodium/potassium channels). The future of performance in this sport is in accurately identifying the specific, most effective workouts/series of workouts that yield the production of these proteins, because the training stimulus determines which genes are copied and, therefore, which proteins get made, and in what level of abundance.

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. In an organism with the plasticity of the human body, Training.....is everything!

It is the.....training induced....gene transcription [copying] processes.....that have the greatest effects on fitness acquisition and subsequent performance.

This is a set in stone, law of nature that governs human cellular function.

---

"Age, sex, race, and initial fitness have little influence on Vo2max response to standardized training in a large heterogeneous sample of sedentary black and white men and women."

J.S. Skinner et.al.  
Age, Sex, Race, Initial Fitness, And Response To Training: The Heritage Family Study

Journal Of Applied Physiology.....Volume 90 #5.....May 2001.....page 1770 - 1776

---

".....muscle fibers are not inalterable but are highly versatile entities capable of changing their phenotype from fast to slow or slow to fast. "

D.Pette  
Historical Perspectives: Plasticity Of Mammalian Skeletal Muscle

Journal Of Applied Physiology.....Volume 90 #3.....March 2001.....page 1119 - 1124

---

### **Gene Translation -----**

A training stimulus -- causes a gene to make copies of itself – which are sent to the builders of new proteins [ribosomes] at the construction site. The process of the ribosomes translating the code/instructions of placing amino acids together (building proteins..... protein synthesis) is called, translation. The genes [the codes], are translated.....by the protein builders [ribosomes]. The builders follow the instructions detailing which of 20 amino acids to place together and in what order, to build specific types of proteins. Improvements in nerve cells, muscle cells, etc., are adaptations to training which are the result of this production of new proteins.

### **Translation Initiation Factors -----**

There are regulators of the process of translation, called Translation Initiation Factors. Their role in translation (protein synthesis) is to help attach the copy of the gene [mRNA] to the ribosome [builder of the protein]. Eukaryotic Translation Initiation Factors (eIF's) attach mRNA to the ribosome, so that translation of the mRNA code into protein can take place. If the mRNA does not attach to the ribosome, protein synthesis cannot take place.

### **The 4 steps of Translation -----**

- 1) Ribosome becomes two subunits.
- 2) The t-RNA (transfer-RNA, the ma responsible for grabbing amino acids) binds to one of the subunits, to make a pre-initiation complex. eIF2 causes step 2 to occur.
- 3) mRNA can now bind to this Ribosome subunit. eIF4F causes step 3 to occur. Energy production (ATP) processes cause eIF4E to be phosphorylated (a phosphate is produced and placed on it). eIF4E phosphorylation causes it to bind to mRNA.....the first thing that must happen in step 3. eIF4E bound to mRNA can now attach to the combination of eIF4G & eIF4A. This forms an active complex, which is called eIF4F [this completes step 3].
- 4) eIF4F active complex can now bind to the Ribosome to initiate Translation. The two subunits now recombine to reform the intact, and now active, Ribosome



### **Translation Repressor -----**

There is a manner by which protein synthesis can be reduced/impeded. There is a translation repressor, a "binding protein" called.....4E-binding protein-1 (4E-BP 1).

It can attach to a spot on the Translation Initiation Factors, which will prevent mRNA attachment to the ribosome. If the mRNA cannot attach to the ribosome [the protein builder], protein synthesis cannot take place.

Thus 4E-BP1 is a translation suppressor, "repressing" protein synthesis. Energy production (ATP) processes are very important to translation (protein production). Phosphorylation (a phosphate is produced and placed on something) affects protein synthesis enormously. When production of phosphates is low, 4E-BP1 is un-phosphorylated, and can thus bind to eIF4E to prevent it from binding to mRNA.

### **Importance Of Protein & Carbo Intake Following Workouts -----**

When glucose supply is low, production of phosphates will be low, thus phosphorylation of 4E-BP1 will be low.....thus translation will be repressed. Therefore, one must supply glucose following workouts. When amino acid supply is low, especially essential amino acids [the branched chain amino acids ...leucine, isoleucine, and valine].....translation is low as well. Supplying essential amino acids along with carbohydrates 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.

---

"The Heritage Family Study is a large multicenter clinical trial investigating the possible genetic basis for the large variability in the responses of physiological measures .....to endurance exercise training."

"It is concluded that the cardiovascular systems of men and women, blacks and whites, and younger and older subjects are not limited in their ability to adapt to endurance training."

January 2001..... J.H.Wilmore, et al.

Cardiac Output And Stroke Volume Changes With Endurance Training: The Heritage Family Study

Medicine & Science In Sports & Exercise.....Volume 33 #1.....January 2001.....page 99 & 100

---

### **The Future Of Running Performance -----**

To be able to compete well in the future, it will be important to know which proteins are important to running performance. It will be important to know what kinds of workouts will target and "turn on" the genes for these proteins in the most potent manner. And It will be important to know what nutrients to ingest and when to ingest them will that will optimize the building of these proteins following each workout. Within the next 10 years, the ability to directly measure the degree of activation of specific genes important to running performance will exist. One will be able to directly compare the effects of one training protocol to another, at the genetic [transcription and translation] level. One will know whether 6 interval repeats are more effective than 10 at a given velocity, or if 4 reps are just as effective as 7.....thus identifying the more effective training stimulus.

### **Everything Is Genetic.....Until You Start Training -----**

Fitness level after birth is determined more by activity type, intensity, and frequency, rather than by the traditional concept of, "it's genetic". Everything is genetic, until you start training.....and you start training at birth.

Early age training history. determines present day....."talent".

Free play and games such as tag, tricycle riding, etc, is training ..... regardless of how informal it may be. You will see adaptations in children to this training, just as you will see adaptations in adults to a more formal training program. The most important thing about early age training is that

7

---training is cumulative---. The impact of this cumulative training is what many people have mistaken for "genetic factors" that separate one athlete from a lesser performing one. Years of training produces years of adaptations to training, and facilitates future training. This accounts for people who are "high responders" to certain training as compared to others. Once you leave the crib and learn to crawl, almost all activity is a training stimulus that induces adaptations. Childhood activities are often ignored as a determinant of adolescent and adult sport performance levels, in favor of a "genetics" explanation. The Track & Field governing bodies in several countries have established "talent identification" programs in hopes of identifying "genetically talented" individuals. There is a high probability that such programs are identifying young athletes with extensive informal training histories rather than genetic "wonder kids".

So how come some high school freshman can win a state title when they've never competed in the sport prior to that season?

"Formal" training isn't the only training that humans do. Kids playing tag or riding bikes around the neighborhood is training. Kids playing soccer for several years [especially at midfield or forward position] is training also. Training has cumulative effects on the gene copying processes. The high school freshman athlete is either re-training to a previous high level of fitness, or simply continuing on from previous training. It is a mistake to think that their "being good" right-away is "genetic".

#### **Can't Explain It: Therefore...."It's Genetic" -----**

The basic thinking collectively, over the past 40 years among those in sport, on this subject can be characterized by the following statement; "Can't explain it.....therefore.....its genetic". At some point that has to stop, and we have to at least be willing to acknowledge that our training hasn't been optimal, and we have to be willing to acknowledge different athletes have different training histories that accounts for the differences we like to attribute to....."It's genetic".

The primary limits on human performance are our belief systems.

#### **Lets Stop Blaming Our Genes -----**

If you train, but stop improving, blame it on your genes. This is the " Can't Explain It, Therefore.....it's genetic".....manner of thinking. Unless you have mutated or missing genes that code for something important.....training is what matters.....genetics doesn't. "Genetic factors" are not controlling, limiting, or anything else of significance when it comes to magnitude and rate of improvement.

If you train, but stop improving, blame it on your training program.

There is no reason to be so arrogant as to believe that one's training program is so incredibly effective that it has optimized one's fitness to maximum human cellular function levels. For performance to be "genetic", the function of suppressors [the substances that "turn off" gene copying following a workout] would have to be controlled by the genes. Suppressors are not controlled by the genes. Unless or until someone can accurately rebut this reality, the "its genetic" claims should stop.

#### **There are No "genetic" Limitations -----**

The time has long since past where we should stop inserting the "its genetic" cliche every time we can't explain something, or every time we want an answer that fits neatly within our current comfort zone.

It is an easy --but incorrect-- argument to make, which is to say that.....a runner can do a series of workouts that activate a gene(s).....leading to the production of proteins.....that are responsible for increases in power output and endurance.....and yet that runner will consistently fail to see improvement in fitness level, requiring one to conclude that the runner's "genetics" created a ---ceiling--- on his/her ultimate level of progress and performance level.

## The Ghost In Your Genes

If you still believe that sport performance is largely an "it's genetic" phenomenon, it may be wise to watch the 1 hour documentary [Ghost In Your Genes] aired on the PBS weekly show called NOVA.

It first aired in 2007, and aired again in mid-2010.

You can watch it online at [www.pbs.org/wgbh/nova/genes/](http://www.pbs.org/wgbh/nova/genes/)

If you learned about genes in your high school or college biology or genetics class, the final 10 minutes of this documentary alone will make you feel that the class was a major waste of your time.

From the documentary.....you can inherit things other than your genes.

--- Those things can change the function of your genes.

--- Those things can be changed during your life by nurturing or lack there of, by smoking or lack there of, by stress or lack there of, by training/exercise or lack there of. .

You can function normally while your identical twin has severe autism. How you live can alter your genetics. A famine during your great grandfather's childhood can affect your gene function today. And you can change that during your life.

There may be things you don't know about your genes which is why the "it's genetic" belief system should probably be put on hold for while.

**".....cellular development must be governed by a variety of factors outside the scope of genetic inheritance. This novel and innovative theory provided the framework for modern epigenetics."**

**"Today, epigenetics is commonly defined as changes in gene expression that occur without a change in DNA sequence."**

**".....environmental conditions such as maternal diet can affect the epigenotype of the offspring. During adult life, several factors can impact epigenetic status, including diet, living place work place, pharmacological treatments, and unhealthy habits...."**

**B.L.Stauffer  
Epigenetics: An Emerging Player In Health And Disease  
Journal Of Applied Physiology.....Volume 109 #1....July 2010....page 230 -231**

# Re-think what you think you know about “its genetic” .....

“Telomere length is a primary biomarker of cellular aging. Recently, both telomere length and telomerase activity have been shown to be influenced by various environmental factors such as oxidative stress, psychological stress, and socioeconomic status.....results indicate that moderate physical activity levels may provide a protective effect on...telomere length compared with both low and high exercise energy expenditure levels.

A.T.Ludlow, et al

Relationship between Physical Activity Level, Telomere Length, and Telomerase Activity

Medicine and Science in Sports and Exercise...Volume 40 #10.....October 2008.....page 1764 - 1771

# Re-think what you think you know about “its genetic” .....

parental behavior;

creating an "enriched" environment for one's kids can create changes in their genes that they can pass on to their children.....

".....a large number of recent studies have reported that phenotypes acquired from an animal's environment can be transmitted to the next generation. Moreover, epidemiology studies have hinted that a similar phenomenon occurs in humans. This type of inheritance does not involve gene mutations that change DNA sequence. Instead, it is thought that epigenetic changes in chromatin, such as DNA methylation and histone modification, occur. In this review, we will focus on one exciting new example of this phenomenon, transfer across generations of enhanced synaptic plasticity and memory formation induced by exposure to an “enriched” environment."

J.A. Arai, L.A. Feig

Long-lasting and transgenerational effects of an environmental enrichment on memory formation  
Brain Research Bulletin.....Volume 85 #1-2.....April 2011.....page 30

# Limitations

The limitations humans set for themselves always have something to do with----- time, size, or distance.

The subject matter may be simple, or it may be about sailing west from Europe, fearing falling off the earth [distance limitation]; it may be physiologists and medical doctors telling you it is impossible for a human to run a mile in less than 4 minutes [time limitation]; or it may be college coaches or ESPN commentators saying that some guy is too small to play in the NFL, too short to jump 7'7" in the high jump, etc, etc,[size limitation].

These limitations we set for ourselves, revolving around time, size, or distance, are always the result of the intellectually deadly combination of----ignorance paired with our self-image induced and controlled "comfort zones" that many of us will fight to the death, to maintain.

As a species, we started the process of mass producing air planes before we started mass producing cars. That may be a symbolically significant chronology since we live in an era where star trek and the jetsons will become more fact than fiction for some of us who will live another 40 years.

Its probably a good idea now, to begin learning from the mistaken psychology of our collective past..... and to accordingly, start to be far more aggressive in setting aside limitations we cannot substantiate with an accurate and up-to-date accounting of human cellular function and/or simple physics.

When comparing yourself to others.....you can't blame your genes. It's either your current Training Program, and/or your past Training History. You have to choose one or both of those to blame or attribute your current situation. In running, there are only so many proteins that can be responsible for elite performance, thus there are only so many genes to look at before you have to begin being open to the thought, that in your genes, you're not going to find the limitations that you're looking for.

### **The Major limitations On Human Performance In Distance Running -----**

1. Belief system

2. Lack of knowledge of how best to train human cells to function optimally.....an unwillingness to accept and/or acknowledge that such a situation exists.....or that such knowledge can be acquired if pursued

3. Success Avoidance Behaviors such as self-handicapping, self-sabotaging, and other actions geared toward keeping one's experiences inside one's "comfort zone".....[currently an epidemic both inside and outside of sport]

-----

-----

-----

"Following spinal cord injury (SCI), upper motor neuron paralysed muscles lose the normal type I (slow) and II (fast) fibre mosaic pattern and become predominantly composed of type II (fast glycolytic) fibres."

"A transitional period was seen between 1 and 20 months post spinal cord injury wherein there was a progressive drop in the proportion of slow.....isoform fibres....."

"By approximately 70 months post spinal cord injury a new steady state had been reached characterized by almost exclusively.....fast.....isoform expression."

"This research has demonstrated that post spinal cord injury muscle type II [fast twitch] transformation occurs in stages and commences earlier than previously appreciated."

R. Burnham.....et al...

Skeletal Muscle Fibre Type Transformation Following Spinal Cord Injury

Spinal Cord.....Volume 35 #2.....page 86 – 91.....February, 1997

-----

"The present study provides evidence that advanced age leads to a significant elevation of skeletal muscle fibers displaying coexpression of two MHC isoforms and that a separation into slow and fast fibers in very old individuals may therefore be somewhat misleading."

April 1999.....

Increase In The Degree Of Coexpression Of Myosin Heavy Chain Isoforms In Skeletal Muscle Fibers Of The Very Old

Muscle & Nerve.....Volume 22 #4.....April 1999.....page 449

-----

"These data suggest that the reduced load-bearing activity imposed on the skeletal muscles through bed rest will alter MHC gene expression, resulting in combinations of mRNA and MHC isoforms normally not (or only rarely) observed in muscles subjected to load-bearing activity."

Bed Rest Increases The Amount Of Mismatched Fibers In Human Skeletal Muscle

Journal of Applied Physiology.....Volume 86 #2.....February 1999.....page 455-60

-----



Since performance in all running events from 100 meters to the Marathon is dependent upon the **brain/nervous system's ability** to produce and maintain a **high muscle power output** [which is the determining factor of running velocity].....the **eventual loss of brain cells** [neurons] that control muscle power output is the "human aging" related limiting factor on performance.

Brain cell loss is the underlying manifestation of aging. However, **accelerated aging** is what many, if not most humans experience, especially in the United States and other "developed" nations.

### **What Is Aging -----**

"Aging".....the gradual wearing down and/or destruction of brain cell DNA, is the primary factor that limits human life.

The ends of DNA strands are called telomeres. Shortening of the ends of DNA strands (telomere shortening) over the life span is a process of "normal" aging. Accelerated aging is caused by brain cell atrophy/death. Accelerated aging takes place due to DNA damage induced by oxidants (leading to brain cell destruction). Where intake of antioxidants (Vitamin C, Vitamin E, Beta Carotene, Selenium) is insufficient, and exercise induced production of antioxidants (Glutathione, Superoxide Dismutase) is lacking, long term oxidant induced brain cell death occurs. Long term stress causes long term cortisol (stress hormone) production, which also causes brain cell death. Brain substances called Neurotrophins protect brain cells from cortisol and oxidant induced destruction. Neurotrophin levels are decreased over time by chronic stress, chronic alcohol and caffeine intake, low exercise levels, as well as gradual reduction of brain activity during the traditional "retirement years".

### **The Cause Of Accelerated Aging & Preventable Disease In Humans -----**

--- Chronically high psychological stress.....produces chronically elevated cortisol [stress hormone] and/or high levels of glutamate [a brain chemical], and/or high adrenalin levels.

--- Sedentary life style allows low production of the anti-oxidants called glutathione and super-oxide dismutase that are produced by brain and body cells in as a result of exercise training.

--- Long term intake of "pro-oxidants" & immune cell suppressors, in particular....caffeine, alcohol, and cigarette smoke, that destroy brain cells.

**And obviously, in athletes, the stressors involved with multiple years of overtraining, take their toll on the brain and immune system.**

### **200 Year Life Spans: More Reality Than Sci-Fi -----**

In the absence of accelerated aging inducers,.....gradual telomere shortening in brain cell DNA is what limits human life. This may take a minimum of 150 – 200 years. The average life span in the United States is approximately 70 years. Accelerated aging.....not telomere shortening.....is what is seen in nearly all Americans. "Old" people in our society live literally less than half a life time. How we choose to live, determines how we die.

Most Americans die in relatively painful, medically expensive, and emotionally costly ways.

# A Different Way Of Thinking About

## “Its Genetic”

In trying to get one's brain around the subject of “training history”, think of the term, “muscle memory”, and define what that means in the context of the cliché often used to describe a re-learning a movement pattern.....“its like riding a bike”.

Physiologically, it may help to look beyond the standard training induced adaptations in muscle proteins, such as mitochondria, myosin and actin.

Look into adaptations among activities that take place along the chromosomes themselves. Look at changes in the amount and concentration of gene Transcription Factors, as well as Translation Initiation Factors. Look at long term changes in related areas surrounding the genes themselves.

**Finally, look in to the questionable belief that our –genes-- are set in stone.**

Until a decade ago, the prevailing view was that muscle fiber types were genetically set in stone. This was in contradiction to the very function and purpose of genes themselves, thus that myth was debunked. Likewise, one must be open to questioning the belief that the human genome changes only by haphazard mutation.

In looking into this, one can start with the immune system, the production of anti-bodies in particular. Like the muscle fiber myth, the prevailing view has been that we can only produce a set in stone number of various anti-bodies. Logically, given what we know about the things we're exposed, we'd all be dead if the prevailing view were accurate. In short, we're capable of producing antibodies, the genes for which, we were –not-- born with.

At this point, one must be open to exploring the possibility that there may be other proteins in the human body, perhaps in muscle, nerve, brain cells, that also may exist in our bodies today, though we were not born with the exact genes for them.

I'd like to suggest that the plasticity of the human body is enormous. The right stimuli provided in the right way, yields a given outcome. The challenge is in learning about—discovering the “right stimuli” and the “right way” to apply it.

**"The aim of this study was to compare the demographic characteristics of elite Kenyan runners with those of the general Kenyan population."**

**"Athletes were separated into two groups according to athletic success: those who competed in international competition and those who competed in national competition."**

**"A higher proportion of all athletes ran to school each day (controls 22%, national athletes 73%, international athletes 81%) and covered greater distances."**

**In conclusion, Kenyan runners are from a distinctive environmental background in terms of geographical distribution, ethnicity and travelled further to school, mostly by running."**

**"These findings highlight the importance of environmental and social factors in the success of Kenyan runners."**

V. Onywera, et al

Demographic characteristics of elite Kenyan endurance runners

Journal of Sports Sciences.....Volume 24 #4....April 2006...page 415 - 422

# Getting Into “Gene Level Nutrition”

I'll avoid using the cliché "eat right and exercise" given that such clichés usually result in the deaths of a lot of people due to dumbing things down to a point where they are meaningless, easily dismissed, and ineffectual as motivators of behavior or behavior change.

For athletes and people doing some sort of physical training, the whole point of a workout is to make our cells copy certain genes [ie. gene transcription] and use them to build new proteins [ie. translation] that move our fitness level forward, allowing improved performance level. Intentionally supplying the nutrients used in those processes via food and/or supplements in the amounts required, helps to drive those processes to an optimal level. Thus you'd want to be consuming things that impact the gene copying function, and things that impact the new protein production function.

## So getting into “gene level nutrition” .....

----- Very important to supply amino acids that are used to build the proteins. Can do that via eating protein.

----- Also important to go one step deeper, supplying things called “nucleotides” that used in the process of copying genes. Some medical drinks contain nucleotides [IMPACT Advanced Recovery] and can be used as a post-workout “sport” drink. A number of companies sell nucleotides as a nutritional supplement. They mainly consist of a nucleotide called “ribose”, a plant sugar. Ribose is the “R” in RNA [ribo-nucleic acid]. As important, it is the “R” in deoxy-ribonucleic acid, also known as DNA. We rebuild our genes as well as copy them induced by training, so its very helpful to supply the ribose

----- Design food menu's for yourself that provide consumption of plant based foods [organic if you can afford it]. The various sugars and other substances [polysaccharides, polyphenols, phytosterols] collectively impact cell function in a major way all the way down to the gene. Our cells are constantly copying and remaking our genes. The better we do that the better we age, the slower we age, and the longer and better we live. Intentionally supplying the nutrients used in those processes via food and/or supplements in the amounts required, affects those processes.

----- Its best to view supplements the same as you view food. Both in sport and general health, the nutrients listed below do many things in brain, nerve, immune system, and muscle. Approach their consumption as something to be done across a life time since their effects are spread across a life time. The subject matter here being to engage in the supply of essential nutrients, versus not doing so. Over a period of decades, some is better than none. Design a supplements menu for yourself that provide several days a month of some consumption of things like....

- nucleotides [including ribose]
- colostrums [preferably in liquid form, and preferably consuming relatively small amounts]
- essential amino acids [including Leucine, Arginine]
- minerals [including zinc, magnesium, selenium]

----- Phosphatidylserine....Phos-pha-tidyl-serine is a fat. There are other phosphatidyl substances such as phosphatidyl-choline that are helpful to consume with the phosphatidyleserine. For the average joe human, these are very important in the membrane of brain cells. For many people it has a pretty dramatic effect on memory and just regular day to day brain function. For the average joe human and for athletes, it can suppress the stress and/or workout induced production of cortisol [stress hormone]. In athletes cortisol competes with tissue building substances such as testosterone for binding spots on cells that are trying to engage in the protein production induced by a workout. That limits training adaptations and improvement in fitness level. Cortisol also reduces the function of immune system cells, the end all and be all of sport training as well as the end all and be all of long term health. In the average joe human, cortisol also interferes with cell function in the brain, causing memory problems and problems with sleep and other aspects of day to day brain function.

----- Gene Level Vegetables.....Green leaf vegetables contain substances called iso-thio-cya-nates. 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. Green leaf vegetables contain one of the most important isothiocyanates, called Sul-for-a-phane. The substance has the ability to bind to 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.”

## Terms.....

- polysaccharides = plant sugars [ie ribose = a monosaccharide]
- polyphenols = plant sugars = tannins in tea, flavonoids, flavanones, isoflavonoids., alcohols, sterols
- phytosterols = plant sterols [such as estrogens in soy, etc]
- proteins = bunch of polypeptides
- polypeptides = bunch of peptides
- peptides = bunch of amino acids
- amino acids = bunch of nucleotides
- nucleic acids = DNA, RNA = bunch of nucleotides
- nucleotides = nucleosides with phosphate attached
  - adenosine-5 monophosphate [AMP]
  - guanosine-5 monophosphate [GMP]
  - cytidine-5 monophosphate [CMP]
  - uridine-5 monophosphate [UMP]
- nucleosides = nucleobases + something
  - adenosine, guanosine, cytidine, uridine, thymidine
- nucleobases = adenine, guanine, cytosine, uracil, thymine

**protein**

**protein**

**protein**

**protein**

hot jacuzzi, hot bath  
autogenic Relaxation  
down-time

**Keep the body in an anabolic state.**

**If you get that done everything moves forward.**

**If you don't get that done, nothing else matters.**

"Nucleotide supplementation can reduce postexercise immunosuppression and hypothalamic-pituitary axis activation in endurance exercise models. Nucleotide supplementation may aid recovery from other exercise modalities, such as heavy resistance exercise."

"Thus, the purpose of this investigation was to investigate the effects of nucleotide supplementation on the acute cortisol and immune responses to heavy resistance exercise and its effects on recovery."

"A double-blinded, crossover, mixed methods design with 10 men and 10 women was used. Each performed an acute heavy resistance exercise protocol after a loading period with a nucleotide or placebo supplement."

"Nucleotide supplementation resulted in significant decreases in cortisol and myeloperoxidase immediately after the acute heavy resistance exercise protocol, and significantly lower C creatine kinase values 24 hours later."

"Greater isometric force was observed immediately after acute heavy resistance exercise protocol and at 24 hours and 48 hours with nucleotide supplementation. Nucleotide supplementation seems to attenuate muscle damage, hypothalamic-pituitary axis and immune system activation, and performance decrements after heavy resistance exercise."

A.J. Sterczala, et al

Physiological Effects of Nucleotide Supplementation on Resistance Exercise

Stress in Men and Women

Journal of Strength & Conditioning Research -- Volume 30 #2 -- February 2016 -- page 569

# A Different Way Of Thinking About Age In Sport

That which is the norm, may not be "normal". The average life span for an American is 72 – 75 years. That is the norm, which physiologically, isn't "normal" [see the "Mechanisms of Aging" section of the ETG Packet].

A person who is 1/3 of the way through their life can be considered to be a "young person".

In this context, a [norm] American is still a "young person" at 24 – 25 year old.

Thinking beyond the norm, but towards that which may be "normal".....a person who will live to be 150 years old, will still be a "young person" at 50 years old.

In the context of sport, this 50 year old person will be able to run the same kind of track and road racing times as a [norm] 24 –25 year old. At age 70, this person will run like a [norm] 35 – 37 year old.

# **Human Cellular Function**

**You're either with it  
or against it.**

**Everyone must choose.**



## 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**