You, And Your Genetics, Are What You Eat
Maintaining and Restoring Health In A Rapidly Changing World

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Introduction

Health and healing are normal – cancer and other degenerative diseases are not. However too many people are getting sick today. Many, young and old, are suffering the scourge of the modern western world – various forms of chronic degenerative disease. The reasons why are now increasingly clear.

I hope this paper will put minds at ease and remove the stress of believing that you may have little chance of avoiding one or more of a wide array of serious diseases because your genetic make-up might be flawed.

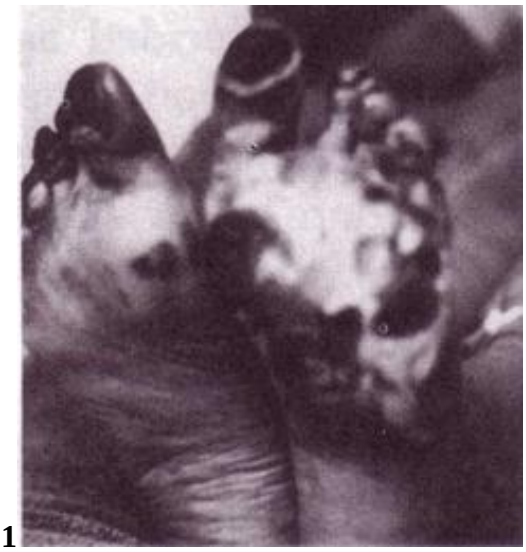
The first sections of this paper will show why your genetic system is probably *not* at the root of most serious health problems you may encounter.

Instead it will show you that most cancer, M.S., arthritis, heart disease, diabetes, colitis, IBS, arrhythmias, and many other degenerative conditions can be avoided, or reversed, by making sensible and necessary dietary and lifestyle choices. However, as it will also show, making these choices requires information not readily available in the mainstream media.

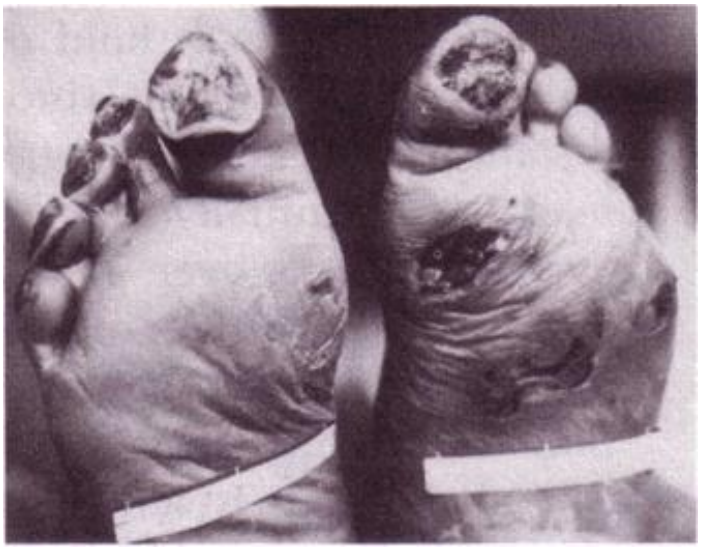
This paper is comprised mostly of scientific and medical research, but presented in a simplified manner, so as to provide you with a clear and simple understanding of how and why we heal. It is intended to provide important environmental, health, and nutrition research that will allow you to simply and quickly begin regaining control of your health.

For the past 15 years I've been fortunate to research and better understand the power of nutrition and Nature's DNA, and to witness incredible healing of chronic degenerative disease most would consider impossible, often regardless of age, and often as a last resort after no success with conventional medicine and powerful prescription drugs.

The following images provide evidence to the extent of how much healing is possible, in this case with chelation therapy: [1]



1



2

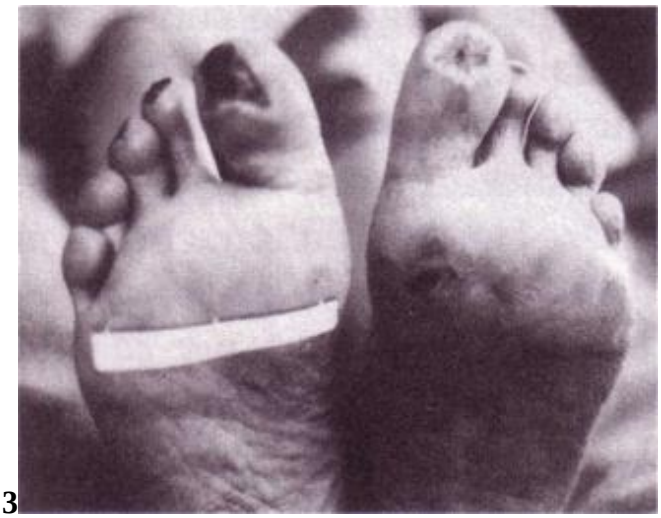
Photo 1: Just two days prior to Dr. Hohnbaum's scheduled operation for amputation because of the presence of diabetic gangrene and ulcerations (Oct 23 1975). He could bear nothing on his feet because of the pain. The dead black areas on his feet indicate that under usual medical procedure, he had been properly directed to have both limbs cut off just below the knees.

Photo 2: Just one week following the first treatment with chelation therapy administered by Dr. Tang to the patient, Dr. Hohnbaum, the ulcerated areas are beginning to heal in from the edges and the gangrene has reversed itself. Here, Oct 30 1975, the diabetic is able to wear hosiery. His pain is gone.

Photo 3: Two months after the last of 15 chelation treatments, in Jan 1976, Dr. Hohnbaum wore shoes and returned to work full time. His diabetic gangrene was eliminated completely and the ulcerations were almost completely healed.

Photo 4: March 28, 1976, when there no longer are signs of the gangrene and ulcerations. Chelation therapy has reversed the gangrenous process and reduced hardening of the arteries to his lower extremities. The patient avoided bilateral leg amputation.

3



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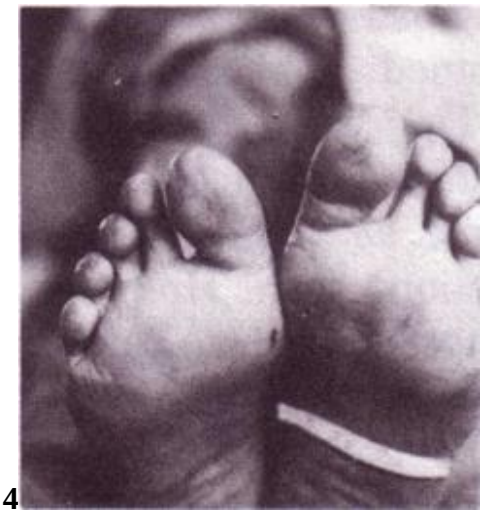

Chelation therapy is just one form of progressive treatment that is now available. I've seen similar healing made possible with nothing more than dietary changes, and for that reason wrote this paper. Too many people are suffering unnecessarily.

There are two primary themes to consider as you read this paper:

1) Our genetic systems appear to be primarily controlled and/or altered by the foods and other chemicals we ingest.

Most people have been led to believe that one's genetic system is at the root of most serious health problems one may encounter. In most cases this simply is not true, as the latest research shows. In the years ahead, how the West views medicine and illness will dramatically change.

In November 2005 conventional medical researchers finally confirmed what orthomolecular medical and environmental researchers have understood for years – that specific foods and chemicals turn genes on and off, and affect ongoing genetic expression.[2] This understanding will eventually cause a revolution in the way future drugs are developed. Many of our modern disease states are primarily a result of pollution, malnutrition, and/or improper exercise habits. Such factors are dramatically affecting ongoing genetic development and health in people.

To some it may sound implausible – that simply eating a specific food or supplement, could permanently change your behaviour for the better, or reverse diseases such as schizophrenia,

Huntington's or cancer.[3] However, in the latest research, normal rats have been made to behave differently just by injecting them with a specific amino acid (a building block of protein). The change to their behaviour was permanent.[4] The amino acid altered the way the rat's genes were expressed.[5]

This is now raising the idea amongst conventional medical researchers that drugs, dietary supplements, and/or other nutrients might permanently halt the genetic effects that predispose people to mental or physical illness, just as orthomolecular medical researchers have shown for 25 - 30 years.

Dr. Linus Pauling first proposed the term Orthomolecular Medicine in 1968 in the journal *Science*. (One of the greatest thinkers of the 20th century, Pauling was one of the fathers of modern chemistry, having won the Nobel prize for describing the nature of the electron. He also made many important medical research discoveries. In addition, along with Watson and Crick, his research was critical to the discovery of DNA, the backbone of all life on Earth.)

In practice, the orthomolecular doctor relies heavily on laboratory testing. In addition to standard clinical chemistries, orthomolecular doctors now employ a wide range of sophisticated laboratory analysis, including those for testing levels of amino acids, organic acids, vitamins and minerals, functional vitamin status, hormones, immunology, microbiology, and gastrointestinal function. Many of the newer tests have yet to be adopted by most in conventional medicine.

Orthomolecular medicine prescribes the use of natural substances found in a healthy diet such as vitamins, dietary minerals, enzymes, antioxidants, amino acids, essential fatty acids, dietary fiber, phytonutrients, etc. in the prevention and treatment of diseases. It focuses on the role of proper nutrition & exercise in relation to health. Nutrition and/or nutritional intervention comes first in medical diagnoses and treatment – drug treatment is used only for specific indications.

Orthomolecular medicine is defined as the provision of the optimum molecular constitution, especially the optimum concentration, or balance, of substances that are normally present in the body, for the purposes of treating disease and preserving health. The field of orthomolecular psychiatry deals with the use of orthomolecular medicine to treat psychiatric problems.

This paper is designed to show you how to choose foods to enjoy a full and vibrant life.

2) Our genetic systems can not adapt to change quickly. The very gradual evolution of our genetic systems was the product of millions of years of exposure and adaptation to natural chemicals and unpolluted foods. However, in just 60-70 years the modern world and the physical environment in which we live have rapidly changed. As a result, a combination of factors are now dramatically affecting our health. These are:

- Excess stress due to high paced lifestyles,
- Modern technologies yet to been proven as safe – including intensive agricultural farming methods, processed foods, many modern electrical devices, and certain medical practices,
- high levels of industrial and agricultural pollution,
- and a lack of proper exercise.

America spends more money per capita on health care than any other country. Yet it is one of the unhealthiest societies, leading the world in obesity and with 73.5% of deaths caused by degenerative disease in 2001.[6] Canada is not far behind.

Junk foods, such as sugary sodas and chips make up nearly one-third of calories in the U.S. diet.[7] Moreover, Americans consume approximately 50% of the world's pharmaceutical drugs.[8] North American seniors are taking an average of eight to twelve prescription drugs daily for multiple health problems.[9] Britons spend about ¼ as much and live just as long[10], although they also are suffering serious health problems as a result of their "modern" western living.

While Americans are "living" as long as most western counterparts, many spend their last years in hospitals and homes.

Canada has the highest cancer death rate in the G8, and the second highest rate in the world.[11] Few Canadians realize Ontario is "officially" one of the most polluted places in North America.[12] Even fewer realize that "unofficially" hundreds of thousands of pre-regulation oil well sites in Alberta, B.C., Saskatchewan, and the northern territories contain shallowly buried toxic dumps of diesel fuel and radioactive materials which are seeping into the water table. Many Canadian cities and towns are highly polluted due to previous and/or ongoing unregulated industrial, forestry, and/or agricultural activity.

This paper was expanded from a presentation I made to the Canadian Government's Senate Committee on Energy, Environment and Natural Resources in August 1999 regarding toxins in the food chain. It provided the Senators with a simplified, scientific look at complex environmental issues, in terms anyone could understand.

Specifically, it addressed the problematic effects of industrial pollution on the food chain, and the plant & animal enzyme chemistries dependant on it. As indicated in the Committee's report, the presentation helped persuade the Senators to recommend that the Canadian Environmental Protection Act be put into a perpetual state of review. The presentation and discussion that followed can be found below as Appendix 6.

In addition to troubling environmental issues, this paper looks at what modern agribusiness and food processing have done to so many foods most of us take for granted as being safe to eat.

This paper in not about doom and gloom. Instead it's meant to provide proactive, prevention-based, worry-free solutions for healthy living on our troubled planet.

To better understand how, it is organized into three general sections.

PART 1 examines:

- how the body heals itself
- why healing is normal and degenerative disease is not
- how genetic systems evolved primarily due to food types historically eaten by a species
- why one's genetic code is usually only of secondary importance as relates to the development of most chronic disease
- how food and activity continue to affect your ongoing genetic development

- how chemical pollution and heavy metals are also affecting genetic expression
- how the body cleans and heals itself with regular light exercise and balanced nutrition

PART 2 examines:

- factors affecting metabolism and how metabolism is controlled
- safe sources of nutrients and how they affect our bodies
- dangerous foods and other toxins to avoid

PART 3 examines:

- metabolic imbalances, such as acidosis, that silently cause the illness in most sick people
- advanced types of metabolic testing available to determine nutritional imbalance and/or toxic chemical or heavy metal exposure
- various proven therapies to rectify metabolic imbalances and eliminate toxins

The paper also addresses rapidly changing attitudes in the health care field, and various medical services available if required (Appendix 5: Medical Industry in Transition).

This and the other appendices provide related information, such as reading lists, other research, healthy food lists, etc. To move around the document quickly, hyperlinks have been used for the table of contents, footnotes, appendices, return buttons, as well as certain sections that link to websites to allow further research.

I believe, and hope this will also show, that the planet also has the potential to heal just as quickly as sick humans. It briefly looks at cost effective programs for a healthy environment and possible ideas for proactive tax incentives and other potential government policies (friendly to industrialist and environmentalist alike), which along with regulation, can help to restore our once pristine environment and food sources.

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Background to This Research

The study of particle physics, nuclear chemistry, and health sciences has been the primary focus of my work for the past 25 years. I've always been interested in the environment & sciences, and have a BA in Economics/Environmental Studies from Middlebury College in Vermont. My thesis was an economic/scientific analysis and forecast of North America's energy needs and technologies, focusing on fossil fuels, nuclear power and alternative sources. After college, I worked 4 years on Wall Street and in Denver in energy related project finance, before deciding to return to Canada to become a fulltime bobsled athlete in 1986, and an athlete/coach in 1989.

As an athlete I began research into nutrition chemistry, sport related bio-chemistry & mechanics, and engineering – in order to better understand human performance in order to develop new coaching methods and training programs.

To further improve our athlete's chances of success, Paragon Technologies was incorporated to research, develop and manufacture new sports equipment for competition and training. Our patented sports equipment designs have produced world records and unprecedented performance levels in many sports. In addition to ongoing research and community work, the company also

provides training, nutrition, and customized equipment consulting to top professional and amateur athletes, as well as design and manufacturing consulting to major sports equipment manufacturers. Our R&D generated record-producing equipment designs for NIKE and adidas.

Paragon's sport related programs helped Canadian athletes win Olympic and World Championship medals as well as set many world records. Much of this was due to new applied nutrition chemistry and equipment we developed, which allowed us to succeed naturally in sports rife with steroid use.

Paragon's nutrition research was begun in 1987 (just prior to the Ben Johnson steroid scandal at the 1988 Seoul Summer Olympics) to help athletes find alternatives to steroids. Steroid use in sport targets one aspect of human biochemistry – increased RNA synthesis at the cellular level. At that time, the use of such drugs was believed to be the way to further improve human performance beyond perceived natural boundaries of performance. In fact, the records set at the 1988 Winter and Summer Olympics were so superior that many thought those levels would not be achieved again with the advent of sophisticated drug testing. Initially that sentiment appeared to be correct, as for the next few years athletic performances began to fall off in most power sports.

However, we took a different approach to improving human performance. Whereas steroid use targets one aspect of human biochemistry, I hypothesized that most western athletes were probably malnourished and lacking important nutrients for health and superior athletic performance because:

1. modern farmlands have become contaminated and depleted in minerals,
2. most athletes eat a poor selection of foods,
3. normal physiological function requires interdependent, properly balanced enzyme action.

If this could be corrected, athletes might approach levels of athletic performance previously considered only possible with drugs.

I researched the most important nutrients for athletes, determined which ones needed to be enhanced for athletics, and made further adjustments for mineral depletion, environmental contamination, and other factors affecting the modern food chain. I prepared and tested supplements and nutrition regimens for myself and the athletes I was training.

The athletic results achieved with these nutrition regimens were rapid and unprecedented. Paragon athletes set the first of many world records 4 years later in 1992. They (and others using them) went on to set world records in their sports, in many cases far surpassing those set in 1988 using steroids.

Moreover, as applies to this paper, in 1992 Paragon began providing nutrition consulting to a few non-athletes. Surprisingly, most those suffering from previously chronic degenerative conditions made rapid recoveries. Over the last 14 years Paragon has continued to provide mostly volunteer consulting to many individuals with the same consistent results. By altering aspects of the person's diet and supplementing it with a synergistic mix of nutritional supplements (which many bodies of research indicated would be effective in countering a particular condition), more than 95% of those people saw a significant improvement or recovered completely. In some cases the individual had no other concurrent therapy, in others ongoing use of prescription medications was continued.

The same principles that helped our athletes and the ailing individuals mentioned above can help you safely navigate on our increasingly polluted planet. Until mainstream agri-business, mass food production, and various modern health services fully adjust to the realities of today's world, citizens will have to make smart choices to avoid unwittingly exposing oneself to various potential health threats.

This paper is meant to be read in the order it was written. Concepts and scientific theory established earlier are required to better understand the latter sections. I suggest reading the Table of Contents first – to get a feeling for the paper's flow – and then the whole paper. If these concepts seem new, or a bit overwhelming, don't worry – read through all the sections carefully and pick up what you can. When you have been through it all once, read through it again. Previously difficult concepts will get clearer as you put different sections of the paper together to better understand the overall picture. After you have a good general understanding of all the sections covered, you can then use the hyperlinked Table of Contents to move around to the sections most specific to your own needs.

While there are many unsettling facts presented herein, and very serious problems challenging the long term health of our society, there is no question that robust, healthy living is possible for most with the proper education. I hope this paper helps you achieve that, and that you enjoy learning about this as much as I have.

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Disclaimer: Every effort has been made to ensure that the information contained in this paper is complete and accurate. However the author is not engaged in rendering professional advice or services to the individual reader. The ideas, procedures, and suggestions contained herein are not intended as substitute for a consulting physician. The information in this paper does not cover all possible uses, actions, precautions, side effects, and interactions. All matters regarding your health require proper medical supervision.

PART 1

How the World has Changed and Why This is Affecting Human Health

Several significant developments in the 20th century dramatically altered the environment in which we live. This is affecting health in most societies. In summary:

Up until the 1930s: Food sources were primarily natural, lifestyles were more physically active, and work environments less stressful. There was little synthetic crop fertilization, few environmental toxins, no fast food, very few additives, very little processed food, little cancer and much less degenerative disease.

Since then, in the US alone, annual production of organic chemicals soared from 1million tons in 1930 to:

- 7 million tons by 1950,
- 63 million tons by 1970, and
- 500 million tons, or 1 trillion pounds by 1990.[13]

Pesticide and synthetic fertilizer use accelerated dramatically after WWII, contaminating and disrupting the natural return of nutrients to the soil.

Today: In addition to processed food, fast food, junk food, a toxin saturated environment, and higher stress 50-60 hour workweeks, the food chain has also become polluted with contaminants and depleted of important minerals & microorganisms because of modern agricultural practices.

Toxins and Malnutrition are Rampant in Western Society

Research shows the average American diet no longer provides the nutrition required for a foundation of good health.

The June 2004 issue of the Journal of Food Chemistry and Analysis reveals that three food groups - sweets and desserts, soft drinks and alcoholic beverages - comprise almost 25 percent of all calories consumed by Americans. Salty snacks and fruit-flavored drinks make up another five percent, bringing the total energy contributed by nutrient-poor foods to at least 30 percent of the total calorie intake. Sodas contributed 7.1 percent of the total calories eaten. Sweets topped the list, followed by hamburgers, pizza and potato chips. In contrast, healthy foods such as vegetables and fruit make up only 10 percent of the caloric intake in the U.S. diet. [14]

Half of all foods eaten are overly processed convenience foods known to have little if any nutrient value[15] [16]. Forty percent of middle class American children are severely malnourished, and adults fare far worse, upwards to 90%.[17] Both children and adults choose to eat for taste, cost and convenience. [18]

We regularly consume over 2,800 FDA-approved food additives with another 10,000 additives being "incidental" to the agriculture and food-processing business.[19] [20]

Air and water contain more unwanted chemicals, radiation, toxins, pesticides, herbicides and other pollutants than ever before; in 1979 the U.S. EPA declared that up to 20% of all deaths in

America are caused by pollutants and environmental hazards.[21] Pollutants act to use up nutrients faster than they can normally be re-supplied. [22] [23] [24]

Voluntarily, in the US one-fourth of all adults smoke (while the rest of us involuntarily inhale secondary smoke), and more than half consume liquor regularly; illicit drug usage is difficult to estimate. As with pollutants, drugs and stimulants of any kind destroy nutrients faster than they can normally be re-supplied.[25] [26] [27]

These factors are affecting normal biochemical function in many people and significantly contributing to increased obesity, cancer, mental health problems, juvenile learning disorders, and degenerative disease striking young people.

For example, neurotransmitter disorders are the cause of much mental illness and various learning disorders. In 1982 Rodolfo R. Linus showed that deficiencies of calcium impair the secretion of neurotransmitters in the brain.[28] For calcium to be absorbed, magnesium, vitamin D and other nutrients also must be available in the proper ratios. However, as many studies show, calcium, magnesium and other important mineral levels in foods have fallen by as much as 60-100% due to soil depletion associated with synthetic fertilizer use. Please go to Appendix 1, as the figures are hard to believe.

Mineral deficiencies are just part of the problem. A lack of essential amino acids, fatty acids, vitamins and other micronutrients contribute to many degenerative disorders.

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Cancer and Degenerative Illness are on the Rise

An increasing and unprecedented number of North Americans now suffer from poor health and degenerative disease due to poor nutritional sources, a polluted environment, and/or unhealthy lifestyles.

In the US in 2001:

- Heart Disease accounted for 28.9% (700M) of deaths,[29]
- Cancer accounted 22.9% (553M) of deaths,[30] and
- Collectively, degenerative diseases disrupted the lives of a significant percentage of society, as well as killing 73.5% of those Americans who died that year[31].

Degenerative conditions associated with nutritional deficiencies manifest themselves in a variety of manners, depending on the individual. The weakest part of a person usually fails first. In one individual a particular deficiency might cause mental illness or learning disorders, in another, muscle cramping, back pain, bowel disease, arthritis, and/or cancer.

Unfortunately for most North Americans, conventional medicine has been slow to realize the roles of poor nutrition in causing disease and therapeutic nutrition (nutritional intervention) in healing. But, this is changing as modern health science spreads though the medical community.

Because of the body's incredible ability to heal, most degenerative conditions can be reversed if the cause of the problem is rectified in time.

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The Power of Nutrition to Restore Healing & Normal Metabolism

A study performed at the Shriners Burn Trauma Center at the University of Cincinnati Medical School conclusively demonstrated that burn trauma victims (children experiencing severe burns over 60% of their bodies) fared far better when given extra nutritional supplementation over and above the normal "well balanced diet" generally prescribed by practitioners. 100% of those children receiving the extra supplementation lived, whereas sadly 44% of those children who were given the regular, traditional, medically approved "well balanced diet" alone subsequently died.[32] The scientists stated that, "to our knowledge, this is the first controlled study to demonstrate what has been suspected and accepted for some time, that nutritional intervention improves survival... It may well be that fortification of the diet with still greater quantities of protein or with selected amino acids may further improve these variables." [33]

Research shows that if proper bio-available nutrients are restored before the body's entire enzyme matrix stops functioning, the body has an amazing ability to use its DNA, RNA, enzymes and nutrition to heal and return to a normal metabolic state, usually regardless of age.

In addition to healthy food choices from primarily organic sources, there are many nutritional supplements available to the consumer, which can allow the body to restore and maintain normal metabolic function.

When administered properly, rapid and seemingly miraculous results often result. The worst degenerative disease can often be reversed. The body of experimental evidence supporting the effectiveness of nutrition combined with various food supplements in treating most forms of illness has been growing very rapidly for the past 15-20 years.

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How the Body Heals Through the Self-Organization of Nutrients

Human understanding of biology has advanced so far in the past 30 years that its now quite easy to visualize the basics of why we heal.

Recognizing a few simple relationships is critical to understanding how to maintain health and recover from illness, and why proper supplement formulations have become important to help the body heal in this modern era of depleted nutrition.

These can be quickly and easily understood regardless of previous scientific training.

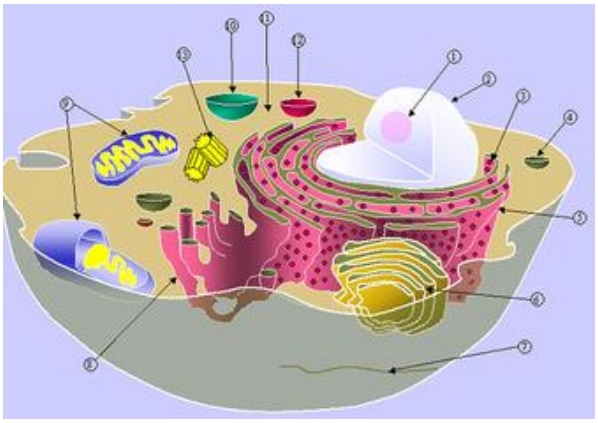
In summary:

1) Healing is normal, degenerative disease is not.

2) Healing is a rebuilding, or regeneration, of the body's cells. Most healing requires no external assistance if the body gets reasonably clean air and water, proper nutrients, appropriate exercise, and enough rest.

3) Healing is possible because of 1) ***DNA,*** 2) ***enzymes,*** and 3) ***nutrients in our food***. The adult body is like a massive jigsaw puzzle. It contains about 50-100 trillion cells, each of which is made up of millions of atoms. Amazingly, every single atom making up critical structures is precisely put into its place because of enzyme action on our food.

4) This is possible because each of our estimated 50-100 trillion cells contains DNA, the master architectural blueprint for the entire body. Each cell uses its DNA and subsequent DNA derivatives, such as RNA, to instruct enzymes to assemble nutrients into the very precise and complex structures of different proteins, fats, and sugars, that make up our bodies.

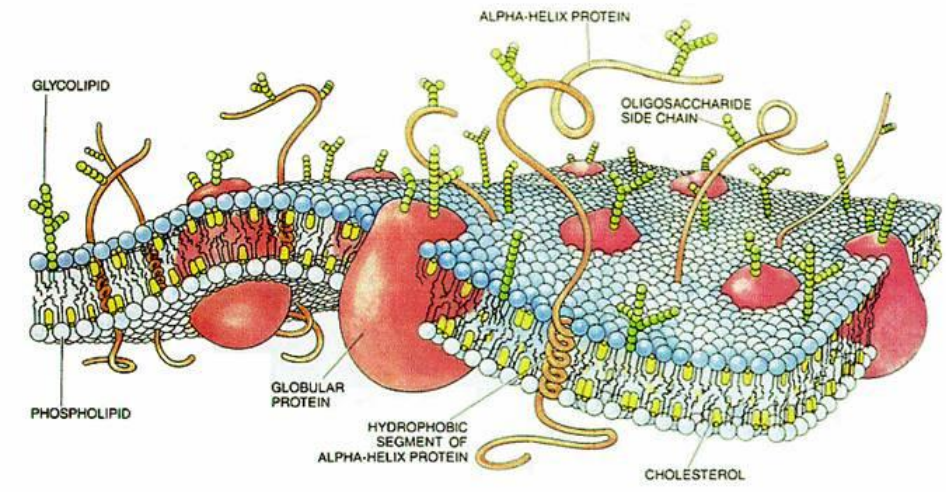


SIDE NOTE: These pictures will give you a better idea of how most of our cells are organized.

In the picture to the left, the nucleus (in white) contains the nucleolus (in pink), home of the cells DNA. Run your cursor over the picture for names of other various cell compartments, many of which produce and contain enzymes.

The walls of cell structures are ***membranes***, which can be seen more clearly below.

These membranes are mostly composed of lipid, or ***fatty acids***, and are known as a **lipid bilayer.** Embedded within most membranes are a variety of ***protein*** molecules that act as channels and pumps, moving different molecules into and out of the cell.



In most cells, various ***proteins*** are tied across those two layers, providing structural strength and specific passageways with different functions that allow the tranfer of ***nutrients*** and ***waste*** accross cell membranes.

These ***proteins*** and ***fats*** are mutally attracted due to their ***opposing*** shapes and electrical charges. The proteins are rich in positively charged sulfur and are held in place by binding to negatively charged essential fatty acids (EFAs—omega 3 & 6 discussed below). The lipid bilayer is the foundation of all biological membranes, and is a prerequisite of cell-based life.

Fats and oils readily bond to ***phosphates*** forming a mono layer **phospho**lipid film, with the phosphates on one side, and fatty acids on the other. (In the picture above, the zig-zag lines

are the fatty acid tails, and the phosphates are the blue dots.) At proper concentrations, certain kinds of fats and oils, when left alone in a test tube of water, will self-organize to form a "bilayer." This potential for self-organization of fats in water is one of the factors that allowed the first life on Earth to form. ***Self-organization*** occurs because many molecules will naturally organize with others based on their respective electric charges and shapes.

(That lipid bilayer is composed of two opposing mono-layers of fat molecules arranged so that their hydrocarbon (fatty acid) tails face one another to form the oily bilayer core, while their electrically charged or polar heads (phosphates) face the watery or "aqueous" solutions on either side of the membrane.)

In fact, the potential for ***self-organization between the simplest of food groups*** is what led to the formation of the food chain. Life on earth began with the simplest of earth's molecules self-organizing into more complex structures. Humans, and the rest of earth's life forms, are designed to self-organize as well, as long as we have the right balance of natural food groups and other nutrients that allow this to happen.

This paper will discuss how certain foods and environmental toxins interfere with normally self-organizing cell function. For example, the wrong balance of food intake causes our cells to produce too much acid, leading to acidosis. The corrosive and damaging effects of too much acid production are at the root of much modern disease (see Part 3). As well, unhealthy fats, which do not have the same shapes or properties , do not fit well into the membranes pictured above, interfering with nutrient & oxygen transport and cell division, and contributing to the development of cancer. Toxic metals also interfere with all these normal processes, in particular by disrupting enzyme action, the key to healthy vibrant life.

5) Most of the body's cells, including our genetic code, are regularly replaced as a result of cell division, a life-long ongoing process. This enables the body to replace worn parts with new ones. However, for this is to occur properly, all required nutrients must be present and in balance.

6) All life forms use enzymes to assemble and self-organize random nutrients into orderly structures. Enzymes are special proteins found in our body and our foods. There are approximately 4000 different enzymes in a typical cell (which are activated with co-enzyme factors), each with its own specific chemical function, or job.[34]

7) ***Vitamins*** (also known as co-enzymes) and bio-available ***minerals*** (other cofactors) found in foods help "activate" our enzyme systems.

8) Our DNA/RNA instructs our cells how to use all these enzymes and co-enzyme/factors in a coordinated manner. This matrix of interdependent enzyme activity is analogous to a sophisticated manufacturing plant, where the independent, parallel production of different smaller parts allows the more complex assembly of another later in the process.

9) *Individual enzymes* only react with *specific nutrients*. Because of their very precise action, enzymes only produce very specific by-products. These by-products are usually required for subsequent enzyme reactions. This "matrix" of interdependent enzyme action can be

thought of as an ongoing chain reaction. If certain essential nutrients and/or co-enzyme/factors in food are in the wrong form, or missing altogether, enzyme activity, and the chain reaction, eventually stops.

10) ***Orderly enzyme action*** is one of two ways in which chemicals can react together. The other is through ***uncontrolled random chemical reaction***.

An example of random chemical action is gasoline combustion. Such reactions are difficult to control and produce many unwanted by-products, like smog in the case of gasoline.

A car engine randomly mixes gas with oxygen and burns it to create carbon dioxide and water. If the fuel and oxygen ratios are correct the emissions are carbon dioxide and water, and non-toxic to plant and animal life.

However, if during that random reaction there is only enough oxygen to combine one oxygen atom with every carbon, carbon monoxide is produced, instead. As well, impurities in the fuel, such as sulfur compounds, might react with oxygen as well, creating sulfur dioxide. The creation of such chemical byproducts in a car engine is essentially uncontrolled.

If random reactions were the only way for chemicals to interact there would be no life on Earth, as life processes are orderly, requiring the production and re-use of specific by-products, not ones that are randomly produced. To prevent the generation of random by-products and maximize nutrient use, all life uses self-organizing enzyme chemical reaction as the basis for catalyzing growth and maintaining health.

Synthetic chemicals and/or randomly produced chemical by-products can interfere with our precise enzyme based metabolism, as only specific nutrients & compounds work with human enzyme systems, as discussed above.

Therefore healing and regeneration can be interrupted by synthetic chemicals, environmental toxins, or poor nutrition, as anything that interferes with the body's normal enzyme based biochemistry affects healing.

11) While enzyme based healing and growth processes look slow, they actually occur at very high speeds. Enzyme reactions are approximately 3000 times faster than random chemical action (which is also very fast, as anyone who has seen gasoline explode knows). An enzyme is capable of 100,000 individual reactions per second. Enzyme action is so fast and exact, it can assemble billions of atoms into very precise structures within hours. That is how a mushroom can "mushroom" overnight, and why healing and growth occur in all life forms.

12) However, anything that interferes with the exceptional speed of these processes will cause disease, or other impaired bodily function like muscle cramping, depression, digestive problems, headaches, etc. Proper nutritional supplements can help restore normal enzyme action by providing essential nutrients that may be low, or missing, in today's food supply because of synthetic fertilizer use in agriculture, food processing, or environmental pollution.

13) Life as we know it is just an ongoing series of complex interdependent enzyme interactions. A continuous multiple-stream chain reaction. If just a part of this process stops, degenerative disease results. If all of it stops, we stop.

However, as the attached research shows, in most cases if proper nutrients are restored before the entire matrix stops functioning, the body has an amazing ability to use its DNA/RNA, enzymes and nutrition to heal and return to a normal metabolic state, regardless of age.

14) The lymphatic system is the most important physiological system for combating foreign bodies such as viruses, bacteria, or fungi. It's also designed to help our bodies collect and eliminate wastes and toxins. Much of the refuse generated by cellular activity is dumped into the lymph system, which is like a waste filtration system in the body.

The lymphatic system is composed of lymph vessels, lymph nodes, and organs. The functions of this system include the absorption of excess fluid and its return to the blood stream, absorption of fat (in the villi of the small intestine) and the immune system function.

Lymph vessels are closely associated with the circulatory system vessels. Larger lymph vessels are similar to veins. Lymph capillaries are scatted throughout the body. Contraction of skeletal muscle pumps the lymph fluid through the system. This is what makes moderate daily exercise so important.

Lymph organs include the bone marrow, lymph nodes, spleen, and thymus. Bone marrow contains tissue that produces lymphocytes. B-lymphocytes (B-cells) mature in the bone marrow. T-lymphocytes (T-cells) mature in the thymus gland. Other blood cells such as monocytes and leukocytes are produced in the bone marrow. Lymph nodes are areas of concentrated lymphocytes and macrophages along the lymphatic veins. The spleen is similar to the lymph node except that it is larger and filled with blood. The spleen serves as a reservoir for blood, and filters or purifies the blood and lymph fluid that flows through it. If the spleen is damaged or removed, the individual is more susceptible to infections.

Unlike the circulatory system, the lymphatic system lacks any central "heart-like" organ to pump lymph fluid throughout the lymph vessels. Instead, as mentioned above, the lymphatic system depends on muscular movement, breathing, and simple gravity to move lymph fluid throughout the body. Thus, frequent movement is critical for humans to properly move lymph and prevent lymph fluid build-up in certain areas of the body. (The Thoracic Duct is the only part of the lymph system that does contain smooth muscle, the same muscle type that exists in the lower digestive system and the arterial system, in order aid lymph flow.)

To summarize the section above: the body stays healthy by regenerating itself, continuously replacing worn cells with new ones. This constant turnover (Healthy Metabolism) requires four things to occur properly:

-the correct architectural plan (DNA/RNA found in every cell),
-precision machines to assemble nutrients (enzymes) in a self organizing manner,
-specific ingredients (bio-available nutrients and co-enzymes), and
-moderate exercise, which:

a) stimulates metabolism, and
b) pumps toxins from the lymph system through muscle contractions.

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How Food and Activity Affect Your Ongoing Genetic Development

All life is maintained by a continuous consumption and utilization of food and energy – a perpetual flow of fresh nutrition, or stored energy, that sustains an organism its entire living existence.

Since life began evolving from its simplest forms 3.1 billion years ago,[35] genetic systems have developed ***as a result of*** this continuous consumption & utilization of specific nutrient biochemicals (and various forms of electromagnetic radiation) that propel life and evolution.

As discussed above, all chemical, and bio-chemical, ***self-organization*** occurs because most atoms and molecules will naturally organize with specific others based on their respective electric charges and shapes, and mutual attractions/repulsions that exist between them.

The self-organization of lifeless inorganic molecules into organic forms capable of supporting life laid the foundations for the modern food chain, and the development of lipid membranes, proteins, enzymes, and DNA. This process has continuously provided increasingly complex nutrition for the fastest developing life forms near the top of the food chain.

Put in simple terms, over the ages the ***genetic codes*** found in Nature's organisms evolved and self-organized as they did primarily because of the foods eaten by that organism. This genetic development was further affected by each organism's mental and physical activity, exposure to various electromagnetic particles and fields (capable of mutating chemical structures), and finally – evolutionary selection.

Genetic evolution is always ongoing. Individual organisms, albeit very gradually, use more complex nutrients to evolve into more and more complex genetically-organized life forms. Concurrently (on a macro level) the food chain, made up of such life forms, becomes more complex and organized, providing more highly developed nutritional components to allow organisms higher in the food chain to develop even more complex genetic systems.

However, that said, Paragon's and other orthomolecular research shows that one's genetic code is only of secondary importance as relates to the development of most chronic disease.

Our research indicates that two factors: 1) ***specific nutritional and environmental inputs***, and 2) ***physical & mental activity***, primarily control and modulate the body's translation of the genetic code, and to a great degree, ongoing replication of the genetic code within each cell.

Various levels of nutrients and activities, which can easily be adjusted, affect nutrient availability, hormonal output, and how & what the genetic code ultimately produces on a daily basis, controlling the level of cellular regeneration, or healing, that ultimately results from genetic transcription driven by specific responses to activity & nutrition inputs.

Different combinations of nutritional inputs produce different genetic expressions, some of which may produce beneficial development, while others can produce degenerative effects or chronic disease. That said, the body requires unadulterated chemical inputs to produce a strong

body and immune system, as all DNA in genetically-based life has adapted and evolved to work on a balance of natural biochemical compounds, free of synthetics.

Recognizing the Sophistication of DNA and Nature's Engineering

Humankind's ability to analyze and process chemicals is still relatively new – only having really begun in the 1800's. The modern periodic table of chemical elements is just 100 years old, DNA was only discovered some 50 years ago, and the human genome was only fully mapped in 2003.

On the other hand, the complex matrix of enzyme based chemical and reproductive processes that govern all life has been steadily evolving and improving for more than 3 billion years. Evolution's unrelenting efforts to extend lifespan have produced sophisticated self-organizing systems for healing and regeneration that are based on the specific natural nutrients we have eaten throughout our evolution.

Nature's engineering is magnitudes more sophisticated than anything Humankind will ever conceive. The human body, considered the pinnacle of Nature's innovation, is the most precisely engineered and manufactured machine that we know of in the Universe.

Among other things, our twin stranded DNA has the ability to repair itself. A testament to the integrity of our much maligned DNA is that in every living person DNA has been passed on and modified from every previous generation, without a single interruption, since the beginning of human evolution, hundreds of millions of years ago. This represents such an incredible feat of toughness and endurance, that in comparison, the remarkable continuous operation of one's heart over a full lifetime seems insignificant.

The accuracy of DNA replication in all organisms is also amazing. Despite the immense size of human DNA, an error occurs only about once in each 10-100 billion base pairs[36], with the complete process of DNA replication in human cells taking just a few hours.

Additionally, in a balanced and unpolluted ecosystem, significant genetic birth defects are normally quite rare, affecting approximately just 1 in 200.[37]

We are only beginning to appreciate the complexity and precision of our enzyme based biochemistries. It will be years before have isolated the myriad of interdependent functions and substances that make life possible. The more we learn and understand about Nature, the human body, and the complicated processes that drive them, the more we realize that we can not alter the grand design without upsetting the balance.

So far we have discovered 3000 psychoactive chemicals, allowing the brain to react to outside stimulus. More than fifty psychoactive substances are produced by the brain that activate aggression, sedation and memory. The brain can function at a rate of over 100,000 chemical reactions per second. A quantity of information equal to 500 hundred sets of encyclopedias can be stored in our memory.[38] The brain has 100 billion neurons and 100 trillion connectors for memory alone. Even with today's high-tech diagnostic tools, most of the brain's operations

remain a great mystery. The brain, as with the rest of the body, is made up of trillions of tiny cells.[39]

The body's circulatory system is 60,000 miles long. Each blood cell encircles the body up to 2500 times a day. The lungs contain 300 billion capillaries. For every pound of fat, your body has to supply an extra 200 miles of blood capillaries.[40]

Nerve cells have long threadlike shapes capable of transmitting nerve impulses from one region of the body to the other. Clear biochemical communication is important for health.

Feeding our bodies with natural substances is critical to restoring and/or maintaining vigorous health. Western medicine is slowly recognizing that the body's structures, its DNA, and the foods we eat control the most powerful healing systems, and that these systems require nutritional and/or other substances truly compatible with its entire design.

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Modern Factors Affecting Genetic Expression and Cellular Replication

New research data shows that nutritional and environmental factors affect enzyme balance and function, and the genetic translation and replication dependant upon it. Unfortunately, as discussed in the a section below, because poor nutrition and environmental contaminants are interfering with normal enzyme function, genetic translation and replication are being altered accordingly.

It's taken millions of years of evolution for Nature to develop the incredibly complex matrix of specific enzyme systems that allow life to replicate. Consequently, plant and animal life are unable to adapt to the explosion of food additives and chemicals developed over the past 40-50 years, as these life forms can't evolve new enzymes to process new chemicals "overnight". The inability of our enzyme systems to properly metabolize many synthetic substances is interfering with the normal expression of our genetic code and normal cell function.

For example, synthetic compounds that are closely related to natural compounds are falling into enzyme receptors and altering normal biological function. This is the problem with trans fatty acids. This is also the problem with organo-chlorines and other "gender benders" compounds, which are altering normal hormone function in all life forms.

Nature's enzyme systems evolved to work with natural compounds. This is why most of the billions of tons of synthetic chemicals produced have become very problematic for healthy plant and animal life. Therefore we must be careful not to eat synthetic foods or additives that interfere with normal metabolism. As well, the 7,000,000 synthetic chemicals we have created need to be used very carefully and controlled properly.

New research also shows that specific balances of foods, natural or synthetic, and the ratios of minerals and other nutrients they contain, affect the composition of our tissues and most

metabolic function in our bodies. Inappropriate balances of different foods alter critical mineral balances within our tissues, affecting:

- **proper tissue pH**, and the healthy cellular regeneration dependant upon it. Normal cellular regeneration requires normal cell division and DNA replication, which requires a proper pH level within our tissues (discussed in a later section).
- **neuro-endocrine function** (which regulates our body's hormone systems)
- and **the intracellular** (inside the cell) **bio-chemical balance of our cells**.

  That in turn affects the relative balance of thousands of different processes of enzyme action, RNA translation, and the subsequent formation, or biochemical make-up, of our tissues, irregardless of our own DNA and overall genetic makeup.

These nutrient balances are critical to our ultimate tissue formation and biochemical makeup. Very sensitive tissue tests done on spousal partners, who were not "genetic relations", but who ate the same meals, showed almost identical mineral balances in their tissues, despite different genetic make-ups. The extremely sensitive measurements were calibrated in milligrams %, or milligrams per 100 grams of tissue. One milligram % is equal to 10 parts per million. Incredibly measurements of partners of no genetic relationship will often show identical levels of most minerals down to the milligram %. Conversely, mineral balances of tissue in people who are related genetically will bear no resemblance when the two people are eating different foods.

The reason this is so relevant is that minerals and other nutrients are critical to activating many important enzymes. Different mineral balances will produce different balances of enzyme activity, which in turn affect how our genetic code is expressed. (Gene Expression is defined as the process by which a gene's coded information is converted into the structures present and operating in the cell.)

As discussed later in this paper, this shows that you are what you eat, and that your body chemistries are not exclusively the product of your overall genetic code. The reality is that your genetic code both produces metabolic action and manufactures tissues based on the amounts & types of exercise you get, and, what nutrients and various chemicals you ingest – in food you eat, air you breath, fluids you consume, and substances you rub into your skin; as well as by radiation and other subatomic particles you may absorb.

Tissue breakdown and metabolic disorders lead to degenerative disease. As seen above, this is most often caused by malnutrition, improper exercise, and environmental factors, and not the DNA you inherited.

(For a clear and simple overview of how your genetic code is expressed and of the latest irrefutable research showing how foods affect this see Appendices 8A & 8B.)

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Toxic Pollution's Disastrous Effects on the Environment and Health

Pollution, much of which we can't see — in the form of contaminated air and water; chemically and genetically altered foods; synthetic chemical fertilizers which alter the mineral balances of the soils; pesticides sprayed on crops and yards; artificial food additives; electronic radiation; etc., — is causing significant levels of degenerative disease and biological mutation amongst life forms. Made even worse by poor food choices, many of us now get sick because our bodies are overwhelmed trying to eliminate non-natural substances that interfere with our natural biochemistries.

As of 1994, in the US there was approximately one ton of municipal waste created per person/year. Incredibly there was also one ton of hazardous waste created per person/year, and even more shockingly, one ton of industrial waste created per person each week.[41]

As can be summarized from the data below, these figures have increased dramatically since then, and Canada's per capita pollution totals are probably even worse than those of the United States. The manner in which all developed nations are polluting the Earth is turning out to be one of the most irresponsible actions mankind has ever committed.

The Commission for Environmental Cooperation North America (CEC) is a NAFTA treaty organization monitoring pollution in North America. On May 17, 2003, the trinational organization released its annual report, *Taking Stock,* which revealed that a group of 15,000 industrial facilities across North America released and transferred 32 percent more toxic chemicals from 1998 to 2000.[42] These facilities, with chemical releases and transfers up to 100 tonnes, represent the majority of polluters in Canada and the United States.

"It's very discouraging to see such a large number of facilities report releasing more pollution in our environment, since they are found in communities across the continent," said Victor Shantora, Acting Executive Director for the CEC. "The small 'p' polluter might not grab the same headlines as a large power plant or chemical manufacturer, but their effect is being felt throughout the North American environment."

Pollution levels prior to 1998 were already disastrously high. Regardless in just two years, in Canada, these "small p" polluters registered a 66 percent increase in chemical releases and transfers. In the United States, the same group recorded an increase of 29 percent.[43]

In Canada these "reported" figures are still a very misleading representation of the facts. The actual pollution figures are much higher. This is because Environment Canada's National Pollutant Release Inventory reporting (NPRI) excludes many large sources of toxic emissions. Irresponsibly, the agriculture, forestry, fishing, oil well drilling/operations, and mining industries are exempt from reporting. Only downstream industries that process their products must report.[44] Obviously these primary industries are major contributors to pesticide and chemical pollution.

The NPRI data also fails to show discharges of several very poisonous substances, such as dioxin and mercury, which are released in amounts below reporting thresholds. One drop of dioxin is considered by some researchers to be enough to kill 1000 people.[45]

In 1993, in the Great Lakes Basin alone, Canadian companies reported that they dumped 111 million pounds of toxic chemicals.[46] How many drops of dioxin were excluded from that 111 million pounds of toxic waste? The Canadian Government has essentially created pollution reporting rules that allow industry to covertly pollute, and is thereby deliberately misleading the public to believe that industry is accountable to Environment Canada.

More than ***7.3 billion pounds*** (3.3 million tonnes) of 206 "matched" chemicals (chemicals common to Canada's NPRI and the United State's TRI) were officially reported as released to TRI and NPRI in 2000 by manufacturing facilities, electric utilities, hazardous waste management/solvent recovery facilities and coal mines. Many of these chemicals are carcinogens or cause developmental or reproductive effects.[47]

Fourteen percent of those total releases, an incredible ***483 million pounds*** (219,000 tonnes) of chemicals, are known or suspected carcinogens.[48]

Sixteen percent of total releases, ***560 million pounds*** (254,000 tonnes) of chemicals, are linked to cancer, birth defects and other reproductive harm (California Proposition 65 chemicals).[49] Many of these chemicals are being released into the air. Almost one-half of the 7.3 billion pounds (3.3 million tonnes) were releases on- and off-site, with over one-quarter being on-site releases to air.[50]

The jurisdictions in North America with the largest total reported amounts of chemical releases and transfers were Texas, Ohio, **Ontario** and Pennsylvania. Together, they accounted for more than one-quarter of the total reported.[51] Despite the NPRI accounting which lowers officially reported numbers, Ontario was still ranked as the 3rd worst polluter among all states and provinces.[52]

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The Bio-Magnification of Toxins

To compound the problem, the vast majority of industrial chemical production is petroleum derived. As a result many compounds are fat-soluble and get stored in our fat tissues. These residues concentrate in fat based animals at the top of the food chain. As discussed in greater detail below, it's estimated that 90-95% of all the pesticide sprayed on conventional food concentrates in meat, fish and dairy products, or animals highest in the food chain.[53] We are the highest such animals.

The potential for concentration, or bio-magnification, is alarming. The US EPA estimates that fish can accumulate up to 9 million times the levels of PCBs in the water in which they live and feed.[54] On top of that, half of the world's fish catch is fed to livestock (including farmed fish), where toxins get further concentrated again by the animals eating them.[55]

As we have not evolved the necessary enzymes, often we do not have capacity within our lymph systems, to properly process synthetic foods or other compounds that enter our body. A build-up of synthetic compounds can interfere with or block the body's normal biochemistries and lead to genetic mutation, altered genetic expression, and/or degenerative disease.

Persistent Organic Pollutants (POPs & PBTs)

Eliminating PCBs and other highly toxic chemicals is very difficult. Many governments and communities are ignorantly trying to incinerate them, making the problem even worse. Dangerous chemicals that are emitted into the air, fall to the ground, are ingested by us and by the animals we eat, are concentrated in fat, and later result in birth defects, behavioral problems, cancers and leukemias.[56]

Dr. Neil Carman is an expert in POP disposal, who worked for the EPA in Texas inspecting incinerators. He says every single incinerator had problems, often malfunctioning at night or on weekends, due to electrical, computer or control system glitches or operator error, causing the shutdown of critical systems.

He refers to the sacrifice zone—the zone around an incinerator where the levels of contamination are always too high. In the sacrifice zone around an incinerator in Jacksonville, Arkansas which operated for only one year, everyone in the neighborhood had high levels of dioxins in their blood." No one is safe, not even thirty, forty or fifty miles from the incinerator.," said Dr. Carman.[57]

PCB's (polychlorinated biphenols) have not been produced since 1977 because they were found to be so dangerous to our health. For over fifty years before that they were considered harmless and were dumped into the soil, so there are thousands of 'hot spots' around North America and Mexico that need to be cleaned up. As a result of this dumping, there are persistent low levels of PCB's found around the world.

These levels are higher in cold regions because they are condensed out of the air and as a result polar bears have high levels in their blood, as do whales in the oceans. Because humans are at the top of the food chain, the levels become concentrated and a breast-fed baby gets the highest dose of its lifetime.

Dr. Carman says kids pay the biggest price in cancers and leukemias which often occur in clusters around hot spots like Anniston, Alabama where Monsanto produced PCB's (insulating oils for transformers) and Agent Orange pesticides.

It wasn't long after Monsanto began producing PCBs that it became apparent that these chemicals posed major problems to human life. Three years after initial production began the faces and bodies of 23 out of 24 workers in the Monsanto plant had become disfigured.[58] That didn't stop Monsanto. For fifty years more than 1.5 billion pounds of the chemical was produced before it was banned in 1977.[59] The employees of the Anniston plant were poisoned and the dioxins are still there fifty years later. It's thought that PCBs can probably be found in the tissues of every fish on the planet.[60]

When Agent Orange was sprayed in Viet Nam at minute levels of only three or four parts per million, mothers exposed to even these low levels produced infants with terrible birth defects. It also caused sterility and other health problems. A hospital there still has jars filled with deformed

fetuses caused by Agent Orange, proof that hormonal and reproductive systems are disrupted by dioxins.[61]

We must stop putting these chemicals into our atmosphere. When PCB's are heated, the chemical formation breaks apart, forming dioxins. There are seventy-five different dioxins, depending on the number of chlorine atoms and where they are attached to the benzene atoms. Dioxins are the most toxic synthetic substances known to Man.

Benzene was one of the first recognized cancer-causing agents. All PCB's, dioxins and other POPs are also known as PBT's –Persistent, Bioaccumulative and Toxic. *Persistent* because they can survive in our bodies for our lifetime, in nature for decades, and they can migrate in nature, being blown around by the wind. *Bioaccumulative* because molecules in the environment are taken up by feeding fish or moose or beef, are concentrated in their fat, and then are passed on to whoever eats their flesh. A cow is a giant accumulator and can bio-magnify toxin concentrations twenty-five million times above the initial level of contamination, then pass it on to humans through its milk or meat.[62] *Toxic* because these substances are very toxic at extremely low concentrations.

There are safer ways to destroy toxic waste. PCB's can be safely broken down at room temperature using a solution of catalytic agents. A process developed at Princeton University and patented in 1994 breaks down PCB's and generates chlorine and hydrochloric acid that can be sold and used.[63] The biphenols that are left are less toxic and can be treated and degraded.

Truck mounted technologies can do on-site destruction so the waste does not have to be transported. If a truck transporting these wastes were to burn anywhere along the route to the incinerator, "the contamination would be catastrophic", and accidents do happen along any highway. The U.S. Army and the Japanese government have approved alternate technologies.

Endocrine Mimickers and "Gender Benders"

Synthetics that closely resemble natural organic compounds can also fall into biochemical receptor sites and erroneously stimulate the body in undesired manners. This is the problem with endocrine mimickers and disrupters which alter normal growth, sexuality & sexual development, other hormone function, and many other metabolic processes.

As is discussed throughout this paper, health is normal, disease is not. Genetic defects are normally very rare. Almost everyone's genetic design has been successfully passed on from generation to generation without interruption since the beginning of life on Earth. It is estimated that one's chances of having a true genetic defect are about 1 in a 200[64]. Our genetic composition has been continuously re-engineered and refined by Nature throughout human evolution. As is discussed further below, Nature's genetic engineering is so thorough and redundant in its ability to repair and regenerate that nothing Man has designed comes even remotely close to being as sophisticated.

So if the body normally works so well, why are so many people sick? Why is cancer now the leading cause of death in the country?[65] Why is Canada second in the world with the highest number of cancer deaths?[66] The answers to those questions are simple. As shown in the sections below, new research is showing that both the combination of poor nutrition habits and the toxins contained in food, water and air are causing errors in ongoing genetic reproduction.

This is the primary reason so many are sick and we spending more than $140 billion a year in health care, a staggering $4375 per person per year.[67] At that rate we will spend about $328,125 per person on health care throughout a Canadian's life, more than 1.3 million dollars for a family of four. We are squandering our wealth and are in the process of bankrupting our society and our future.

Most people don't understand how toxins make us sick. If they did, they would not be eating and/or using so many of the products they buy today. Chemical pollution can take a long time to damage the genetics of an adult human or animal, so that it almost looks as though there is nothing wrong until its too late.

Worse though, it creates immediate genetic damage in the unborn. In 1986 in Arkansas, the milk of 70% of breastfeeding mothers was found to be contaminated with heptachlor, a commonly used but toxic pesticide which had been banned several years before.[68] Around the same time a Hawaii study of 120 infants whose supply of breast milk was found to be contaminated with heptachlor, found the development of the infant's brains to be severely retarded.[69]

Unfortunately these are not isolated cases. More than a decade after these studies emerged, the US Agency for Toxic Substances and Disease Registry finally confirmed that long-lived toxic chemicals have now been determined to definitely affect the intelligence of children exposed to chemicals in the womb.[70] Examples such as this show the need for a "precautionary principle" when evaluating new chemical compounds and deciding whether to use a substance or not.

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Household Contaminants

The air inside your home and workplace is an extension of your lungs. You eat approximately two to three pounds of food per day, drink about three pounds of liquid, and breathe 15 pounds of air. You can live 40 days without food, three days without water, but only four minutes without air.[71]

What you eat goes through your digestive system enabling your body to separate nutrients from waste material. The lungs have no such defensive filtering system. What you breathe goes directly into the bloodstream. It is then carried via the blood to every cell in the body. The poor air quality in our homes is so serious, particularly in those newer constructions, that officials at the Environmental Protection Agency (EPA) have stated that indoor air quality is the most significant environmental issue which we have to face now and into the next decade.[72]

In 1989, the EPA submitted a report on indoor air quality to the United States Congress. The report concluded that North America's worst air pollution is found inside our homes. A five-year EPA study showed that many homes had chemical levels 70 times higher than the air outside,

and that cleaning and personal care products, commonly found in every home, are three times more likely to cause cancer than air-born pollutants.[73]

An estimated 1,500 hazardous substances pollute North American homes. The EPA estimates 6,000 cancer deaths are caused every year by indoor air pollutants.[74] A 1990 study revealed that because of household consumables, housewives have a 55% higher risk of cancer than women working outside the home.[75]

Many homes have become silent, health-destroying environments. Children are the most susceptible to such toxic environments. Since 1960, there has been an 80% increase in respiratory problems amongst children. I think these problems are the result of many pollutants and compounded by malnutrition, such as a magnesium deficiency, and often, a lack of exercise. For many of these children, *puffers* have unnecessarily become a permanent part of their lives.

Pressure-treated lumber has been used in building materials for decades and had not been noted as an environmental problem until recently. However, over the last few decades it has been used extensively in building outdoor decks and playground equipment. Unfortunately, arsenic and other chemical compounds are used in the lumber as a deterrent for insects, fungus, etc. With approximately 40 million tons of arsenic used in pressure-treated lumber annually, its outdoor use has lead to large amounts of arsenic being released into the environment. Children playing on decks and playground equipment are becoming increasingly exposed to arsenic as the wood ages and compounds are released into the air and surrounding soil. Recent studies have estimated that a child could pick-up over 7 micrograms from arsenic-treated wood. As of December 2003, chemical companies no longer have EPA approval to sell arsenic compounds for treating lumber used around homes. As a protective measure for existing treated wood, it is suggested that it be somewhat sealed through staining or painting.[76]

Formaldehyde is in almost everything you use in your home, from toothpaste to laundry soap. It is used as a preservative. Nine billion pounds are produced every year in the USA. The Board of Health issued a statement that there is such a high degree of formaldehyde in our bodies that, when we die, we do not decay as quickly.[77] The National Institute of Occupational Safety and Health warns that formaldehyde should be handled with caution. It is a human carcinogen suspected of causing birth defects and genetic damage. It also causes headaches, joint pain, chest pains, depression, ear infections, chronic fatigue, dizziness, and loss of sleep.

Formaldehyde and arsenic are just two problem substances. There are thousands of others. Eliminate or minimize the number of potentially hazardous substances you bring in to your home. If you do have a reason to keep them, store them in sealed containers away from living and sleeping areas.

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Cancer Now Kills More American Children Than any Other Disease

The governments of the world have not properly regulated the chemical revolution that began in the 1930's. Cancer now kills more American children than any other disease.[78] Cancer in children was practically unheard of 40 years ago. Many of our agricultural and chemical

industries are inadvertently ruining our soils and the food generated there with chemical waste, chemical fertilizers, pesticides, and genetically altered crops.

And, contrary to what experts and governments thought in the past, as we are discovering there are no safe levels of toxic chemicals. These chemicals have slowly spread themselves throughout the food chain and are weakening immune systems and causing illness to all life forms. There is no reason for this to be happening. Short-term political and economic interests have created enormous environmental damage and unnecessarily given the chemical industry a bad name.

Examined as a whole, all these facts and statistics present some very scary, yet unavoidable, conclusions:

- Even if we were to stop releasing toxins tomorrow, as a result of those spilled so far, cancer rates should continue to rise for several years to come, as historically, data shows that widespread environmental repercussions lag behind the actions that cause them.
- Since it is unlikely that we will be able to stop toxic polluting immediately, we can thereby further infer that cancer rates will accelerate at an even faster rate than they are now.
- It is not unreasonable to forecast that we will lose a higher percentage of our society to early cancer death. This has already begun as evidenced by the changing mortality statistics.

While this is a horrifying prospect, an even greater threat to our society's future lies with the bigger problem of immediate genetic damage to the unborn, the future of our society. We can expect many children with diminished intelligence, permanent learning disabilities and weak immune systems, thereby lowering the overall intelligence and physical strength of our society. In a short period of time we threaten to undo millions of years of evolution. Much of it cannot be regained once lost. This is unacceptable.

In the years ahead, the uninformed will suffer disproportionately. Educating the masses on how to eat and avoid the environmental poisons spilled to date is the key to sustainable, affordable health care systems based on proactive, preventative systems and actions.

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Skyrocketing Health Care Costs Are Not Sustainable

Most Canadians are not interested in environmental chemistry. And, if Canadians don't understand enough chemistry to make the proper choices for themselves, Government has to do the necessary research and classification needed to protect them. Canadians trust and expect their Government to make the right policy choices.

The Canadian Environmental Protection Act (CEPA) must address basic chemical realities. The Act needs further improvement to ensure for sustainable use of chemicals from which we can advance a viable economic and social framework. It needs to require immediate classification of

any compound we create so that we can properly regulate chemical use, and eliminate the generation and use of dangerous substances.

In the past, a society could flourish in the short term as long as it could transport pollution out of its environment, or move itself to new, uncontaminated frontiers. Today there are few places to put our garbage, and no new lands left.

As a result our lands are becoming more and more polluted. Our health bills are skyrocketing and quality of life eroding. In just a few years Canadians spending on health care soared from $61 billion in 1991, to $91 billion in 1999, to 123 billion in 2003, and is forecasted to be 142 billion by 2005.[79] In addition, a huge and hidden deferred tax to clean up the mess we are generating is accumulating very quickly. Neither condition is economically or socially sustainable.

Solving the Environmental Problems

How we use chemicals will significantly affect our economic and social welfare. It's backward to be considering short-term economic and social matters when building a foundation for long-term chemical policy.

The media lead many to think that environmentalists and modern industry are incapable of cooperating. My work exposes one to the concerns of environmentalists and industry alike. With the help of government, the two can, and must, operate in harmony if we are to successfully meet the health related challenges of the 21st century.

A few small revisions to create a strong and effective Canadian Environmental Protection Act should be the first step in helping getting our chemical house in order. A ban against future production of the most toxic chemicals, along with full NPRI reporting is essential. To complement this, we should enhance R&D tax credits and other tax incentives to stimulate Canadian industry to reduce unnecessary consumption of resources and to develop clean and efficient industrial and transportation technologies for the 21st century.

The engineering expertise necessary to develop such technology lies within Canadian industry. Canada must help our industry invest in the future. These technologies will be as necessary to the 21st century as computers and communications systems were to the latter half of the 20th century. Their development will make the first countries and companies to develop them just as wealthy as the pioneers of earlier technologies, because pollution induced health problems and global warming leave society no choice but to develop such technologies.

In our free enterprise system, technology is developed based on demands for it. Well organized, forward thinking governments and corporations recognize future demands and implement R&D programs to meet them. Canada and its industry should be leading the way. There is no reason why we cannot be healthy and wealthy.

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How To Stay Healthy In The Meantime

By making intelligent choices about the way you live your life, you can avoid and/or recover from the illness plaguing many. The remaining sections of the paper address issues regarding healthcare, the food we eat, and how it affects your metabolism and health.

Accepted Medical Theory is Rapidly Changing

- We are what we eat.
- Hippocrates went further, stating that food should be our medicine and medicine should be our food.

The wisdom of these age-old sayings is beginning to be fully appreciated by the western medical complex. (*We Are What We Eat*, Economist, Sept 4th, 2003)

Western researchers are realizing that genetic expression and cellular reproduction are significantly affected by nutrition[80].

The very latest research released in November 2005 proves what many orthomolecular medical researchers have already known for many years: ***Specific*** **nutrients and molecules turn s*pecific* genes on and off, and on an ongoing basis**.[81]

This is the most important fact in this paper. It will prove to be one of the most important medical discoveries of our time. It will ultimately affect the manner in which disease is diagnosed, and medications are developed. (For an easily understood report and editorial published by the *New Scientist* magazine explaining this, please see Appendix 8A)

Because of this definitive research Western understanding of maintaining health is rapidly changing.

Historically, doctors have relied on various *observations* to determine what affects human health. Hippocrates' observations of the interconnection between human health, food, and the environment formed the foundations of western medicine. However, many western practices determined to be critical for good health (after more than 2000 years of observation) were forgotten in the second half of the 20th century with the advent of modern medical research.

The initial success of certain vaccines and antibiotics led many to believe that modern research and medicines would eventually lead to cures for any illness, regardless of the cause. But, it should be noted that antibiotics and vaccines were first developed before Humankind had even discovered DNA's role, or nutrition's role in controlling genetic expression. These therapies, and many other western medical developments, were products of good hunches and "shooting in the dark", not of a thorough understanding of how the human body is designed and works.

These early successes, combined with the gradual unraveling of the human genetic code led to a false confidence within the western scientific community that Humankind was unlocking the

keys to disease and, that by isolating defective genes and developing drugs to counter their effects, we would solve the world's health problems.

However, its now being recognized that our previous "understanding" of genes and the factors affecting their expression was premature. This only makes sense, as the entire Human Genome was not fully deciphered until 2003. While we will probably require many more years of study before its true intricacies are revealed, the mainstream research reported in November 2005 leaves no questions about the importance of nutrition in maintaining healthy genetic expression.

Humankind's current knowledge of biochemistry remains minute when compared to the sophistication of Nature's design which controls life. Researchers are re-learning that specific nutrition and a clean environment are critical to maintaining health, regardless of the number of beneficial synthetic medicines developed in the lab.

Modern *theoretical* research is evolving very rapidly. Humankind's total scientific knowledge only doubled from 1 AD to 1750. It doubled again between 1900 - 1950 and 1950 - 1960. It quadrupled in the '70s, and again in the '80s. There was a staggering tenfold increase in the `90s. It's projected that the rate of growth will probably continue to accelerate in the first ten years of the new millennium.[82]

In the last 50 years scientific knowledge has multiplied more than 1600 times over. About 90% of all humankind's scientific knowledge has been accumulated in the last 10 years, or in about one half of one human generation.

The period of time required for *knowledge to multiply* is becoming the critical factor to determining the length of a "knowledge-generation gap". Just 50 years ago that was two human generations, or fifty years – today it is only months long. In a decade it may be measured in weeks or days. (see Appendix 12, The Knowledge Torrent Effect: What it Means for the Development and Commercialization of Science and Technology in the Months and Years Ahead)

As such, even scientific theory generated just 10 years ago regarding genetics and health care is already dated.

Accordingly, many earlier and erroneous conclusions regarding health are being re-examined. Previously accepted scientific opinion on dietary issues regarding refined sugars, sodium, calcium, & other minerals, fats and oils, the role of cholesterol, plastics & toxins contamination, microwaving of food, etc., are no longer considered valid.

As discussed above, one of the most important medical "rethinking" regards nutrition and genetic reproduction. In addition to the research mentioned above, other genetic researchers are also showing that dormant genetic "defects" ***can*** be activated by poor diet.[83] However I believe these "defects" will ultimately be determined not to be defects at all, but the normal result of genetic development caused by malnutrition. This understanding will have a profound affect on the direction of health care in the decades to come.

For the past few decades the public has been reading about one discovery after another of a gene "responsible" for illness. The articles usually imply that such genetic defects are hereditary and that there is nothing one can do about it, as the causes are "genetic".

This may be convenient thinking for those who wish to avoid responsibility for maintaining their own health, and who are looking for any prescription that can help them avoid disease.

However environmental scientists have been observing the effects of synthetic chemicals and nutrition on the genetic development of animals at various levels of the food chain for years. This has also been recognized in humans by forward thinking researchers and doctors.

An understanding of the connection between nutrition and cellular replication became possible ever since two critical discoveries:

a) DNA's role in cell division and replication, and
b) the precise nature of the enzyme action that make it possible.

Because of these, we now known that anything interfering with normal enzyme balance or activity will first cause a chain reaction of problems within the organism, and then again further up the food chain, when that organism is consumed by another.

This new understanding places primary responsibility for health on the individual (which can choose its nutrition), rather than on a genetic act of God (for which we are helpless).

These ever-growing realizations by the public at large are creating a revolution in consumer attitudes towards health care options before them.

Note: This researcher believes nutrition affects the actual replication of genes every time a cell divides. The reasoning is simple: if any of the many levels of enzyme activity required for the copying of DNA is compromised by nutritional factors, how can the body make accurate copies of DNA and other derivative genetic structures in the body?

However, very few in the medical community understand these important research discoveries and conclusions. I believe this is because of two reasons. This first is that most remain unaware of the research published over the last few years.

The second is that most MDs only received about 6 hours of nutrition classes in 4400 hours of training.[84] As of 1989, of the approximately 130 medical colleges in North America, less than 25% had courses on nutrition. On the other hand, graduates of the 4 CNME certified naturopathic medical colleges in North America have 200 hours of academic classes, and 1000 hours of clinical nutrition.[85]

But change is slowly coming. North American Medical schools are now rapidly adapting to expand training in Nutrition and alternatives practices as well. Many conventional medical practitioners are establishing integrated medical clinics, which offer a wide and comprehensive range of medical services. That said, it will be many years before the majority of doctors are up to speed on nutrition and its affects on genetics.

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The Individual's Growing Role in Maintaining Health

Doctors may be able to solve certain acute medical crises, but as can be seen above, preventing degenerative diseases, which are increasingly plaguing Western society, is largely up to the individual, and the food & lifestyle choices one makes.

Preventative Medicine is gaining credibility, as it prevents so much unnecessary suffering and grief. As modern research tools help us to better understand why we get sick, health agencies and practitioners are instructing populations on how to lead healthier lives.

One of our healthy choices needs to be regular ***moderate*** exercise. This helps the body eliminate toxins, which collect in the Lymph System, one of our body's waste disposal systems. Muscle contraction is the only bodily function that pumps our lymph system. Exercise allows our body to "take the garbage out." A sedentary lifestyle, which is unnatural compared to the active lifestyles our ancestors from which we evolved, allows toxins to accumulate in our cells and the lymph system, and can lead to serious toxin related disorders, including lymphoma and other cancers.

Regular, moderate exercise and proper foods help keep the blood rich in oxygen. This is very important as cancers, bacteria, and virus all require low oxygen (anaerobic) conditions to flourish. Merely maintaining optimum oxygen levels in one's blood is a better defense against viral and bacterial illness than most medicines.

Excessive exercise can be just as harmful as too little. People who exercise fanatically are often in oxygen "debt", as their body's ability to deliver oxygen to the individual cells is over taxed. Their tissues are often in an acidic state, and are also subject to increased free radical damage associated with excessive levels of intense physical training. Increased production of various cellular wastes associated with continual intense exercise can also overwhelm the lymph system.

Recent research work on endurance athletes shows that continual daily training causing high levels of damage to red blood cells and ferritin (an iron-phosphorus-protein complex containing about 23% iron) thereby impairing the body's ability to transport and store iron, which is required for proper oxygen delivery and metabolism.[86] [87] As always, moderation is the healthy choice.

How active we are, and how much of & what foods we eat, affect homeostatic biological responses that regulate:

- the production of energy,
- the storage of critical nutrients within our bodies,
- and the rate of cellular regeneration going on within the body at all times.

Healthy food choices are very important. If one becomes depleted of various nutrients, the body can only stretch its limited stores for so long. Once essential nutrients are exhausted, due to stress, poor diet, pregnancy, and/or an unsustainable lifestyle, the weakest body part will give out first, and other problems may follow.

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You Control Your Metabolism

How energetic you feel and what body weight or mass you maintain are determined by how you regulate your metabolism with the food and activity choices you make. Five factors affect this dramatically:

- Consumption of high-energy, healthy foods vs. low-energy, poor food choices
- Total food consumed in a meal vs. energy required over the next few hours
- Average total physical activity expended during a day
- Proper hormone function
- The pH balance of your bodily fluids

When these factors are properly balanced you can control your weight as you wish. While the first three of the above are pretty obvious, many are not aware that the fourth factor, proper hormone function, is very important, and dramatically affected by the types of food you ingest, particularly by the ratio of various minerals, sugars, fats and oils in the diet.

The fifth factor, pH balance, is affected by the quality and ratio of various minerals, carbohydrates, proteins, oils and fats you eat. The charts provided below will make it easy for you to pick the foods best for you.

There are many different types of protein, sugar, carbohydrate, fat and oil discussed below. You may not recognize various terms at first, but each type is explained. If you are just learning about foods, you should read these sections once to become familiar with the terms and general message, and then read it again for better comprehension and retention. The appendix also contains several books which discuss all of this in greater detail, and very concisely as compared to many texts.

If You Need to Lose or Gain Weight

Proper dietary choices combined with moderate exercise are the answer to losing or gaining weight. The food choices you make (particularly as applies to carbohydrate and oil) determine whether the body ingests foods that speed up or slow down human metabolism. For example excess consumption of simple sugars makes you fat. Increased consumption of healthy oils, like flax oil, increases oxygen uptake & transport, raising metabolism and burning calories. Exercise levels and other daily activity also determine whether you will stimulate or depress your metabolism. All of this is discussed in detail in the sections below.

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The Importance of Proper, Relaxed Digestion

Digestion requires more energy than any other bodily function. Processing food is the single most important bodily function to an animal's survival, and as such, is a biological priority.

Thinking uses enormous amounts of energy as well. This is why you can fall asleep after a heavy meal—as all of your energy required to stay alert is temporarily diverted to digestion.

Good digestion requires healthy food, a relaxed atmosphere, and thorough chewing of food. Incomplete digestion can lead to serious health problems.

All digested food that we use passes from our digestive system into the bloodstream. In a utopian world our blood would only contain substances that are good for us, however there are many ways for pathogens to enter the bloodstream—through organisms and contaminants in the foods we eat and drink; contaminated air we breathe; insect bites, cuts and other perforations of the skin; etc.

The digestive system is the foundation of our immune system strength. Proper gastrointestinal function is critical to adequate nutrient delivery and can impact all aspects of body function and our health.

Any digestive disorder has the potential to cause nutritional deficiencies which can cause disease. As well, the digestive system is designed to keep invading organisms out of our bodies.

A simple analogy is helpful in understanding the basic form of our digestive system as it relates to the rest of the body. Consider the geometry of a donut shaped object. The human body's fundamental form is similar to that of a donut.

The inside surfaces of our mouth, throat, stomach and intestines – everything that we call our digestive tract (i.e. the donut hole) – is continuously connected to the outside surfaces of our body, that we call skin (i.e. the outside of the donut). If we stretch our imaginary donut into a longer tube, the digestive tract is still on the inside, and our skin is on the outside. The inside and outside surfaces make up one continuous unbroken surface.

This simple geometric analogy teaches us that, anatomical differences aside, a common trait shared by our skin and our digestive tract is that they both face outward from the body. Nature designed us this way to provide a continuous protective barrier from the outside world.

The human body's immune system is designed to attack foreign complex molecules (combinations of simple molecules) not made by our own bodies. This is one of the reasons Nature evolved our bodies to require full digestion of our foods for proper health. To ensure our immune system to functions properly, we are designed to break down complex food groups into their smallest parts, and to later reassemble them into the more complex parts specific to our individual needs and familiar to the immune system. Therefore complete digestion is critical to proper function of the immune system.

If a person is not fully digesting his/her foods a number of problems arise. For example:

- Partially digested food molecules are usually too large and in the wrong chemical form to pass into the bloodstream.
- Partially digested food is not available to many of the body's enzymes requiring foods in their simplest forms.

- Undigested food can also feed other unfriendly organisms in your digestive track. This can lead to and overgrowth of yeast and bacteria leading to gas, bloating, and chronic infection.
- Should you develop "leaky gut syndrome", where a weakened digestive system allows undigested food or waste to pass from the small or large intestine into the blood stream, this can cause food allergies and other adverse reactions as the immune system attacks the complex molecular structure of the "unknown invader".

Many of us take digestion for granted. This is a big mistake, because most health problems ultimately result from a nutritional deficiency, or a digestive disorder that prevents us from absorbing various nutrients properly. The first line of defence for a healthy immune system is a healthy digestive system. Improper digestion almost always leads to disease.

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The Electrically Charged Building Blocks of Foods

Food, like most other things on the planet are electrically balanced, or "neutral" to touch. You will not get an electrical shock touching them. However this can be deceiving, as most compounds on the planet are made up of vast quantities of electrically unbalanced (or "charged") acidic acids and alkaline bases.

As most people know, opposite electrical forces "attract" and like forces "repel". It's the electrically unbalanced, or polar, nature of the microscopic components of our food which make them healthy for us. Nature is able to move things around in our bodies primarily due to electrical attraction or repulsion.

Therefore one of the things your body must first do is to break down "neutral" foods into their dynamic and reactive acidic and alkaline building blocks.

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How Various Parts of Your Digestive System Work

For a brief overview of the many parts of the Digestive system and their many functions, if you are on line, please refer to the Virtual Anatomy Textbook-Digestive System on the web.

There are four basic parts of the digestive system for breaking down your food (the mouth, stomach, pancreas, and small intestine) and two for the elimination of wastes (the colon and kidneys). The four digestive sections are responsible for the acidic and alkaline breakdown of your food.

The first alkaline digestion of carbohydrates starts in the mouth with enzymes found in your saliva. This is why thorough chewing of your food is so important, as without thorough chewing this initial alkaline breakdown is less complete.

This is also why rapidly digesting refined foods can accelerate rotting of teeth. If there were no enzymes in your saliva, this carbohydrate could harmlessly sit on your teeth doing nothing as it

does on a cupboard shelf. However refined carbohydrates react with enzymes to produce simple sugars too rapidly, wreaking havoc on your teeth and mouth.

Next the chewed food is soaked in an acid bath contained in your stomach. (The very powerful acids in your stomach are contained within the alkaline lining of the stomach's walls. The stomach needs adequate bio-available sodium to maintain this protective alkaline lining.) Some simple foods and nutrients are passed through the stomach lining into the bloodstream, but most do not enter the blood until they pass through the small intestine.

Nature has evolved our bodies to makes sure everything is broken down into its simplest forms. Once the food has had its first alkaline and acidic digestion, our body's repeat this process a second time. Our partially digested food once again goes through an alkaline breakdown in the duodenum, the uppermost section of the small intestine, with secretions from the pancreas. If we are not chewing our food properly to achieve adequate alkaline digestion in the mouth, we can put unnecessary strain on the pancreas.

Next, this slurry of nutrients, or chyme, heads to the acidic middle section of the small intestine, for the final acidic breakdown of our foods. Bile, first manufactured in the gall bladder, and then stored and secreted from the liver, helps to digest fats and oils. With digestion and nutrient breakdown complete, the majority of dissolved nutrients pass through the small intestine's walls into the bloodstream, about 3-4 hours after we have eaten it.

The acidic liquids of the small intestine now need to be neutralized and dried out. This occurs in the large intestine or colon and take about 8 hours (if you are regular—with 2 or more normal bowel movements per day). The large intestine represents the terminal phase in digestion. Here, large amounts of water and salts are reabsorbed back into the blood and recycled, leaving only the familiar fecal matter. Unlike the fast-moving chyme in the small intestine, this fecal matter moves slowly and contains few nutrients and much less water. A properly functioning colon contains 3 meals most of the time.

However, if you are lacking regularity, one bowel movement or less, you probably have 6 meals in the colon at once. Chronically constipated people often have as many as 8-9 meals in the colon at once. As described below, this is not a healthy situation, but it usually can be improved quickly with a change of diet and/or exercise.

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Constipation is a Slow Killer

The colon is designed for continuous expelling of waste and toxic substance. If this process is slowed on a chronic basis, a person risks increased chance of reabsorbtion of waste and toxins into the body, causing auto-intoxication which can lead to any number of serious degenerative diseases.

Adequate exercise, water, essential fatty acids, and vegetables (for alkaline mineral, fiber and roughage) are important for maintaining regularity. Eat in a relaxed environment and at regular hours. Chew your foods well.

Exercise keeps the abdomen physically moving, thereby stimulating elimination. Too much exercise can disturb digestion as well, particularly if too soon after a meal.

Because digesting protein requires adequate water, high protein diets can cause dehydration which can lead to constipation. Athletes ingesting additional pure protein powders require a lot of extra water to prevent dehydration, constipation, and muscle cramping associated with dehydration.

Flax oil and the other essential fatty acids help keep the colon healthy, as well as improving flow of material. Healthy stools should be firm, but slightly softer rather than hard.

Two to three regular bowels movements per day is optimum. Once a day, is not enough and indicates that one is slightly constipated. Anything less is usually a problem that will lead to health problems in the longer term.

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Total Food Digested in One's Life and Lifespan

Studies on mice have led many researchers to predict the body can only digest a limited amount of food over a life time. While there are many factors associated with aging, even if these researchers are only partly right, it would make sense to eat the foods that are most easily digested while providing the richest source of nutrients. And even if they are wrong, this still makes sense, as your body functions best on nutrient rich food.

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Using Food and Your Body Efficiently

Building cells takes energy and uses up one's available lifespan. Once we have reached adult age, cellular replication slowly becomes less effective and efficient with each new copy.

Therefore once cells have been developed, you want to preserve their health as long as possible. When they age, or are damaged (***degenerate***), one wants to ***regenerate*** news ones as efficiently as possible. Such regeneration requires nutrients, energy, and chemical processing. The less regeneration we need to do, the better, as it's less work for our body.

Proper work and exercise choices are essential to maintaining healthy muscles and body parts with a minimum of regeneration and energy. For example, by eating the wrong foods, or by running out of the right fuel to provide fuel for a particular activity, you can unwittingly cause your body to cannibalize itself.

This is because the brain only runs on sugar available in the blood (blood sugar levels are the product of carbohydrate digestion, see below). If you run too low on blood sugar, the body must break down proteins (usually from muscle) into the sugars required for brain function. The body is unable to make sugars for the brain from fat. Fat can only be burned as a slower burning fuel for muscle.

Therefore intensive mental activity for long periods of time without adequate proper carbohydrate consumption will cause muscle wasting to occur. Eating protein to fuel the brain is very inefficient, as protein digestion is energy intensive and taxing on the kidneys, as excess nitrogen (in the form of toxic ammonia) produced by metabolizing protein must be removed as urine. To prevent muscle wasting, adequate long chain carbohydrates should be consumed to provide a slower burning, steady supply of sugar to the active brain, as described below.

Strenuous physical and mental activity also produce acid by-products in our body. Acids are produced when there is a lack of oxygen and other key nutrients to burn fuels properly in our body. As you will learn below, various foods and nutrients prevent our cells from overproducing acid and protect us from the destructive actions of acid build-up in our tissues.

However, those who work too hard without proper foods and rest can overwhelm their cells ability to eliminate acid. They develop a silent and serious condition known as ***acidosis***. Assuming a sick person's problems are not the result of environmental contamination or other toxins, acidosis is now considered by many health practitioners to be at the root of much degenerative disease, including many cancers.

While many parts of a cell are designed to handle longer exposures to acidic conditions, other sensitive cell structures, such as our DNA are not.

As is discussed further below, three primary factors allow an excessive buildup of acid in the body:

- The consumption of the wrong balance of foods.
- A lack of moderate exercise, which keeps our tissues saturated in oxygen and our lymph system pumping.
- Continuous excessive anaerobic exercise, which can generate too much acid for the body to metabolize.
- Continuous high stress of any nature.

Acidosis refers to a general build-up of acid in all of our body's cells. Do not confuse this acid build-up, with acid reflux that causes heartburn, although acidosis can certainly contribute to acid reflux. Acidosis refers to the acid level in all of our cells, not just those in the digestive tract. And, while strong acids play an essential role in digestion and other processes, in a healthy body those powerful digestive acids are contained by special mucous linings in our digestive tract.

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PART 2

The Essential Nutrients

Our bodies require six basic forms of uncontaminated nutrient:

- Water
- Minerals
- Vitamins (Enzyme co-factors)
- Proteins
- Fatty Acids
- Carbohydrate

There are a few excellent books listed below that explain the roles of nutrients in the body. I highly recommend reading read them after reading this paper. They were selected from the more than 100 texts & books in my own research library.

Prescription for Nutritional Healing was written by Dr. Balch, MD & Phyllis Balch CNC. It and other books listed below are concise reference sources that will provide background information on all important nutrients not fully addressed in this paper, i.e., water, the amino acid building blocks of protein, vitamins, and minerals.

This paper isn't meant to reinvent the wheel and present a detailed analysis of that which is commonly found in top nutrition books. Instead it refers to lesser known, yet fundamental problems with today's food supply, and the myriad of derivative problems stemming from those.

As discussed in detail in the sections that follow:

-Carbohydrates primarily provide energy for the body. How, and in what balance, they are eaten is critical to your health. In addition to providing energy, they are also used in building many other structures in the body, including DNA.

-Fats & oils are critical to: proper hormone function, help regulate weight and metabolism, provide a myriad of structural molecules to build our bodies, and provide fuel as well.

-Proteins provide amino acids which allow our body's to manufacture enzymes as well as other important proteins. They are considered the building blocks of life. They too can be used as fuel, but only as a last resort.

Water

Clean, pH balanced water is critical to health. Test your water to make sure it pH is near 7.0. Much of the bottled water I have tested has a low pH. Poland Springs bottled water I tested had an acidic pH of 5.5, more than 20x more acidic than it should be. Every source will be different. Check yours carefully.

Most urban tap water is too contaminated for drinking and cooking. When tested by Health Canada, most municipal water supplies contained trace drug residues of antibiotics, birth control hormones, heart medications, anti-depressants, etc. being flushed down the toilet.[88] Water from agricultural lands can be worse.

If you are drinking well water, you should have a mineral analysis done on it as well. One of my relatives has extremely high levels of calcium and magnesium, which has caused potassium deficiencies in every family member drinking that water. It should be checked for toxins as well.

Most understand the importance of drinking uncontaminated water. There are many sources available. However, some are not as readily available as others. Read the above mentioned texts before making the choice best for you.

Vitamins

As mentioned throughout this paper, most vitamins are catalysts to enzyme function in the body. The above mentioned book list will provide a good overview of their individual functions.

It's very important to remember that all nutrients work in synergy. Taking a "beneficial" vitamin without its partner nutrients will cause depletion of those partner nutrients. This is a serious problem today. The various types of intracellular metabolic testing discussed earlier, such as hair analysis, blood cell analysis, and other readily available techniques are the only way to know what your individual nutrient balances are. (Extremely knowledgeable practitioners can estimate your imbalances fairly well through lengthy interviews or questionnaires, however such practitioners are hard to find, and they will not be able to garner as much information as can be done with state-of-the-art testing.)

Minerals also work with or alongside vitamins to catalyze various biochemical reactions in the body. Some of them also play key roles as electrolytes. They are essential to health and need to be absorbed in balance. Organic vegetables and fruits of all colors are excellent sources of important vitamins and other synergistic nutrients such as mineral and phytonutrients.

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Minerals

Mineral Bioavailability: Why Many Mineral Supplements Don't Work In Humans

Minerals need to be in a form that the body can easily absorb. Many you buy in the store are not (i.e. Magnesium Oxide). This is because they are still in their cheapest raw mineral form.

As discussed earlier, the best farmlands in the world are relatively close to large sources of raw mineral and rock which wash into the nearby soils through river systems and flooding. These raw ores, like magnesium oxide and calcium carbonate can be dissolved by the roots of plants, which then convert them into protein bound forms (specific chelated forms) which animals like us can absorb when the plants are eaten.

Once again, Nature's enzyme systems produce specific kinds of protein-bound mineral we are designed to absorb (published research, as well as our own athletic testing, shows most synthetic formulations are very much inferior). Certain therapeutic doses of various vitamins and minerals, may be required for an unsustainable fast-paced life, and/or to treat certain advanced medical conditions.

Healing with Organic Vegetable Juices and Soups

Freshly made organic vegetables juices and soups are mineral rich and the most potent healing compounds I've used. They are loaded with balanced, synergistic levels of minerals, vitamins, active enzyme and many other micro nutrients yet to be discovered. Dr. Bernard Jensen's, *Foods That Heal* is an excellent book to start with to learn about healing foods, soups, and juices.

While they can be more expensive and time consuming to make, they are critical to achieving healing in many serious illnesses, particularly those related to acidosis, such as cancer, arthritis, many digestive disorders, etc. They are not appropriate for those with an overly alkaline body, although such a situation is usually rare, as most people are too acidic.

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Magnesium and Other Mineral Deficiencies are a Major Cause of Birth Defects

Studies have shown taking magnesium supplementation during pregnancy has a dramatic effect in reducing birth defects. The *Journal of the American Medical Association* reported a 70% lower incidence of mental retardation and 90% lower incidence of cerebral palsy in the children of mothers who had taken magnesium supplements during pregnancy.[89]

I believe it will also be shown to be critical in helping to prevent postpartum depression.

Magnesium is a vital catalyst in enzyme activity, especially the activity of those enzymes involved in energy production. Possible manifestations of magnesium deficiency in any human, pregnant of not, include confusion, insomnia, irritability, poor digestion, rapid or irregular heartbeat, musles spasms and cramping, seizures, and tantrums. Often a magnesium deficiency can be synonymous with diabetes.

Magnesium deficiencies are at the root of many cardiovascular problems and may be a major cause of fatal cardiac arrhythmia, hyper tension, and sudden cardiac arrest. It also contributes to asthma, other pulmonary disorders, chronic fatigue, chronic pain syndrome, depression, and irritable bowel syndrome.

Research has also shown that magnesium deficiency may also contribute to the formation of kidney stones.

Magnesium, potassium and certain other minerals, are not found in high concentrations in the blood. Therefore traditional blood tests are not effective indicators of magnesium deficiency. To test for magnesium deficiency, a procedure called an intracellular (mononuclear cell) magnesium screen can be performed. Hair analysis can also be used. It is less expensive and will provide information on other minerals and vitamin balances as well. Magnesium screening should be a routine test as a low magnesium level makes almost every disease worse.

Organic leafy green vegetables and the juices made from them are rich natural sources of magnesium. Dehydrated organic goat whey powder is another excellent overall mineral supplement. It's naturally formed mineral-protein chelates are derived mineral rich goat milk. Its only draw back is that it low in magnesium. Magnesium Asporatates and/or Malate are some of the best human-made supplements available, and can be used in conjunction with Goat Whey. Magnesium Asporatate must be ordered from the United States (see below). Magnesium Malate is available in Canada.

Minerals and Vitamins Must be Consumed in Balance

Taking supplemental vitamins and minerals incorrectly can cause major health problems. Many doctors are still not aware of many of these balance requirements.

One of the best examples and biggest problem are calcium supplements taken for osteoporosis and other health conditions. Calcium is one of the most important minerals we consume.

Calcium absorption requires fat, magnesium, vitamin D, and trace levels of manganese, boron and other minerals to occur. Many are taking doctor prescribed forms of calcium and Vitamin D alone, which ultimately causes an accelerated depletion of calcium in the body, and severe health problems in addition to a more rapid onset of osteoporosis. (The initial calcium doses will be absorbed, however as calcium's uptake requires the other nutrients mentioned above, once the body's internal stores of magnesium and the other nutrients have been depleted taking up the calcium supplement, additional calcium cannot be absorbed, leaving it to cause problematic and potentially life-threatening calcification – calcium deposition in the tissues and joints.)

An excess of calcium relative to potassium and/or other minerals in the body can caused a reduction in metabolic rate, potentially leading to fatigue, depression, anemia, thyroid disorders and/or a host of other problems. Any mineral or nutrient in excess will eventually cause an imbalance within the body.

Therefore, any vitamin and mineral supplementation must be carefully planned, monitored, and when necessary, adjusted to ensure it is sustainable. Hair analysis and other metabolic testing can be useful tools in determining whether you are ingesting nutrients in a balanced manner.

Determining Mineral Balance

Mineral imbalance is very common today, and is usually due to an imbalance of mineral stores within the body caused by various prolonged physiological stresses, inadequate nutrition or supplement habits, and/or prescription medication use.

Metabolic testing can determine mineral and/or other nutrient imbalances. By reestablishing synergistic nutrient and electrolyte balance, many health problems can be solved as discussed below.

Mineral imbalances can either take a few hours, or several weeks, to correct, depending on the level of magnesium, potassium and/or other mineral imbalances in your intracellular tissues indicated by an HTMA (Hair Tissue Mineral Analysis) or other suitable metabolic test.

Issues Related to Mineral Balance and Hypertension

As relates to mineral imbalances, there are two types: ***Relative*** (to another mineral) and ***Absolute*** (a distinct shortage regardless of other mineral levels). Relative imbalances are very common today.

This is because:
- Most soils have become depleted due to 60-70 years of synthetic chemical fertilizer use,
- Food processing destroys the natural protein chelates suspending mineral within our food,
- High stress mental, physical, and/or athletic activity require high amounts of mineral intake,
- Consumption of junk foods, microwave cooked food, and restaurant eating, and/or poor overall dietary habits lead to chronic malnutrition,
- Inorganic mineral forms found in many supplements are not absorbed efficiently by the body,
- Many drugs, such as ACE inhibitors and diuretics, significantly alter the healthy balance of ***extracellular*** (in the blood or serum) and ***intracellular*** (inside the cell) mineral stores.

Calcium, sodium and potassium are the primary components of our electrolytes and must be maintained in relative balance to one another for the body to work properly. Magnesium while not considered an electrolyte, is critical to proper cardio-electrical and other metabolic functions in the body. As well, specific balances between pairs or groups of minerals: such as calcium & magnesium; and sodium & potassium, must be in the proper ratios. All such minerals require other synergistic nutrients, such as vitamins and various coenzyme factors to assure their proper metabolism and sustained long-term balance.

For example, vitamin B6 and other nutrients help to maintain magnesium/calcium balance. A deficiency of B6 will cause the body to collect calcium and secrete magnesium.

The kidneys continually strive to maintain optimum potassium/sodium balance. If potassium builds in the body, the kidneys will either increase sodium retention and/or urine potassium secretion to maintain an optimum balance – and vice-versa for falling potassium levels. It responds in a similar manner to increasing or falling sodium levels.

This renal balancing of potassium and sodium is critical to the body being able to maintain a wide enough voltage differential (electrical potential) between the ***extracellular*** sodium-rich blood (***serum)*** and the potassium based ***intracellular*** fluids inside the cell. As discussed in the earlier section concerning tissue pH, this voltage differential is required to maintain the electromagnetic forces that operate sodium/potassium based pumps that produce the proper flow of various biochemicals in and out of the cell, through its membranes. Adequate potassium in the cell's membrane is required for this pumping action to occur (see below: Na^+-K^+-ATPase: aka The Sodium Pump).

To maintain these critical electrical balances and related functions, the body stores 98% of its potassium and 99% of its magnesium inside the cell, and not in the extra-cellular serum (blood) that is usually tested. As such, It's important to remember that blood tests for potassium and magnesium are of limited value without intracellular readings. TMA (tissue mineral analysis) or other cellular analysis is required for such determinations. Widespread use of such intracellular metabolic testing diagnostics by the medical community has been quite limited so far, but is rapidly gaining acceptance as research establishing its effectiveness becomes better known.

For the reasons above it is no longer appropriate for doctors, or researchers developing drugs, to only use conventional blood work to determine potassium and magnesium balances as relates to disease diagnosis, or determinations of potential drug interactions in drug development research.

Magnesium and/or Potassium Deficiency Often Leads To Hypertension

I believe a deficiency of magnesium, and/or other nutrients related to its metabolism (such as potassium), are usually the initial cause of hypertension, or high blood pressure. Subsequent medication often further compromises intracellular potassium uptake, further compromising the body's ability to reduce blood pressure naturally, both by reducing the beneficial effects of higher levels of intracellular potassium, and by affecting uptake of intracellular magnesium, as discussed further below.

The smooth muscle within your arteries requires magnesium to relax, and calcium to contract. A lack of magnesium would result in a contraction of blood vessel walls, leading to increased blood pressure.

There are two manners in which one can develop a magnesium deficiency. An excess of intracellular calcium relative to magnesium causes a ***relative*** magnesium deficiency, and the potential for high blood pressure. A depletion of magnesium causes an ***absolute*** deficiency.

An absolute deficiency of magnesium can be caused by insufficient intake to meet the demands of stressful work, regular intensive exercise, and/or moderate alcohol consumption, all of which

required large amounts of magnesium for their metabolism. An excess of dairy, or other foods rich in calcium, would exacerbate these hypertension-causing issues.

As indicated below, the use of an pharmaceutical ACE inhibitor drugs for those suffering from hypertension will further disturb one's previously imbalanced electrolytes, and in turn, will further deplete one of magnesium, and interfere with intracellular potassium uptake, both of which are required for the absorption of nutrition from the blood into the cells. Obviously, any blockage of nutrients to one's cells would ultimately reduce one's energy levels and affect most other physical and mental functions.

This will contribute to fatigue and weight gain, as cellular uptake of nutrients from the serum, normally meant to enter the cell through the cell membrane, would be partially blocked by low intracellular potassium availability, as a result of the ACE inhibitor drug reducing serum potassium uptake by the cell. Adequate potassium in the cell membrane is required for nutrient absorption through the cell membrane. If the body is unable to use nutrients circulating in the blood stream, it will store them as fat.

More recent research indirectly shows that a lack of potassium uptake might affect magnesium uptake, as well, as magnesium uptake may be hormonally controlled, as indicated in the magnesium related research attach below (Mysteries of Magnesium Homeostasis). Dr. Watt's HTMA research, as well as other well established research discussed below, shows the importance of adequate cell membrane potassium to allow proper uptake of hormones through the cell membrane.

A few facts: Up to 30 percent of angina (chest pain) patients do not have badly blocked arteries, but may be suffering from an electrical imbalance that is driven by mineral deficiency, most commonly magnesium. An astonishing 40 to 60 percent of sudden deaths from heart attack may occur in the complete absence of any prior artery blockage, clot formation or heart rhythm abnormalities, most likely from spasms in the arteries (magnesium is a natural antispasmodic). Moreover, magnesium deficiency has been linked to sudden cardiac death[90].

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How and Why Our Blood Vessels Need to Remain Flexible

The cardiovascular system is designed to accommodate the physics of pumping fluids. Unlike gases, fluids are not easily compressed. This is why you hear water hammer in any rigid piping system that does not phase the water's flow (and the resulting water pressure) on and off gradually. The resulting shock wave, created by the rapid stopping or starting of the flow of an incompressible liquid, sends shock waves through the rigid pipes.

There are 3 primary forms of muscle in our bodies, Cardiac, Smooth, and Skeletal. Nature designed our blood vessel piping to be flexible to accommodate the efficient pressure surges created by a pulsing two-beat heart, which is composed of ***cardiac*** muscle.

Our arteries contain a ***smooth*** muscle lining, which in some manners is similar to cardiac muscle, and operates on an automatic, involuntary basis to open and contract blood vessel channels to assist in achieving the necessary flexibility. (The remaining flexibility in healthy blood vessels

is imparted by the fluid-like essential fatty acids contained therein, which are bound to proteins in all cell membranes, and which make them more ductile).

Magnesium, Calcium, Muscle Function, and Energy Use

The human body contains approximately 20 to 28 grams of magnesium, 60% is found in the bones and teeth, while the remaining 40% is found in muscle[91]. After potassium, magnesium is the second-most plentiful positively charged ion found within the cells of the body, signifying its importance in the multitudes of physiologic cellular functions.

One of the most important metabolic processes – the synthesis and consumption of ATP, is directly linked to magnesium. ATP, synthesized by our bodies from sugar and fat we eat, is the primary fuel used by the body to power almost every bodily function. Magnesium-driven ATP processes activate approximately 300 different enzymes which are involved in diverse functions such as DNA and RNA synthesis, glycolysis, intracellular mineral transport, nerve impulse generation, cell membrane electrical potential, muscle contraction, blood vessel tone, and the regeneration of ATP[92]. No magnesium, no ATP. No ATP, no energy production, no life.

The incredibly well designed heart seems like it is built to run forever, beating more than 3 billion times in 70 years, 42 million times per year, pushing 250 million quarts of blood in the average lifetime, almost enough to fill a large football stadium.[93]

However, even the most fit individual, capable of running a world class marathon or playing in the NFL or NHL, will die within minutes if he or she becomes overly dehydrated or adequately depleted of magnesium and/or one of the other minerals found in our electrolytes. Unfortunately, this is happening far to frequently in sport today due to ignorance and malnutrition.

Calcium causes skeletal muscle fibers to contract, while magnesium relaxes them. Too much calcium and insufficient magnesium, leads to sustained muscle contraction – producing twitches, spasms, cramps, muscle pulls and tears, back problems & disc degeneration, and even convulsions, seizures, and heart attacks.

The smooth muscle of our arteries, while different in structure from cardiac and the skeletal muscle of our limbs and other body parts, still works like all muscle, requiring calcium to contract, and more importantly, magnesium and ATP to relax.

While somewhat counter-intuitive, it's important to remember that the energy expended in any muscular action is expended relaxing, or "reloading", the muscle, not firing it. A muscle lacking magnesium will electrically "lock" shut, as with cardiac arrest, or rigor mortis. As just discussed above, this can also produce muscle pulls, hernias, compressed discs, pinched nerves and numbness, reduced intestinal function, etc., etc.

Smooth muscles directed by too much calcium and insufficient magnesium can tighten the bronchial tract, causing asthma; cause cramping in the uterus and painful periods; and cause spasms in blood vessels, resulting in hypertension.

Muscle and other tissue maintains a chemical difference between the blood vessel serum outside the cell and the intracellular fluids inside the cell. Potassium and muscle relaxing magnesium are kept inside the cell, and by virtue of their presence there, keep sodium and muscle-contracting calcium outside the cell.

Anything upsetting the necessary intracellular potassium and magnesium balances spells potential cardiovascular and/or other metabolic disorder(s).

Smooth muscle tissue requires full saturation in magnesium to prevent spasm or other forms of contraction, produced by calcium, that reduce blood flow and increase blood pressure (discussed further below).

At the biochemical level, magnesium and calcium can act antagonistically towards each other. Many enzymes whose activities critically depend on a sufficient amount of intracellular magnesium will be detrimentally affected by small increases in levels of intracellular calcium. Growth of cells, cell division, and intermediary metabolism are also absolutely dependent on the availability of magnesium, which can be compromised if excess calcium is present.

To understand how you can create a calcium/magnesium imbalance in your own body, crush a calcium pill and see how much dissolves in 1 oz of water. Then crush a magnesium pill and slowly stir it into the calcium water. Introducing the magnesium dissolves the remaining calcium, making it more water-soluble.

This relationship affects the bloodstream, heart, brain, kidneys, and all body tissues. A lack of calcium dissolving magnesium cause muscle spasms, fibromyalgia, hardening of the arteries, and even dental cavities. As well, kidney stones are produced if there is too much calcium in the kidneys and not enough magnesium to dissolve it.

All the muscles, including the heart and blood vessels, contain more magnesium than calcium. If magnesium is deficient, calcium floods the smooth muscle cells of the blood vessels and causes spasms leading to constricted blood vessels and therefore higher blood pressure, arterial spasm, angina, and heart attack.

A proper balance of magnesium in relation to calcium can prevent these symptoms. Calcium excess, stimulating the cells in the muscular layer of the temporal arteries over the temples, can cause migraine headaches. Excess calcium can constrict the smooth muscle surrounding the small airways of the lung, causing restricted breathing and asthma. Finally, too much calcium, without the protective effect of magnesium, can irritate delicate nerve cells of the brain. Cells that are irritated by calcium fire electrical impulses repeatedly, depleting their energy stores and causing cell death.[94]

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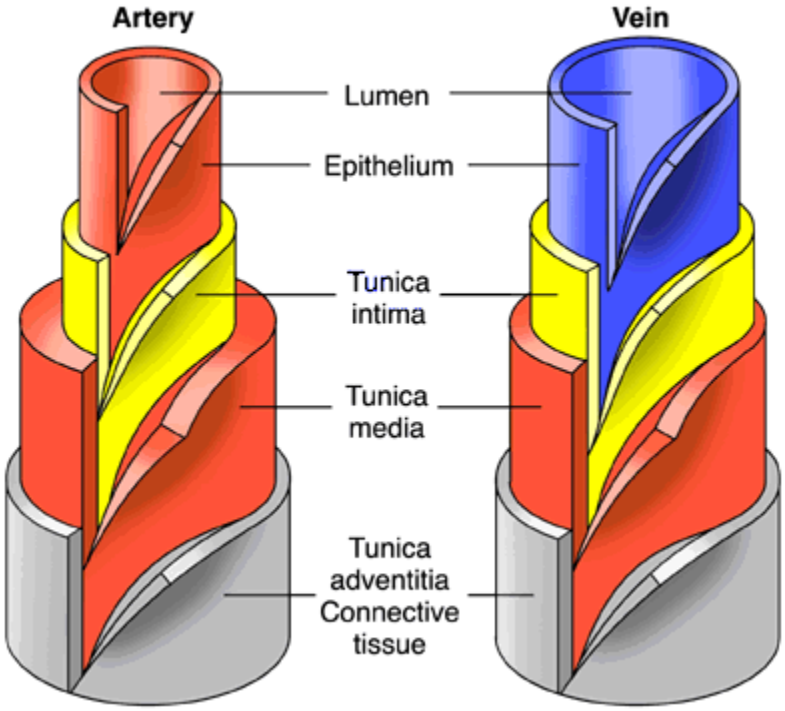
The Make Up Of Our Blood Vessels

Artery walls comprise three layers:

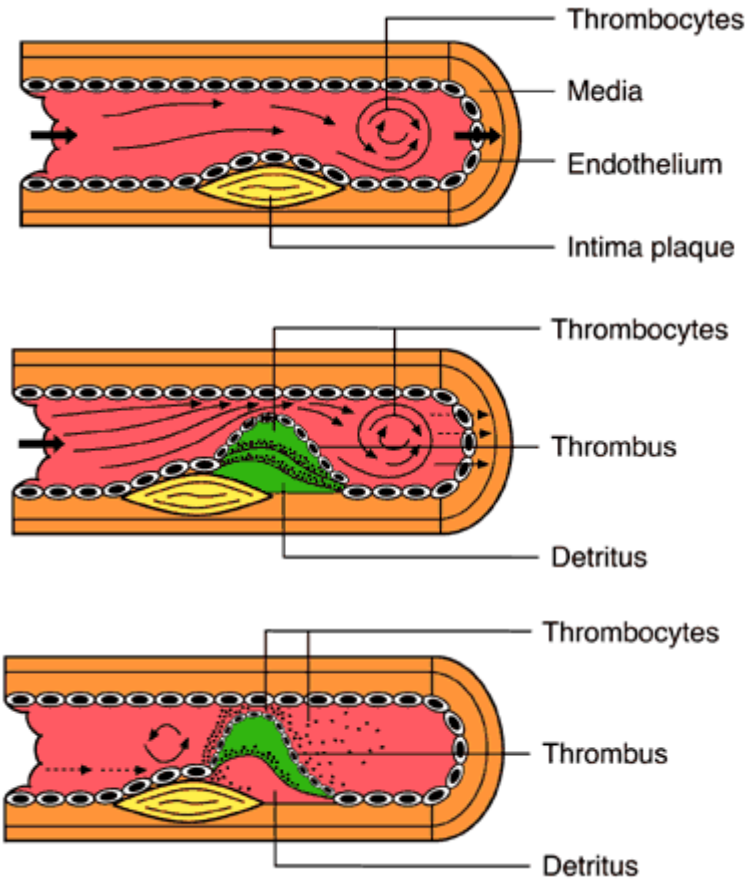
- The adventitia connects the artery to surrounding tissue.
- The media contains smooth muscle cells which control the size of the arterial lumen by contracting and relaxing.
- The intima mainly comprises endothelial cells.



http://www.healthandage.com/html/res/primer/heart.htm

The endothelial cells in the ***intima*** are also known as the ***endothelium.*** The endothelium is made up of flat cells that line the blood & lymphatic vessels, the heart, and various other body cavities. Endothelial cells are metabolically active and produce a number of compounds that affect the vascular lumen (the tube-like space within an artery or vein) and platelets. Compounds that constrict the lumen, or tube, raise blood pressure, compounds that relax it lower blood pressure. Anything that penetrates and coats the ***media*** lining below it can cause a thickening and hardening of the arteries. The endothelium is referred to often in the various sections below).

In atherosclerosis (atheroma), lesions develop in the intima and media. One of the most important early events in the development of an atheromatous lesion may be the binding of low density lipoproteins (LDL) to the endothelial cells of the intima. The LDL are oxidized, the barrier function of the endothelium is altered, and underlying tissue is exposed. Normally the body repairs the damage, but with repeated insult, the repair process is affected and forms fibrous plaques. Blood clots (thromboses) may occur on the surface of the plaques.



http://www.healthandage.com/html/res/primer/heart.htm

How Blood Pressure Builds

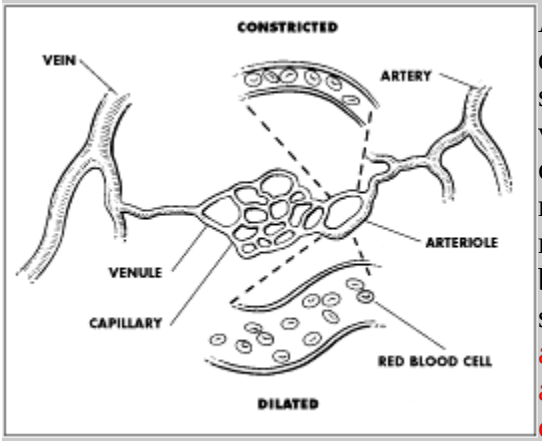
There are many ways to induce hypertension:

1) The arteries can spasm and constrict due to electrolyte and/or arginine/nitric oxide imbalance (arginine is an amino acid involved in the synthesis of nitric oxide. See appendix 9A below).
2) They can harden due to a lack of essential fatty acids in their cellular makeup which are required to keep them more flexible.
3) They can harden and narrow by becoming covered in cement-like calcium & fat based plaques reducing flexibility and channel volume.
4) One's blood can thicken due to too few essential fatty acids, too much saturated fat, water loss, drug use, or other causes. Such blood would also loose some of it's oxygen carrying capacity due to the lack of essential fatty acids, forcing the heart to pump thicker, low oxygen blood at a faster rate to ensure adequate oxygen supply to the tissues.
5) And finally some, or all, of the above occur at the same time.

All of the above scenarios, even very serious conditions, can usually be reversed through nutritional therapy if caught in time.

The first scenario applies to many people, so we'll discuss that first.

From http://www.pdrhealth.com/content/nutrition_health/chapters/fgnt12.shtml



As the arteries conduct oxygen-rich blood deeper and deeper into the tissues, their circumference steadily shrinks, ultimately ending at the arterioles. These tiny vessels, which feed blood into the network of capillaries supplying the individual cells, play a crucial role in maintaining your blood pressure. When their muscular walls tighten, there's less room inside and blood pressure rises. If the muscles relax, the available space increases and blood pressure falls. As discussed above, all muscle requires magnesium and arginine/nitric oxide to relax. Most of the medical community has not recognized that much elevated blood pressure is probably related to a magnesium deficiency, but this is probably because most do not do a proper tissue analysis for intracellular stores of magnesium.

Some high blood pressure medications (the so-called ACE inhibitors) work by relaxing the walls of the arterioles. Others (diuretics) take the opposite approach, reducing the volume of blood the constricted arterioles must contend with. Diuretics do this by prompting the kidneys to wring salt and water from the bloodstream. If you are taking this type of medication, extra salt in your diet will counteract its effect.

I think this particular long-term use of diuretics is one of the least responsible medical approaches I've encountered. First, the last thing any overly constricted blood vessel needs is less blood. Blood carries the incoming magnesium and nutrients required to relax the blood vessel. Secondly, this approach would put one's kidneys under incredible strain, and prevent the body from absorbing magnesium and potassium as well. See below.

Some Causes Of Magnesium Deficiency

- renal losses (tubular defects, diabetes mellitus, alcoholism, drugs*)
- negative intake
- negative GIT (gastrointestinal track) absorption
- GIT losses (diarrhea, vomiting, laxatives)
- requirements excessive sweating

* diuretics, ACE inhibitors, aminoglycosides, amphotericin B, cyclosporin & cisplatin.

Mg^{++} interacts with other ions at a cellular level as well. It acts as a non-competitive inhibitor of Ca^{++} channels and as such may be regarded as an intracellular Ca^{++} antagonist. In addition to interactions with Ca^{++}, Mg^{++} has marked effects on the regulation of transmembrane Na^{+} and K^{+} movements.
http://www.anaesthetist.com/anaes/jnl/2000/2000fe23.htm

Potassium

http://www.pdrhealth.com/drug_info/nmdrugprofiles/nutsupdrugs/pot_0208.shtml

Potassium is an essential macromineral in human nutrition with a wide range of biochemical and physiological roles. (While much of the text on potassium found below is common knowledge, much of this was obtained from the website listed above.)

Among other things, it is important in the transmission of nerve impulses, the contraction of cardiac, skeletal and smooth muscle, the production of energy, the synthesis of nucleic acids, the maintenance of intracellular tonicity, and the maintenance of normal blood pressure.

In 1928, it was first suggested that high potassium intake could exert an anti-hypertensive effect. Accumulating evidence suggests that diets high in potassium may be protective not only against hypertension, but also strokes and cardiovascular disease and possibly other degenerative diseases, as well.

(Sam Bock's Note: Excess potassium in the bloodstream is potentially lethal. This is why potassium supplements are usually sold in single doses of 99mg or less. That said individual higher dosages may be required for people with potassium deficiency. People requiring higher amounts of potassium should spread dosages during the day and take it with food.)

Potassium is a metallic element with atomic number 19 and an average atomic weight of 39.09 daltons. Its symbol is K. It is an alkali metal and belongs to the same group as lithium, sodium, rubidium, cesium and francium. The only non-alkali element that it shares some similarities with is thallium. The thallous cation is similar in size to the potassium cation, which is the basis of the use of thallium for myocardial perfusion imaging. The thallous cation is considered a potassium cation analogue. Potassium exists physiologically in its univalent cationic state. It is the principal ***intracellular*** cation with an intracellular concentration of about 145 milliequivalents or millimoles per liter. This is 30 to 40 times greater than its ***extracellular*** concentration, which is normally 3.5 to 5.0 milliequivalents or millimoles per liter. About 98% of the body's potassium is in intracellular fluid.

The major cause of potassium deficiency is excessive losses of potassium through the alimentary tract or through the kidneys. Potassium depletion typically occurs as a consequence of malnutrition, prolonged use of oral diuretics, from severe diarrhea and from primary or secondary hyperaldosteronism, diabetic ketoacidosis or in those on long-term total parenteral nutrition who have received inadequate potassium. Signs and symptoms of potassium deficiency include hypokalemia, metabolic alkalosis, anorexia, weakness, fatigue, listlessness and cardiac dysrhythmias. Prominent U-waves are seen in the electrocardiograms of those with hypokalemia.

The intake of potassium in the American diet ranges from about 1,560 to 4,680 milligrams (40 to 120 milliequivalents or millimoles) daily. The potassium intake of vegetarians is at the high end, and even higher in those eating organic food sources. Foods that are rich in potassium are fresh vegetables and fruits. A medium-size banana supplies 630 milligrams of potassium or about 75

milligrams per inch; a medium orange, 365 milligrams; half a cantaloupe, 885 milligrams; half an avocado, 385 milligrams; raw spinach, 780 milligrams per three to four ounces; raw cabbage, 230 milligrams a cup; raw celery, 300 milligrams a cup. Some vegetable juices supply up to 800 milligrams per serving. A dietary intake of about 3.5 grams of potassium is considered to be a desirable intake of potassium for adults.

Potassium supplementation has been demonstrated to bring about small but significant reductions in blood pressure in those with mild to moderate hypertension. The mechanism of this effect is unclear. Possible mechanisms for this antihypertensive effect include a decrease in plasma renin activity, effects on resistance vessels related either to a high potassium concentration or to a decrease in the number of angiotensin II receptors and natriuresis (potassium inhibits sodium reabsorbtion in the proximal tubules). (Sam Bock's Note: I believe it may be partly tied to potassium's role in trans- membrane nutrient and hormone delivery. I believe it is somehow involved in the uptake of intracellular magnesium, which while is still not well understood, but increasingly thought to be hormonally controlled, as discussed above. As potassium is required for the proper uptake of hormone by our cells, potassium affects on hormone activity could be affecting magnesium uptake in this manner.)

The mechanism by which increased potassium intake may prevent stroke is not known. Possible mechanisms include potassium's hypotensive effect, inhibition of free radical formation, prevention of vascular smooth muscle proliferation and prevention of arterial thrombosis. In *in vitro* and in animal studies, elevation of extracellular potassium concentration within the physiological range has been shown to inhibit free radical formation from macrophages and endothelial cells, as well as to inhibit proliferation and thymidine incorporation of vascular smooth muscle cells and to reduce platelet sensitivity to thrombin and other agonists. High potassium diets have also been shown to reduce oxidative stress on the endothelium of high sodium chloride-fed stroke-prone spontaneously hypertensive rats independent of blood pressure changes.

NOTE: The next sections will be of interest to those with cardiovascular problems. However, some of the language is more technical than that found elsewhere in this paper. If you have heart problems you may wish to read these sections once and then reread them a second time if you had trouble understanding the material the first time around.

For those without heart problems, and no interest in the material that follows, you can skip directly to the next section of the paper on Proteins.

However, if you are on Blood Pressure medication, or have experienced irregular heartbeats from time to time, you may want to look at this material as well.

Potassium Homeostasis And Clinical Implications

Am J Med. 1984 Nov 5;77(5A):3-10. Related Articles,

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?CMD=Display&DB=pubmed

Brown RS.

The clinical estimation of potassium balance generally depends on the level of serum potassium. Since the extracellular fluid contains only 2 percent of the total body potassium, it must be recognized that potassium deficits are usually large before significant hypokalemia occurs, whereas smaller surfeits of potassium will cause hyperkalemia. The total body potassium is regulated by the kidney in which distal nephron secretion of potassium into the urine is enhanced by aldosterone, alkalosis, adaptation to a high potassium diet, and delivery of increased sodium and tubular fluid to the distal tubule. However, the distribution of potassium between the intracellular and extracellular fluids can markedly affect the serum potassium level without a change in total body potassium. Cellular uptake of potassium is regulated by insulin, acid-base status, aldosterone, and adrenergic activity. Hypokalemia, therefore, may be caused by redistribution of potassium into cells due to factors that increase cellular potassium uptake, in addition to total body depletion of potassium due to renal, gastrointestinal, or sweat losses. Similarly hyperkalemia may be caused by redistribution of potassium from the intracellular to the extracellular fluid due to factors that impair cellular uptake of potassium, in addition to retention of potassium due to decreased renal excretion. An understanding of the drugs that affect potassium homeostasis, either by altering the renal excretion of potassium or by modifying its distribution, is essential to the proper assessment of many clinical potassium abnormalities.

Both hypokalemia and hyperkalemia may cause asymptomatic electrocardiographic changes, serious arrhythmias, muscle weakness, and death. Hypokalemia has also been associated with several other consequences, including postural hypotension, potentiation of digitalis toxicity, confusional states, glucose intolerance, polyuria, metabolic alkalosis, sodium retention, rhabdomyolysis, intestinal ileus, and decreased gastric motility and acid secretion.

The Na^+-K^+-ATPase (Sodium Pump)
http://arbl.cvmbs.colostate.edu/hbooks/molecules/sodium_pump.html

The Na^+-K^+-ATPase is a highly-conserved integral membrane protein that is expressed in virtually all cells of higher organisms. (Sam Bock's Note: This pump, built of a dynamic and reactive protein that adjusts its function and shape based on various biochemical stimulus, is found in most cell membranes, and uses intracellular bound potassium and extracellular bound sodium to draw nutrients into the cell. Anything interfering with sodium and potassium metabolism, has the potential to seriously disrupt cellular metabolism.)

As one measure of their importance, it has been estimated that roughly 25% of all cytoplasmic ATP is hydrolyzed by sodium pumps in resting humans. In nerve cells, approximately 70% of the ATP is consumed to fuel sodium pumps. As discussed above, ATP is the body's primary energy source. As noted, significant amounts of energy are consumed running these pumps to

transport and utilize nutrients. Anything interfering with their function will lead to decreased energy levels.

Renin, Angiotensin I, and Angiotensin II, and ACEs
http://jan.ucc.nau.edu/~daa/lecture/chfmeds.htm

Renin is released into the blood from the kidneys when blood pressure is low. Renin changes angiotensinogen in the blood to Angiotensin I which then, in the presence of angiotensin converting enzyme, is changed into Angiotensin II. Angiotensin II is a potent vasoconstrictor. An increased peripheral resistance (higher blood pressure due to vasoconstriction) creates a lot of afterload on the left ventricle.

Untreated and sustained hypertension will eventually create so much work for the left ventricle that it will fail - eg. - congestive heart failure. Angiotensin-Converting Enzyme Inhibitors (ACE Inhibitors) simply prevent or block the conversion of Angiotensin I to Angiotensin II. These medications do this by inhibiting the enzymatic activity of Converting Enzyme - the enzyme that converts Angiotensin I to Angiotensin II. Once Converting Enzyme is inhibited, the systemic blood pressure drops and with the lower blood pressure there is an improvement in cardiac function - i.e. - lower blood pressure, lower myocardial oxygen demand, reduced preload, decreased afterload and improved cardiac function.

Adverse Side Effects: GI distress, dizziness, skin rashes, hypotension

What Are Angiotensin Receptor Blockers (ARBs) and How Do They Work?

Angiotensin II is a very potent chemical that causes the muscles surrounding the blood vessels to contract, which thereby narrows the blood vessels. This narrowing increases the pressure within the vessels and can cause high blood pressure (hypertension). Angiotensin receptor blockers (ARBs) are medications that block the action of angiotensin II. As a result, the blood vessels dilate and the blood pressure is reduced. The lower blood pressure makes it easier for the heart to pump blood and can improve heart failure. In addition, the progression of kidney disease due to high blood pressure or diabetes is slowed.

ARBs are used for controlling high blood pressure, treating heart failure, and preventing kidney failure in people with diabetes or high blood pressure. Since these medications have effects that are similar to those of ACE inhibitors, they are often used when an ACE inhibitor can not be tolerated by patients.

With which drugs do ARBs interact?

ARBs have few interactions with other drugs. Since ARBs may increase blood levels of potassium, the use of potassium supplements, salt substitutes (which often contain potassium), or other drugs that increase potassium may result in excessive blood potassium levels.

I feel this may be why many people taking these drugs have very low tissue potassium levels. The ARB may be blocking the cells uptake of potassium necessary to maintain ***intracellular*** potassium, potentially causing: 1) a derivative inability to absorb nutrition at the cellular level (as this requires intracellular stores of potassium), causing fatigue, susceptibility to illness, weight gain, depression; 2) increased potassium levels in the blood that would lead to cardiac rhythm abnormalities.

Worse, if an ARB is then used with a diuretic, that valuable source of potential intercellular potassium, being kept out of the cells by the ARB, would be quickly expelled by the kidneys, along with the magnesium necessary to relax smooth, cardiac and skeletal muscle, as well as that necessary to absorb potassium (see below).

The gradually falling intracellular potassium levels would slowly crash that person's metabolism, by preventing and reducing nutrient and hormone absorption by all of the body's potassium dependant cells, causing fatigue, depression, copper build up, and other problems.

The concurrent prevention of magnesium absorption would not only contribute to potential for arrhythmia, and insomnia, but also reduce the body's ability to catalyze enzyme function and produce all- important ATP.

ARBs may also increase the blood concentration of lithium (ESKALITH) and lead to an increase in side effects from lithium. Rifampin reduces the blood levels of losartan, and fluconazole (DIFLUCAN) reduces the conversion of losartan to its active form. These effects could decrease the effects of losartan.

What Are Other Side Effects of ARBs?

While I disagree with the use of blood pressure medications if natural means have not been exhausted first, ARBs are considered by most conventional doctors to be well tolerated by most individuals. However the most common side effects are cough, elevated serum potassium levels, low blood pressure, dizziness, headache, drowsiness, diarrhea, abnormal taste sensation (metallic or salty taste), and rash. Compared to ACE inhibitors, cough occurs less often with ARBs.

The most serious, but rarer, side effects are kidney failure, liver failure, allergic reactions, a decrease in white blood cells, and swelling of tissues (angioedema). ARBs usually are not prescribed for pregnant patients because they may cause birth defects. Individuals with severe kidney problems and those who have had a severe reaction to ARBs probably should avoid them.

http://www.medicinenet.com/angiotensin_ii_receptor_blockers/article.htm

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Thiazide Diuretics

Thiazide diuretics affect the renal tubular (kidneys) mechanisms of electrolyte reabsorbtion, directly increasing excretion of sodium and chloride in approximately equivalent amounts. Indirectly, the diuretic action reduces plasma volume, with consequent increases in plasma renin activity, increases in aldosterone secretion, increases in urinary potassium loss, and decreases in serum potassium. The renin-aldosterone link is mediated by angiotensin II, so coadministration of an angiotensin II receptor antagonist tends to reverse the potassium loss associated with these diuretics. (This does not take into account the equally important magnesium loss caused by the diuretic.)

The mechanism of the antihypertensive effect of thiazides is unknown.

Thiazide diuretics are not metabolized but are eliminated rapidly by the kidney. At least 61% of the oral dose is eliminated as unchanged drug within 24 hours. The elimination half-life is between 5.8 and 18.9 hours. (I believe this would have the potential to store in tissues, as it is not metabolized, although the vast majority would be gone within weeks.)

http://www.rxlist.com/cgi/generic3/diovan_hct_cp.htm

Drug Class And Mechanism: A thiazide diuretic is a diuretic (water pill). It works by blocking salt and fluid reabsorbtion in the kidneys, causing increased urine output (diuresis). It has also been used in treating mild high blood pressure, even though the mechanism of blood pressure lowering is not well understood.

Drug Interactions: Thiazide diuretics are eliminated rapidly by the kidneys and the dosage may have to be reduced in kidney dysfunction. They should be used with caution in patients with liver disease because of fluid and electrolyte problems.

Patients allergic to sulfa may also be allergic to a thiazide diuretic because of a similarity in the chemical structure of the medications. A thiazide diuretic can aggravate kidney dysfunction, and is used with caution in patients with kidney disease. Even though a thiazide diuretic is considered important by conventional doctors in treating excess fluid accumulation in patients with cirrhosis, loss of fluid and electrolytes in these patients can worsen kidney function and even cause the patient to go into a coma. A thiazide diuretic can cause lowering of blood potassium, sodium, and magnesium levels. Low potassium and magnesium levels can lead to heart rhythm abnormalities… http://www.medicinenet.com/hydrochlorothiazide/article.htm

Treatment with diuretics, except for those that spare potassium and magnesium, increases urinary magnesium excretion by 25% to 400%[95].

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Minerals and Normal Function Of The Heart

To better understand how minerals and nutrients affect heart function we need to look at the basic function of the heart.

The heart has four chambers. The upper two chambers are the atria, and the lower two chambers are the ventricles. Blood returning to the heart from the body in the superior and inferior vena cava contains low levels of oxygen and high levels of carbon dioxide. This blood flows into the right atrium and then into the adjacent right ventricle. After the ventricle fills, contraction of the right atrium pumps additional blood into the right ventricle. The right ventricle then contracts and pumps the blood to the lungs where the blood takes up oxygen and gives off carbon dioxide. The blood then flows from the lungs to the left atrium and into the adjacent left ventricle. Contraction of the left atrium pumps additional blood into the left ventricle. The left ventricle then contracts and pumps the blood to the rest of the body. The heartbeat (pulse) that we feel is caused by the contraction of the ventricles.

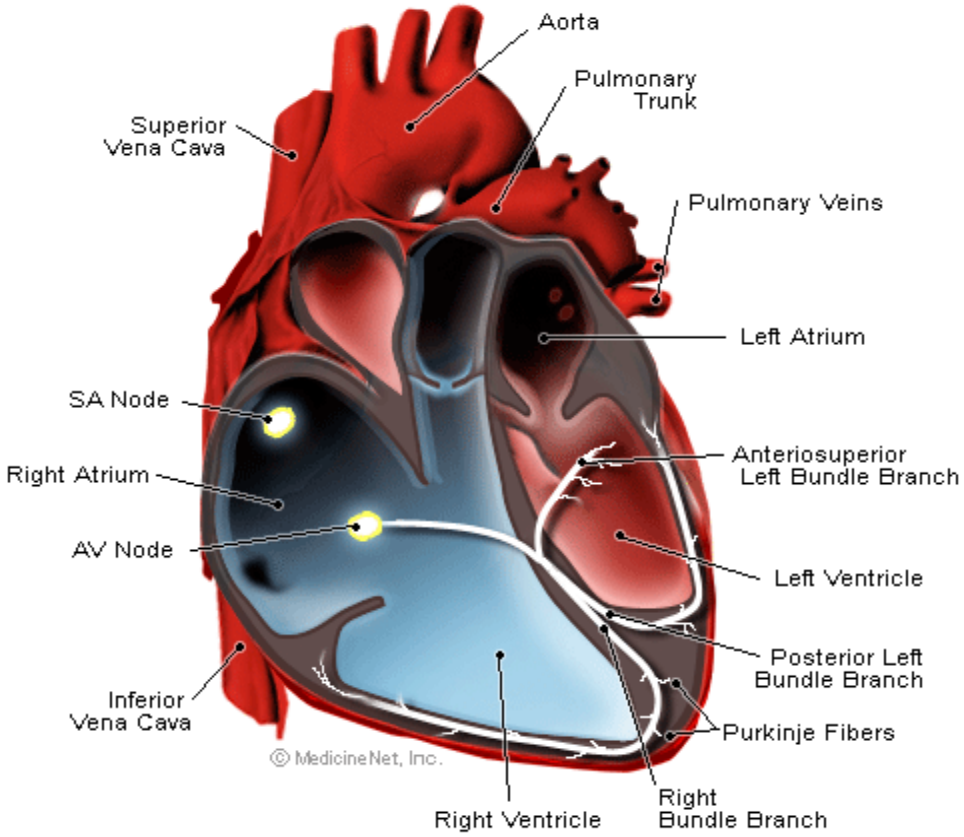
The ventricles must deliver enough blood to the body for the body to function normally. The amount of blood that is pumped depends on several factors. The most important factor is the rate of contraction of the heart (the heart rate). As the heart rate increases, more blood is pumped. In addition, the heart pumps more blood with each beat when the atria contract and fill the ventricles with additional blood just before the ventricles contract.

With each beat of the heart, an electrical discharge (current) passes through the electrical system of the heart. The electrical discharge causes the muscle of the atria and ventricles to contract and pump blood. The electrical system of the heart consists of the SA node (sino-atrial node), the AV node (atrio-ventricular node) and special tissues in the atria and the ventricles that conduct the current.

The SA node is the heart's electrical pacemaker. As discussed below, the SA node requires adequate magnesium for this signalling to occur normally. It is a small patch of cells located in the wall of the right atrium; the frequency with which the SA node discharges determines the rate at which the heart beats. The electrical current passes from the SA node, through the special tissues of the atria and into the AV node. The AV node serves as an electrical relay station between the atria and the ventricles. Electrical signals from the atria must pass through the AV node to reach the ventricles.

The electrical discharges from the SA node cause the atria to contract and pump blood into the ventricles. The same discharges then pass through the AV node to reach the ventricles, traveling through the special tissues of the ventricles and causing the ventricles to contract. In a normal heart, the rate of atrial contraction is the same as the rate of ventricular contraction.

At rest, the frequency of the electrical discharges originating from the SA node is low, and the heart beats at the lower range of normal (60-80 beats/minute). During exercise or excitement, the frequency of discharges from the SA node increases, increasing the rate at which the heart beats.



When rapid arrhythmias (tachycardias) and premature contractions occur because of abnormal electrical activity of the atria, they are called atrial tachycardias and premature atrial contractions (PACs). When tachycardias and premature contractions occur because of abnormal electrical activity of the ventricles, they are called ventricular tachycardias and premature ventricular contractions (PVCs).

Slow arrhythmias (bradycardias) can occur because of slowing of the electrical signals initiated by the SA node, a condition called sinus bradycardia. Bradycardias can also result from varying degrees of "heart block", wherein certain medications or diseases in the electrical conduction system of the heart impedes the transmission of signals from the atria to the ventricles (see the "BRADYCARDIAS" section below).

Premature contractions are isolated heartbeats that occur earlier than expected. The premature contraction is followed by a pause, as the heart electrical system "resets" itself. The contraction following the pause is usually more forceful than normal contractions. The patients frequently perceive these more forceful contractions as palpitations.

Defining Palpitations And Arrhythmias

Much of the following section contain information sourced from Penn State University Health Services at http://www.sa.psu.edu/uhs/pdf/PalpitationsUHS.pdf and MedicineNet at http://www.medicinenet.com/atrial_fibrillation/article.htm

• Palpitations can occur without heart disease as a result of abnormal heart rhythms (arrhythmias).
• The SA node is the pacemaker of the heart.
• Slow heart rhythms are called bradycardias. Rapid heart rhythms are called tachycardias.
• The average normal heart beats at a rate of 60 times per minute.
• Some patients with arrhythmias have no symptoms while others can have symptoms, such as palpitations, dizziness, shortness of breath, or chest pain.
• Arrhythmias can occur because of disease of heart muscle, valves, electrical system, or arteries to the heart (coronary arteries).
• Palpitations can be evaluated with testing, such as blood tests, echocardiogram, EKG, Holter monitor, treadmill testing, and tests of the coronary arteries.
• Palpitations can be relieved in many patients by stress reduction, stopping cigarettes, and reduction of caffeine and alcohol.

Palpitations are unpleasant sensations of irregular and/or forceful beating of the heart. In some patients with palpitations, no heart disease or abnormal heart rhythms can be found. Reasons for their palpitations are unknown. A cardiologist can confirm whether palpitations you may experience are of this nature. Such "unknown" causes are usually a result of low intracellular levels of magnesium and potassium. They can often be eliminated by balancing intracellular electrolytes, and by increasing blood oxygen transport levels with dietary increases of essential fatty acids (which will also have a lowering effect on blood pressure).

In others, palpitations result from abnormal heart rhythms (arrhythmias). Arrhythmias refer to heartbeats that are too slow, too rapid, irregular, or too early. Rapid arrhythmias (greater than 100 beats per minute) are called tachycardias. Slow arrhythmias (slower than 60 beats per minute) are called bradycardias. Irregular heart rhythms are called fibrillations (as in atrial fibrillation discussed below). When a single heartbeat occurs earlier than normal, it is called a premature contraction. Abnormalities in the atria, the ventricles, the SA node, and the AV node of the heart can lead to arrhythmias.

Correcting Arrhythmias

The ***sinoatrial*** (SA) node, located in your heart's right atrium near the entrance of the superior vena cava, looks for dropping oxygen levels in venous blood returning to the heart. When it senses lower oxygen levels it automatically starts to beat faster until returning oxygen levels are renormalized.

The SA node requires adequate magnesium for proper electrical function, particularly at slower heart rhythms. If you are deficient in magnesium, it can behave erratically when lying down or

resting (as I have personally experienced when I became temporarily magnesium deficient as a full time athlete).

However, I have yet to see an arrhythmia that was not corrected with:

1) a combination of balanced magnesium, potassium, sodium and calcium intake (differing depending on the individual case) to restore proper SA node electrical function and proper smooth & cardiac muscle contraction,
2) other synergistic vitamins, minerals and nutrients to ensure this,
3) elimination of unhealthy foods and drinks
4) increased essential fatty acids to increase oxygen transport,
5) regular moderate exercise,
6) and very importantly, regular quality rest.

Providing that one gets the adequate sleep, doesn't consume coffee or other adrenaline stimulating substances, and get adequate exercise, many arrhythmia normalize quickly, sometimes within hours if the cause is mineral imbalance, which it often is.

A lack of activity, may make arrhythmia worse by reducing oxygen levels in the blood, so if you suffer from arrhythmia, make sure to get adequate exercise, but not too much, as this will only put you into oxygen "debt", by forcing your body to consume more oxygen than it can supply itself.

Much of the material above and below highlights the importance of magnesium (and potassium) in treating arrhythmia and hypertension. Please keep in mind as you read this that magnesium, while critical, is not a panacea.

As stressed earlier in this paper, all minerals must be in balance for your electrolytic salts to also be in balance to allow smooth muscle to function properly. As well, it is very important that the lipids in your bloodstream are conducive to maintaining healthy flexible arteries, and to dissolving any saturated fatty acid build up. For this we need adequate consumption of essential Omega 3 and Omega 6 GLA fatty acids (see below) in order to maintain proper prostaglandin balance, optimum oxygen transport, and cell membrane flexibility within the cells making up the structural walls of all parts of your cardio-vascular system – heart, lungs, arteries and veins, etc..

As well enough B6, B12, folic acid and methyl donors to prevent the buildup of homocysteine (which causes excess oxidation damage and aging of tissues), and adequate levels of Vitamin A, B complex, C, D, E, synergistic minerals and amino acids (protein building blocks) to ensure the regeneration of damaged tissues, and transport of harmful substances from the body. (For example - adequate levels of cysteine are required to remove and transport metastatic calcium out the plaque that can build up on artery walls.)

As well, "the frequency of premature contractions can be reduced by stress reduction and reducing caffeine & alcohol consumption. High blood adrenaline levels can lead to premature contractions, while stress reduction helps to lower blood adrenaline levels. For patients with persistent palpitations and premature contractions, medications, such as beta-blockers, can be used to block the effect of adrenaline on the heart, thus reducing premature contractions.[96]" (I

would never recommend beta-blockers, as they will also cause other metabolic irregularities. Magnesium and potassium are nature's beta-blockers, and are designed to work in synergy with your body's enzyme systems.)

For a simple overview of the function of the heart, and how various arrhythmias can be treated naturally please see Appendix 9B

While vitamin and mineral balances can have a dramatic affect on cardiovascular and other biochemical functions in the body, the remaining nutrients we ingest are just as important. The remainder of this paper looks at the roles of Proteins, Fats & Oils, and Carbohydrates in maintaining health.

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Sources of Protein

Protein, and the amino acids they are made of, are critical to robust physical and mental health and full development. Carnivores and vegetarians alike need to learn about good protein rich foods.

Most North Americans usually get enough protein in their diets. In fact many are getting too much, particularly those on very low carbohydrate, very high protein/fat diets, like the Atkins diet.

Too much protein is hard on your body's organs, as among other things, it can create an excess of toxic ammonia for your liver to remove (see below). As well a balanced intake between protein and fat/oil is necessary to ensure proper cellular metabolism and to prevent tumor growth and other potential malfunctions involving cell division.

Too little protein, and more specifically, too little of the various amino acids contained in protein, will cause a wide range of health problems. Proteins and their amino acids are critical to maintaining a healthy metabolic rate. Sulfur rich proteins detoxify the body of many poisonous substances, like heavy metals. Others help eliminate metastatic calcium, preventing it from binding to fats and causing plaques on our arteries and brain.

Conventional medical researchers are finally doing the studies showing that all individual nutrients, including the 20 different amino acids from which we make the thousands of different complex proteins, or poly-peptides, must be in proper balance for proper genetic expression.

This paper will not focus on the effects of individual or combinations of amino-acids, and the thousands of different compounds our body's make from them. *Prescription for Nutritional Healing, 3rd Edition*, Phyllis A. Balch, CNC, James F Balch, MD. provides a good beginners introduction to the roles of the different amino acid in our bodies. It also provides guidelines for food choices, vitamin & mineral levels, therapeutic amino acid supplementation. That said any supplementation of amino acids should only be done under the supervision of a qualified practitioner. Individual nutrients, and in particular amino-acids, have very potent effects on the body, that should never be underestimated.

This paper will look at bigger picture issues related to protein consumption in whole foods that are available in today's marketplace. Most people aren't aware of the protein content of many vegetables. This protein is often superior to that found in meat as it easier to digest, and doesn't contain the excess saturated fat and various toxins that are concentrated in most meats sold today.

Metabolic testing is the best way to determine if your overall food intake is balanced.

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Meats

In many countries, meat is very expensive and used only as a garnish at meals. But meat is a large part of the North American diet.

Nutritionists have linked cancer to conventionally raised animal foods.[97] Each time you eat such an animal product you increase the chance of cancer. Men who eat mass-produced meat, dairy products, and eggs daily, will increase the risk of dying from prostate cancer by 360%.[98]

The risk of death from heart attack for the average American man used to be as high as 50%. When reducing meat, that percentage drops to 15%. By avoiding all animal products, the risk of death from a heart attack drops to 4%.[99]

The Seventh-Day Adventists and Navajo Indians eat little or no meat. Hospital records show that they suffer far less from cancer than meat-eaters.[100] Canada has the second highest level of cancer in the world[101] and a very high incidence heart disease…much higher than the poorest countries where they cannot afford to eat animal products.

All animal products are high on the food chain. Air-borne chemicals land on grass and are eaten by cows. Cows drink thousands of gallons of unpurified, unfiltered water. Environmental chemicals, herbicides, pesticides, and fertilizer residues concentrate in the fats of their tissues. As mentioned earlier, a cow is a giant accumulator and can bio-magnify toxin concentrations twenty-five million times above the initial level of contamination, then pass it on to humans through its milk or meat.[102]

Commercial pig and chicken feeds contain animal by-products to boost the protein content in order to accelerate weight gain in their livestock. Weight lifters fill up on meats and high-protein drinks. Protein will increase size and weight gain, however, there are adverse affects with continuous excessive consumption.

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The Protein & Fat In Meats May Be Accelerating Sexual Maturity and Aging

In a world-wide study, it was found that the Eskimos, Greenlanders and the Russian Kurgi tribes had the highest intake of flesh foods. These groups had the lowest life expectancies…in some cases averaging as low as 30 years. In comparison, populations such as the Hunzas, East Indian Todas, Russian Caucasians and the Yucatan Indians live under harsh conditions and eat little or no animal flesh. These populations have the highest life expectancies, as high as 90 to 100 years.[103] The Hunzas eat almost no animal products, living a vigorous life into their 80's and beyond. Retirement isn't common, and many pass their hundredth birthday.

When laboratory rats are fed increased protein, they grow faster and mature earlier, but their life expectancy was shortened.[104] From 1875 to 1975, western societies witnessed the maturation age of females drop from 17 to 12 years of age.[105] Meat in Japan is a garnish at meal time and not the main food event. An average 80-year-old Japanese man has a youthful vigor which most North American carnivores lack. These observations have led to the perception that increased protein intake is impacting the speed of cell reproduction — one of several factors determining

maturity and aging. My personal opinion differs slightly. I think the extra fat and cholesterol (the building block of all hormones) found in many high protein foods might also be contributing to these results.

I also believe the heavy use of growth hormone in intensive farming and increasing amounts of environmentally toxic synthetic chemicals and endocrine mimickers, such as organochlorines—also known as gender benders—will be shown to be contributing to these trends.

Girls are reaching puberty earlier in developed countries. However, African-American girls are developing earlier than their white counterparts. About half of black girls in the United States reach puberty by the age of eight, compared with only 15 per cent of their white counterparts, according to one study[106].

As reported by AFP on April 5, 2002, shampoos containing female hormones may be causing girls to go through puberty at an earlier age. "Unbeknown to many parents, a few hair products - especially some marketed to black people - contain small amounts of hormones that could cause premature sexual development in girls," the British weekly magazine New Scientist reported.

The article acknowledged that the evidence is "largely circumstantial and the case is still unproven". Clinical data, it said, is limited so far to a small study involving four girls, one of whom was a 14-month-old baby, who developed breasts or pubic hair after using the shampoo, and whose symptoms disappeared when the product was no longer used.[107]

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Protein and Other Nutrients Are Recycled Within the Body

Most foods contain proteins, combinations of amino acids, the building blocks of life. Forty percent of all life on earth is smaller than one millionth of an inch.[108] This is the start of the ocean's food chain. Every time one creature eats another, the proteins, vitamins, minerals and fatty acids are reused.

Cells are constantly dying. When your body breaks down damaged cells, the nutrients are reused within the body. This protein is available for cells being rebuilt. Only small amounts of protein are needed for formations of hormones, enzymes and antibodies. Most of the protein is used to rebuild or repair cells. The more efficient your metabolism, the less protein is lost. Subsequently, less protein is needed for replacement.

The Superiority Of Plant Protein

The Lancet, a renowned medical journal reported: "Formerly, vegetable proteins were classified as second-class, and regarded as inferior to first-class proteins of animal origin, but this distinction has now been generally discarded. The facts show that single vegetable foods contain more than enough of all amino acids needed for humans."[109]

The average diet consists of 90 to 120 grams of protein per day; three times what our body needs.[110] The World Health Organization has estimated that the minimum daily requirement for protein is 5 percent of our daily caloric intake. This equals 37 grams per day for an active male and 29 grams for an active female.[111] This also assumes the food is cooked. As protein is better absorbed in raw food due to its active enzyme content, the body actually needs less.

It is difficult to design a vegetarian diet deficient in proteins. Even three thousand calories of rice, which is mostly starch, will supply 60 grams of protein. Harvard researchers, who were investigating the effects of a strict plant food diet, stated it is difficult to obtain a mixed vegetable diet that will produce an appreciable loss of body protein, without resorting to high levels of sugar, jams and jellies, and other essentially protein-free foods.[112]

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Animal vs Vegetable Protein

Many believe that meat-eaters are stronger and healthier than vegetarians. The notion that meat makes the best muscle is taught from childhood, but is this accurate?

Excellent research done many years ago seems to have been missed or forgotten by those more concerned with *current* data over *relevant* data. Nobel prizes were handed out to Europeans in the 1960's for groundbreaking work tying unhealthy fats to cancer, but this seems largely ignored by North American society.

Even earlier research, comparing the benefits of meat eating diets to those of vegetarians, show the benefits of reduced digestion for athletic recovery. A 1907 study published in Yale Medical Journal concluded there is strong evidence that a non-flesh diet is conducive to endurance.[113] Dr. Ioteyko of the Academie de Medicine of Paris discovered that the vegetarian averaged two to three times more stamina and recovered from exhaustion in one-fifth of the time of meat-eaters.[114]

Modern era athletic performances back the findings of these early studies. Some examples:

Dave Scott was the world's greatest ever tri-athlete, winning Hawaii's legendary Ironman, 6 times, 3 of those in a row, when no one else had one more than one. A scholar/athlete, who majored in exercise physiology, he calls the idea that people, and especially athletes, need animal protein a "ridiculous fallacy".[115]

In 1985 athlete, Sixto Lenares cycled 185 miles, swam 4.8 miles and ran 52.4 miles in a single day on training that excluded dairy products, meat, eggs or any type of protein supplement.

Vegetarian Edward Moses, an Olympic Gold medallist, went eight years without losing a race. Paavo Nurmi won nine Olympic medals in distance running. Bill Pickering, at the age of 48, set a new world record for swimming the Bristol Channel.

Canadian tennis player, Peter Burwash, decided to try living on a vegetarian diet. One year later, he was given the highest physical index of any athlete in Canada.

Stan Price held the world record for bench press in his weight class. Andreas Cahling, another vegetarian athlete, won the 1980 Mr. International Body Building title.

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The Danger Of Excess Protein

Although protein is essential, too much causes problems. When more protein is eaten than can be used, it is burned as fuel. Hydrochloric acid is used in the digestion of protein. When too much hydrochloric acid is absorbed by the blood after digestion, it causes over-acidity and toxic residues to build up in the cellular tissue. This disrupts metabolism and taxes the pancreas. Ammonia is a carcinogenic by-product of protein digestion.

The liver and kidneys will enlarge due to the added workload of protein metabolism. If you are an individual with kidney problems, diabetes, hypoglycemia, or hepatitis, a high protein diet worsens the condition.[116] A damaged liver or kidney suffers when overtaxed with protein digestion. When the filtering organs are overburdened, blood, and tissues buffering our blood, becomes more toxic and tend to aggravate other conditions.

DNA and RNA contain purines that are the primary building blocks of our genetic code. Meat-eating causes large quantities of purines to break down and form uric acid. Uric acid causes gout and kidney stones. Both these ailments are cured with a lower-protein diet.[117]

In 1970, when the US Senate Committee wanted to better understand what causes cancer, it pressed Dr. Goi B. Gori, then Deputy Director of the National Cancer's Institute Division of Cancer's Cause and Prevention to tell them what was causing the most cancer. He stated dietary factors were responsible—principally meat and fat intake.[118]

The Journal of the National Cancer Institute reported that the incidence of colon cancer was greater in areas where meat consumption was higher. On hearing this, the meat industry defended their product, stating that genetic factors are responsible.

However, it is known that the Japanese have one of the lowest rates of colon cancers. A study was created to identify any increase of cancer in the Japanese who migrated to the United States. As the Japanese began to eat from our rich North American diet, their susceptibility to colon cancer increased, disproving any genetic link.

Animal products have no fiber. This increases susceptibility to colon cancers among those with high-meat diets. Fiber is the cleansing broom of the intestine. Without fiber, the heavy saturated grease of animal fat clogs up the intestine. As the transit time becomes longer, the stool becomes harder and, eventually, constipation sets in. Milk products, poultry, eggs, fish and meat do not contain fiber. Due to this decrease in transit time, putrefying flesh foods create carcinogens which can contribute to colon cancer.

On May 7, 1976, the president of Riverside Meat Packers announced, "Beef is the backbone of the American diet and it always has been. To think that meat, of all things, causes cancer." Six years later, he died of cancer of the colon.[119]

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Iron: Meat vs Vegetable Sources

Most people are reluctant to reduce or eliminate meat from their diet for fear of becoming anemic. However, spinach has 14 times the iron per calorie than steak. Every fruit, vegetable, bean, legume and grain listed, except sweet potato, has more iron than steak per calorie. The reason that meat has been considered high in iron is that the figures normally used are based on weight. Because fruit and vegetables are high in water, the figures are watered down.

Anemia is a common health problem. The meat industry encourages meat consumption to supply the body with iron. Yet, North America has one of the highest rates of meat consumption per capita and one of the highest incidences of anemia.[120] The origins of this national iron deficiency are evident. Milk, sugar, fat, processed food and junk food have no iron, or Vitamin C needed for its assimilation. It would take a chunk of butter the size of your refrigerator to get the iron content of a bowl of broccoli.

However, it is one of life's paradoxes that many of the most familiar features turn out on closer inspection to be the most complex. And so it with, iron, one of the most familiar and researched yet, arguably, least 'sexy' nutrients.

The majority of the research on iron found below was adapted from Andrew Hamilton's paper *Iron Deficiency: Much More Prevalent Than You Imagined And Posing Particular Risks For Athletes*, available at http://www.pponline.co.uk/encyc/iron-deficiency.html. I have simplified this text as required to best address the needs of those reading this paper.

Most athletes know that iron is required for the formation of the red blood cells used to transport oxygen to hardworking muscles, and that insufficiency of iron causes anaemia, characterized by fatigue, listlessness and a general lack of energy. Because of this, they also know that maintaining iron status and checking red blood cell or haemoglobin (Hb) levels is vital for performance.

However, most athletes are far less aware of the fact that iron is one of the most difficult minerals to absorb, and that they are especially vulnerable to iron depletion through training-induced losses, especially if their event involves endurance training. To make matters worse, the latest and most advanced metabolic diagnostics for measuring iron indicate that that it is perfectly possible to have a healthy blood Hb count while simultaneously suffering from depleted levels of tissue iron. (This is more evidence of why normal blood tests are often unable to determine latent health problems.)

As well, new research has demonstrated such tissue iron depletion impairs the ability of the body to adapt to endurance training.

To better appreciate the complexities of iron nutrition, we need to understand a little about how iron functions in the body. Most of us are aware of its role in transporting oxygen molecules around the bloodstream to the working muscles; the red colour of oxy-haemoglobin in our red blood cells is visible evidence of iron in action. When buried deep in the haemoglobin molecule, an iron atom has the perfect atomic structure to bind strongly enough with an oxygen

molecule to be transported around the bloodstream (in the form of oxyhaemoglobin) but, crucially, loosely enough to give up the bound oxygen to a muscle needing it.

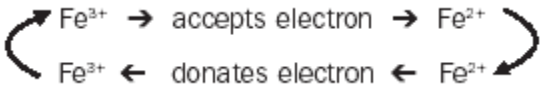
If your iron status becomes severely depleted (through inadequate intake, poor absorption or iron losses), your blood haemoglobin levels will drop, leading to a reduction in your oxygen carrying capacity. The result is fatigue, tiredness and breathlessness, even after gentle exertion – the classic signs of anaemia. Most doctors test for blood haemoglobin levels when they test for iron anaemia, although there are other tests, as we'll see later.

However, iron is also crucial for a number of energy-releasing processes because it activates enzymes called catalases, among others. In this role, iron functions as an 'electron shuttle', passing electrons to and accepting electrons from other molecules, thereby helping to make and break chemical bonds in biochemical reactions that would otherwise not occur.

Although as a plain metal iron is very stable and inert, excellent for making cars etc, it is no good for humans in that form. Biological systems need iron in its 'ionic' form. Strip away two negatively charged electrons from an iron atom and you generate an iron ion, carrying two positive charges (abbreviated as Fe2+); remove a third electron and you get iron ion carrying three positive charges (Fe3+).

The energy levels of the Fe2+ and Fe3+ ions are quite close, which means that these two ions can easily inter-convert by donating and accepting (i.e. shuttling) electrons. If a Fe3+ ion accepts an electron from a molecule in a biochemical reaction, it gains a negative charge and becomes Fe2+. If this Fe2+ ion then passes that electron on to a different molecule, it returns to its original Fe3+ state (see figure 1, below):

Figure 1: Schematic diagram of iron's 'electron shuttling' role in the body



The positive charges carried by these iron ions means that they are easily attracted to negatively charged molecules, or parts of molecules, to which they can often 'lock on' and bind. This is particularly the case with the very strongly positively charged Fe3+ ions, which are attracted to and bind especially strongly with molecules containing negatively charged oxygen atoms.

A good example of this strong binding is with carbohydrates, which are built from molecules with lots of oxygen-containing fragments. While many carbohydrate foods contain iron, the iron ions are sometimes bound so strongly that the process of digestion is not able to pluck them away. The iron stays joined to these carbohydrates as they pass through the digestive tract, and passes out largely unabsorbed.

If the iron is in the more positively charged Fe3+ state, this binding is even stronger than with the Fe2+ state because there is more attraction between the negative oxygen and the more

positively charged Fe3+. This accounts for the poor iron bioavailability of many iron-rich vegetables: the iron is there but can't be easily prised away for absorption.

Even in foods whose iron is readily available, uptake can be considerably reduced by the simultaneous consumption of other food or drinks containing 'iron blockers'. The classic example is tea, containing tannic acid, which readily forms complexes with iron, rendering it far less available to the body. Regardless of any health benefits associated with tea, drinking it with a meal is bad for your iron status.

Another barrier to iron absorption arises from the fact that the cell walls of the digestive tract are electrically neutral, while iron ions are strongly positively charged, making it hard to transport them across the gut wall into your body. However, iron that is chemically bonded to animal protein molecules (e.g. heme-iron found in meat) carries no overall charge and is much more easily absorbed.

For all these reasons, iron nutrition presents a challenge. It is not just a case of consuming enough iron, but of consuming it in a way that makes it fully available to your body, and of also making sure you do not get too much (see below).

There is also the problem of iron loss, which is potentially greater than for many other trace minerals. Iron losses can affect both males and females. In menstruating women, for example, monthly losses amount to an average 28mg – easily doubled if periods are heavy or if intrauterine contraceptive devices are used.

More importantly for athletes, there is a growing body of evidence that heavy exercise or training, particularly of the endurance variety, is a major cause of iron loss.

If you are very active, or are doing athletic training, or think you may be anaemic, proceed directly to the additional information on iron provided in Appendix 10. As discussed in that appendix, to determine one's iron status, in addition to the standard blood tests, a serum transferrin receptor test is the best on offer, although it is relatively new and may not be readily available from your GP. Hair Tissue Mineral Analysis (HTMA) can provide another useful marker.

Given the complexities of iron nutrition, you may be wondering why you can't just take an iron supplement to prevent deficiency. There are three main reasons:

1. Excess iron is not easily excreted. Self-dosage on high-strength iron supplements for long periods of time can induce serious toxicity and potentially lead to very serious health conditions, including liver disease and cancer.
2. Iron competes for uptake with several minerals in the body, especially copper and zinc; large doses of iron can therefore reduce the uptake of other important minerals, creating imbalances;
3. At high doses, iron is known to function as a 'pro-oxidant', helping to promote the generation of cell-damaging free radicals.

A sensible way forward for athletes is to consume a diet that is naturally rich in iron (see tips below) and to assess their risk for iron deficiency (see below). Those whose diets are not iron rich should consider having their iron status tested, using the STFR test if possible.

Those who assess their iron deficiency risk as being significant should seek a test for iron status regardless of diet quality. Routine use of iron supplementation is not recommended until iron status has been properly assessed.

Ways To Boost Your Dietary Iron Intake

- If you're not vegetarian, include a lean cut of grass fed organic red meat in your diet once each week;
- If you are vegetarian, aim to consume more beans (especially lima beans), lentils, dark green leafy vegetables, eggs and nuts;
- Increase your intake of vitamin C-rich foods (including citrus fruits, berries, new potatoes, broccoli, sprouts, tomatoes, peppers and kiwis). Vitamin C helps convert Fe3+ in the body to Fe2+, making it up to four times more absorbable.
- Don't drink tea and coffee with meals as the tannins present strongly bind to any iron in food, making it less available to the body;
- Go easy on your consumption of pure bran, as it is very high in phytates, which also bind iron. If you want more fibre in your diet, go for whole grain breads and cereals;
- Use stainless steel cookware, which can add useful amounts of iron to cooked foods.

Risk Factors For Iron Deficiency

All the factors listed below may increase the risk of iron deficiency, particularly those marked with an asterisk:

- My sport involves significant volumes of running or other forms of endurance exercise*;
- I am female;
- I have regular periods*;
- I have had children;
- There is a history of anaemia in my family;
- I am vegetarian;
- I am vegan*;
- I drink tea and coffee with my meals*;
- I use bran products (e.g. All-Bran);
- I only eat white meat and fish (not red meat);
- I give blood regularly*;
- I cook using aluminium or enamel cookware (not stainless steel or iron);
- I frequently take antibiotics, aspirin or antacids (indigestion remedies).

Vitamin B12

Vitamin B12 is the largest and most complex of all vitamin molecules. It cannot be synthesized by the body. This vitamin is used in such small quantities that the amount on the head of a pin would prevent deficiency for three years (1 milligram). B12 requirements are so minute, they are measured in billionths of a gram.

B12 is formed through microbacterial action. This occurs in the ground by the bacteria in the soil, bacterial action in the stomachs of cows and pigs, and by bacterial action in the intestine of man.

Normally, B12 is absorbed by plants from the bacterial action in the ground. Sadly, soil bacteria have been destroyed through modern farming. Pesticides leach into the ground, killing the bacteria responsible for creating B12. If B12 is not in the soil, it's not in your vegetables.

What about B12 in the intestine? Meat, the recommended source of B12, ferments and creates toxic by-products which destroy intestinal bacteria. Non-B12-producing harmful can bacteria take over. This can leave you totally dependent on the B12 derived from the bacterial action of cows and pigs.

There are very few non-meat sources of B12. Tempeh and soy sauce are made from fermenting soybeans. The fermentation makes these products a source of B12. However, taking a B12 vitamin supplement is often a good insurance policy for vegetarians.

However, the vast majority of B12 sold is not absorbable by the body, as it is readily destroyed in the stomach. That is why better forms of B12 supplements are sold as sublingual forms (placed under the tongue) that can be absorbed directly through the mouth into the bloodstream. That said, most of these preparations are in a synthetic very slightly toxic form that must be transformed 2 and 3 times by the body before it can be used as the two natural forms our body's use.

The best type of B12 supplement is made up of these 2 natural forms found in our body – adenosylcobalamin (aka dibencozide) and methylcobalamin. They are usually accompanied with folic acid, which is involved in many B12 related functions.

Methylcobalamin is the only form of vitamin B12 found in the brain. The liver can get behind in converting cyanocobalamin, into an ample supply of methylcobalamin. Methylcobalamin supports a healthy brain and spinal cord.

Furthermore: Not only is Cn/Cbl difficult to convert and slightly toxic, it requires adequate phosphorus, or alternatively SAM, to be converted to Met/Cbl.

From Thorne's research: http://www.thorne.com/pdf/journal/2-6/coenzymeb12.pdf

"The compound most commonly referred to as vitamin B12 is cyanocobalamin, CN-Cbl; however, this molecule does not occur naturally in plants, micro-organisms, or animal tissues.[1]

CN-Cbl has a cyanide molecule at the metal-carbon position and its cobalt atom exists at an oxidative state of +3, not the biologically active +1 state. In order to be utilized in the body, the cyanide molecule must be removed and eliminated through phase II detoxification.

It is thought that glutathione (GSH) might be the compound performing the function of decyanation *in vivo*, since glutathionylcobal-amin (GS-Cbl) has been isolated from mammalian tissue.[2]

If, in fact, GSH is needed as a cofactor to activate CN-Cbl to the coenzyme forms of vitamin B12, clinical situations characterized by decreased tissue levels of GSH might be expected to result in a functional deficiency of vitamin B12, even in the presence of adequate plasma or tissue levels of the cobalamin moiety (typically labs are looking only for a cobalamin moiety and do not differentiate between CN-Cbl and the active forms of vitamin B12).

"The next step required is the reduction of cob(III)alamin to cob(II)alamin. This reduction is probably dependent upon NADH and possibly either FAD or FMN.[2] Once cob(II)alamin is formed, a similar reduction can shunt it into the formation of cob(I)alamin and subsequently, with ATP, AdeCbl. An alternate pathway can, with the donation of a methyl group from Sadenosylmethionine (SAM), result in the formation of MetCbl from cob(II)alamin. MetCbl becomes cob(I)alamin after donating its methyl group; however, MetCbl can be regenerated, by accepting a methyl group from 5- methyltetrahydrofolate, for reuse in methionine synthase."

"Evidence indicates alpha-tocopherol protects against a reduction in AdeCbl in oxidatively stressed cells.[4] Experimental evidence suggests alpha-tocopherol might be needed for formation of AdeCbl; however, further studies are required to clarify this relationship. If alpha-tocopherol is used in the reducing steps, a deficiency would be expected to decrease the formation of both AdeCbl and MetCbl."

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Are We Designed For Regular Meat Consumption?

Many people believe that because we have eaten animal products for thousands of years they must be good for us.

But, we do not necessarily appear to be genetically designed to be meat-eaters. In comparing our digestive system with the cat family, they secrete ten times more hydrochloric acid than we do.[121] Their digestive tracks are short for the rapid expulsion of putrefying flesh. They can easily eliminate large amounts of cholesterol and have sharp teeth for ripping flesh, all of which humans do not have. Our digestive track is long, the same as in those creatures who digest plant foods.

Ideally, we should probably get most or all of our amino-acids (protein) from plant sources. However this requires a knowledge of what foods contain which amino-acids in order to maintain your own levels at optimum balance for your personality, and lifestyle.

If you are eating a low meat or vegetarian diet, but don't get the proper balance of nutrients to maintain your lifestyle, the latest metabolic testing shows that you can be come deficient (or

overloaded) in certain amino acids, fats, and other nutrients necessary for health. That said trying to avoid such deficiencies or excesses by eating a typical normal western diet rich in meat is not the answer either.

Whether you are a meat-eater of not, if you live a strenuous lifestyle, metabolic testing to determine nutrient levels should be done to determine whether your diet is meeting your needs.

We can digest commercial meat and other animal products, but not large amounts without a price. For example, if you are a woman eating commercial eggs daily, compared with once a week, the risk of breast cancer is 2.8 times higher. If you eat commercial butter and cheese, 2-4 times per week, compared to once a week, the risk of breast cancer increases 3.2 times. If you eat commercial meat daily, compared with once a week, the risk of breast cancer increases 3.8 times.[122]

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Commercial Factory Farms

Modern meat is different from the meat our parents ate 40 years ago. Factory-farmed animals may have up to 30 times more saturated fat. These cows, fowl, and pigs contain dangerously high levels of pesticides, growth stimulants, appetite stimulants, larvicides and insecticides. To get an edge in the marketplace, many farms feel forced to use every synthetic means to encourage weight gain and prevent disease in their livestock. Seventy percent of cattle are given antibiotics. Even with large scale usage of antibiotics to suppress disease, USDA records state that millions of pounds of meat came from animals containing tumors.[123]

Chicken Factories

In the last few decades, the food industry has subjected animals to deplorable conditions. Often, 80,000 chickens are crammed into commercial warehouses—our "modern" chicken coop. Their entire lives are spent in cages, one foot high, with their heads sticking out of the mesh. Crammed together, they fight for territory, will peck viciously and draw blood. To stop this the farms de-beak the chicken. This requires cutting sensitive tissue. Some chickens do not survive the de-beaking and die of hunger or thirst, inches from food and water. Periodically, a wave of hysteria sweeps the warehouse as thousands of birds panic, driven mad by their conditions. Many get Flip Over Syndrome and die of blood clots. Disease is rampant under these confined conditions, so they are pumped full of antibiotics and sulfa drugs. The feed is laced with growth hormones and nitrofurans. Animals suffer intolerable abuse in factory farming.

Chicken pullers select new-born males from hatching trays, placing them in heavy-duty plastic bags to suffocate. In the time taken to read this page, 2,000 new-born male chicks will have been smothered.[124] The unfortunate factory chickens that survive grow to maturity in three weeks. They are pumped so full of antibiotics and steroids, that some can barely stand up. Many are born mutated with three wings, two heads, or three legs.[125] These mutated chickens are sent down the conveyer belt to also become human food. They are sold to well-known, reputable restaurants so that you can buy an inexpensive chicken dinner.

A television documentary test was conducted on 30 supermarket chickens for dangerous forms of bacteria. National brand, kosher, free-range, and regular chickens were all tested. Eight of the chickens tested had salmonella, 12 had listeria and 21 had camplobacter which makes 4,000,000 Americans sick per year. Only 5 had a clean bill of health out of 30 chickens.[126]

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Pig Factories

Pig factories may contain 100,000 pigs living in stalls not much bigger than coffins. They are so tightly confined that they are unable to turn. The stalls are stacked up to three layers high. The waste falls on the pigs below. These clean-loving creatures are forced to breathe the stench of their excrement from the pits below. The conditions are so bad that 90 percent of the pigs raised commercially are ingesting antibiotics.

Pig factories require huge fans for ventilation. If these fans stop, the pig farmer has only 15 minutes to get the fans running or the pigs die. Pig food is often recycled waste or by-products high in contaminants. The feed can be so bad that, in 1970, over half the pigs inspected had stomach ulcers.[127] These sensitive, intelligent creatures live a life of suffering. Many go insane.[128]

Systematic cruelty is inflicted by mass production. Modernization makes animal foods "cost-effective", but the price is paid by the creatures who live a tortured existence, and the consumer who is buying substandard food. Moreover, I believe these toxic conditions are creating toxic animals not suitable for food. As discussed below, in our desire for efficiency in food production, I believe we are creating new bacteria, viruses and other various genetic abnormalities (see below) that will harm the consumer.

Fish

Fish is a better source of protein than meats because it is easily digested and has fewer potentially harmful fats. Cold water fish are high in essential fatty acids.

As discussed further below, garbage, oil spills, sewage, and airborne contaminants are turning the ocean into an international garbage dump. An example of this indiscriminate dumping of garbage into our oceans was brought to light in an article in the Toronto Sunday Sun, April 11, 1993. Soviet ships dumped twenty nuclear reactors and plutonium from nuclear warheads at sea.[129]

The livers of fish concentrate toxins. Monitoring the level of contaminants in fish livers helps to assess the damage to the earth's oceans. In June 1995, Green Peace scientists tested cod-liver oil from six countries. They sampled 22 brands commonly sold in health food stores. Of the 22 samples, 21 had high levels of hazardous contaminants, such as organochlorine pesticides, DDT, lindane and polychlorinated byphenyls (PCBs). One of the popular brands tested would have introduced to the body 128 times the UK estimated daily intake of PCBs.[130] Green Peace documented the potential health dangers of these chemicals. Organochlorine toxins are known to accumulate in human blood, breast milk and body fat, causing birth defects, infertility, and

altered levels of sex hormones. A full discussion of the problems with the oceans, rivers and fish is found below.

Farmed fish should absolutely be avoided. Fresh, wild, cold-water fish is the best alternative when eating a moderate amount of fish in your diet. You can still purchase wild cold-water fish from Northern Canada and Alaska which is relatively free from toxins.

The beneficial oils found in cold water fish can be synthesized in the body from the Omega 3 and 6 fatty acids found in many seed, grain, and nut oils (see below).

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Protein Comparison

The protein in vegetables, fruit, seeds, and nuts is biologically superior to animal protein. The protein from plant food is a light-weight protein or polypeptide. It is cleaner burning and is easily digestible compared to the proteins from meat. Animal protein raises blood cholesterol, whereas, vegetable protein lowers it. Eating meat produced from factory farms is a matter of choice, but one must decide if you can afford the high health risk. I would completely avoid such products if at all possible.

Becoming a vegetarian, cutting back on consumption, and eating only organically produced meat is a sensible approach to eating. The following page is a chart displaying the percentage of calories as protein. Percentage of weight has been the standard used to measure protein content — but it is misleading. Protein levels in food should be measured in relation to calories, not weight. To make a clear comparison, estimate protein value as percentage of calories. See the chart below. Use this chart and the one above showing which food are acid or alkaline producing to make the choices that are best for your individual needs and tastes.

Protein Percentages of Foods

Legumes	
Soy Bean Sprouts	54%
Mung Bean Sprouts	43%
Soy Bean Curd (Tofu)	43%
Soy Flour	35%
Soy Beans	35%
Soy Sauce	33%
Broad Beans	32%
Lentils	29%
Split Peas	28%
Kidney Beans	26%
Navy Beans	26%
Lima Beans	26%
Garbanzo Beans	23%

Vegetables	
Spinach	49%
New Zealand Spinach	47%
Kale	46%
Brocoli	45%
Brussel Sprouts	44%
Turnip Greens	43%
Collards	43%
Cauliflower	40%
Mustard Greens	39%
Mushrooms	38%
Chinese Cabbage	34%
Parsely	34%
Lettuce	34%
Green Peas	30%
Zucchini	28%
Green Beans	26%
Cucumbers	24%
Dandelion	24%
Green Pepper	22%
Artichoke	22%
Cabbage	22%
Celery	21%
Eggplant	21%
Tomatoes	18%
Onion	16%
Beets	15%
Pumpkin	12%
Potatoes	11%
Yams	8%
Sweet Potatoes	6%

Dairy	
Milk 2%	27%
Milk , Whole	21%
Milk, Soy	21%
Milk, Goat	33%
Cheese, Cottage 2%	61%
Cheese, Cheddar	25%
Cheese, Brie	25%
Yogurt, Plain low fat	33%
Yogurt, Plain Skim	41%
Egg, Boiled	31%

Grains	
Wheat Germ	31%
Rye	20%
Wheat, Hard Red	17%
Wild Rice	16%
Buckwheat	15%
Oatmeal	15%
Millet	12%
Barley	11%
Brown Rice	8%

Fruits	
Lemons	16%
Honey Dew Melon	10%
Cantelope	9%
Strawberry	8%
Orange	8%
Blackberry	8%
Cherry	8%
Apricot	8%
Grape	8%
Watermelon	8%
Tangerine	7%
Papaya	6%
Peach	6%
Pear	5%
Banana	5%
Grapefruit	5%
Pineapple	3%
Apple	1%

Nuts & Seeds	
Pumpkin Seeds	21%
Peanuts	18%
Sunflower Seeds	17%
Walnuts, Black	13%
Sesame Seeds	13%
Almonds	12%
Cashews	12%
Filberts	8%

Meats	
Lean Ground Beef	38%
Regular Ground Beef	33%
Sirloin Steak	28%
Leg of Lamb	61%
Lamb Chops	29%
Pork Loin Chop	23%
Pork Rump Roast	39%
Roast Chicken Breast (light)	52%
Roast Chicken Leg (dark no skin)	53%
Roast Turkey Breast (light)	76%
Roast Turkey Leg (dark no skin)	61%

Fish	
Salmon (pink)	57%
Salmon (sockeye)	51%
Tuna	43%
Swordfish	65%

Fats and Oils are Essential to Health and Normal Metabolism

One ***can*** change body weight with dietary changes alone, because the type and quality of food affects one's metabolism. Metabolism is the result of a rate of energy (food) usage in the body.

Foods need to be burned with oxygen to produce the energy we need. Foods rich in Essential Fatty Acids (EFAs) increase oxygen uptake in tissues, oxygen transport in blood, and oxygen burn rates at the cellular level. These foods speed up metabolism.

Most North Americans think fats and oil are bad for them. Nothing could be further from the truth. All fats and oils are classified as different types of ***Fatty Acids.***

Many disorders affecting people today are at least in part due to a lack of healthy fatty acids in the body. North America's fat-free thinking is very dangerous to maintaining health, particularly for women, whose bodies require precise balances of fatty acids and other lipids for proper function of their complicated hormone systems.

The right fats and oil in our diet help our body to regulate energy burn, glandular function and hormone production, cellular repair, maintain healthy nerves, and many other important biochemical functions. Too much of the wrong fats, including essential fatty acids, can cause serious problems, other than just being overweight.

Western society has been eating too much of the wrong fat, and just as problematically, too much of the wrong sugar, which is easily converted into saturated fat and/or cholesterol (see below).

Our bodies need various forms of fat and oil to be healthy.

Certain EFA oils transfer stored sunlight to our bodies (see below). (These also enhance oxygen transport in our tissues as discussed above). If peoples in Northern latitudes do not eat enough of these important oils during the winter they can become sick and/or depressed.

By combining or breaking down fat and oil molecules, the body can make the many different fats it needs from different types we eat.

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Essential Fatty Acids (EFAs): Omega 3, Omega 6, & Omega 6 GLA

Eliminating problem fats from the diet is important, but eating the right fats and oils is just as important. Even if we were to remove all bad fats from our diet, we would still die if we did not eat essential fats which allow vibrant life.

To make sure we are eating the proper amounts of essential fatty acids in our diet, we must identify their sources, their functions, and signs of their deficiency or excess.

Certain fats are defined as "essential fatty acids" because:

- The body cannot make them;

- They are required for normal cell, tissue, gland, and organ function, for health, and for life;
- They must be provided from outside the body, through food or supplements;
- They only come from fats/oils (hence fat/oil-free diets cannot supply them);
- Their absence from the diet is eventually fatal;
- Deficiency results in progressive degeneration, and can lead to death;
- Return of essential fatty acids to a deficient diet reverses the symptoms of deficiency and results in a return to health.

There are 3 basic types of essential fatty acids, or EFAs, one of which is an Omega 3 fatty acid, and two of which are Omega 6 fatty acids. Each of these allows the body to make other more complex derivitives necessary for health.

For example, the simplest Omega 3 EFA is called alpha-linolenic acid, or ALA and is also known as n-3, or 18-3w-3. (The meanings of these chemical names, and the natures of different fats and oils are less complicated than they look, and are discussed and diagramed in the sections below).

From this less complex ALA n-3 oil (found in flax seed, walnuts, hemp, and other rich plant sources) our bodies can make the more complex healthy oils found in cold water fish – DHA & EPA. All of these oils are known as members of the Omega 3 family. Most westerners lack Omega 3s.

The first of the two essential Omega 6 EFAs is linoleic acid or LA (also known as n-6, or 18-2w-6).

CAUTION: While Omega 6s like linoleic acid (LA) are very important for health, they are usually not deficinient in most western diets due to heavy use of vegetable oils. In fact most people have too much Omega 6, which can promote heart disease and cancer if consumed in excess. As well most people are ingesting polluted or altered forms of these fatty acids, causing even more problems. (We'll discuss where to find healthy sources of all the EFAs further below)

The second essential Omega 6 EFAs is called GLA, or Gamma linolenic Acid, 18-3w-6). This EFA is difficient in most people, for two reasons. First, while the body is capable of making GLA from LA, due to poor diets and high stress lifestyles which quickly use up important nutrients necessary for GLA synthesis, many people are lacking the nutrients and enzymes required to convert LA to GLA. Secondly, many people are not eating any rich sources of GLA, some of the best of which are organic borage and evening primrose oils.

Many seeds and nuts are rich sources of EFAs. But there is no seed or nut that on its own gives an optimum ratio (1-2) of n-3 / n-6 to keep us healthy. Too many nuts can lead to an excess in n-6 fatty acids. Flax is the richest source of n-3, but a poorer source of n-6. Sunflower, safflower and sesame seeds contain n-6, but no n-3. So, if you are avoiding poor or toxic sources of vegetable oil (found in many commercial salad dressings, mayonaises, spreads, ice-cream,

packaged cookies and baked goods, etc.,etc.) we must mix and match these seeds, and/or the oils made from them to get both EFAs in the right quantities and ratio.

Most overweight North Americans are deficient in the Omega 3's & GLA and will benefit from adding organic flax oil, borage and/or evening primrose oil to their diets. (These oils are good for you in part because they are highly reactive with oxygen. However due to their extremely reactive natures these oils must be properly pressed and packaged – cold pressed, free of oxygen and light).

Organic flax oil is an excellent source of omega 3 (n-3), but is lower in omega 6 (n-6). Flax oil can be used as a therapeutic treatment for many conditions (cancer, MS, diabetes, and many others) associated with eating too much sugar, poorly processed or overly heated vegetable oils, and/or animal fat which results in an Omega 3 deficiency and low tissue oxygen levels.

Research has clearly shown that essential fatty acids can decrease fat in the body by burning it faster, slowing down fat production, and increasing energy, activity, and heat, all of which burn more calories[131].

Flax oil is very effective for short-term weight loss. However longer term exclusive use of flax oil (usually for at least 4-6 weeks or more) can cause an Omega 6 EFA deficiency in some individuals, potentially resulting in eczema, psoriasis, and/or overly low blood pressure and fainting. So, if you show any of those symptoms, and have been using flax-oil daily to help loose weight and achieve a higher metabolism, it would be wise eat some safflower, sunflower or other Omega 6 rich oils once a week.

If your weight increases after taking good fats (not likely), decrease your intake of sweets, starches, and fruit (which is particularly fattening to those with lower, slower metabolisms).

Blended "essential balance oils" contain both n-3 & n-6 oils in various ratios and can be used by people with normal healthy metabolisms who do not eat a lot of commercially prepared food and/or meats that are already rich in n-6 oils. Hemp oil is legal and has an almost perfect ratio of the two essential fatty acids. While there are no narcotic effects experienced with ingesting hemp oil, tiny trace amounts of THC might be detected in a sport or employment related drug test.

As mentioned above it is important to remember that you may be eating more Omega 6 that you think because it is used in some many different foods and spreads eaten in large quantities today. It would be wise to cut back on various products made form generic Omega 6 oils such as canola, safflower, sunflower, sesame, etc., as these sources are usually polluted unless organic and properly pressed.

If you suffer with acne even though you avoid sweets, you may be consuming too much red meat, nuts, or other foods high in Omega 6 and saturated fats which can cause acne flare-ups.

As mentioned above, never cook with oils containing the essential fatty acids such (flax, sunflower, safflower, canola, hemp, walnut or any other vegetable oil) because this causes the

formation of carcinogenic trans fatty acids. Sautéing in butter is safe (but can be fattening for those with low metabolisms) because the fat is chemically stable, where oils are not.

The Benefits of Uncontaminated Cold Water Fish

The body is able to convert the n-3 and n-6 EFAs into several n-3 and n-6 **derivatives** with important functions in the body.

The best known n-3 derivatives are EPA and DHA, are made in the body and are also found in high fat, cold water fish like salmon. DHA is the primary n-3 found in the brain. Derivatives of n-6 include GLA (found in evening primrose oil), DGLA (found in mother's milk), and AA (found in meat, eggs, and dairy products, as well as in fish). AA is the primary n-6 in the brain.

Wild, uncontaminated, cold-water fish like salmon is probably the best source of protein and fatty acids we can eat. It's rich oil is what allows North American coastal grizzly bears to reach weights of 1500 lbs. as compared to their berry eating interior mountain cousins which usually only reach weights of 800 or so. I'm convinced such fish helped produce the athletic records my athletes realized without steroids.

The body makes various hormone like substances known as ***prostaglandins***, known as ***eicosanoids*** from EFAs, all of which are healthy for us when in balance, but that can become very problematic when out of balance.

Eicosanoids regulate many functions in all tissues on a moment-to-moment basis, such as blood clotting. The body makes hormone-like **series 1 eicosanoids** from the ALA n-3 derivative called EPA, **and series 3 eicosanoids** from the n-6 DGLA derivitave made from GLA Omega 6 found in borage and evening primrose oils. These are often called the "good" prostaglandins because they are anti-inflamatory in nature.

The hormone-like **series 2 eicosanoids** made from the n-6 linoleic acid (LA, 18-2w-6) and its derivative Arachidonic Acid (AA, 20-2w-4), are often call the "bad" prostaglandins, as in excess they are overly pro-inflammatory.

A more comprehensive look at EFAs, derivatives, and eicosanoids is found on page 20 of *Fats That Heal Fats That Kill*, by Udo Erasmus, PhD**.** Dr. Erasmus is world renown as a leading expert in nutritional fats & oils chemistry, and the role these foods play in human biochemistries.

His book is among the most important research texts for the lay person regarding human nutrition. One can't begin to study nutrition without first reading it, as without an understanding of the electro-chemical nature of lipids (fats and oils) and proteins, one lacks the proper foundations for a fuller understanding of human health. It should be mandatory reading for anyone and is listed below in Appendix 4 .

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Understanding Fats and Oils

All fatty acid molecules are made up of strings, or chains, of ***Carbon*** atoms, ranging from 3-22 carbons long. For example, butter contains butyric acid, which is just 3 carbons long. Because it's a short chain fat, it burns quickly and provides a good source of quick energy… good for breakfast. Stearic Acid, found in beef and other animal fats, is 18 carbons long, and much harder to digest.

These carbon strings and are surrounded with varying quantities of ***Hydrogen***.

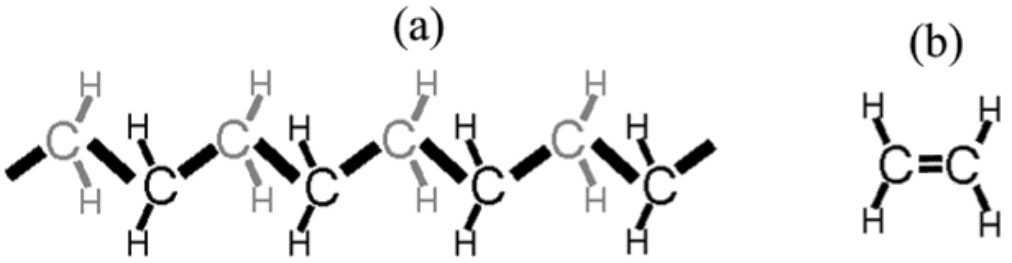
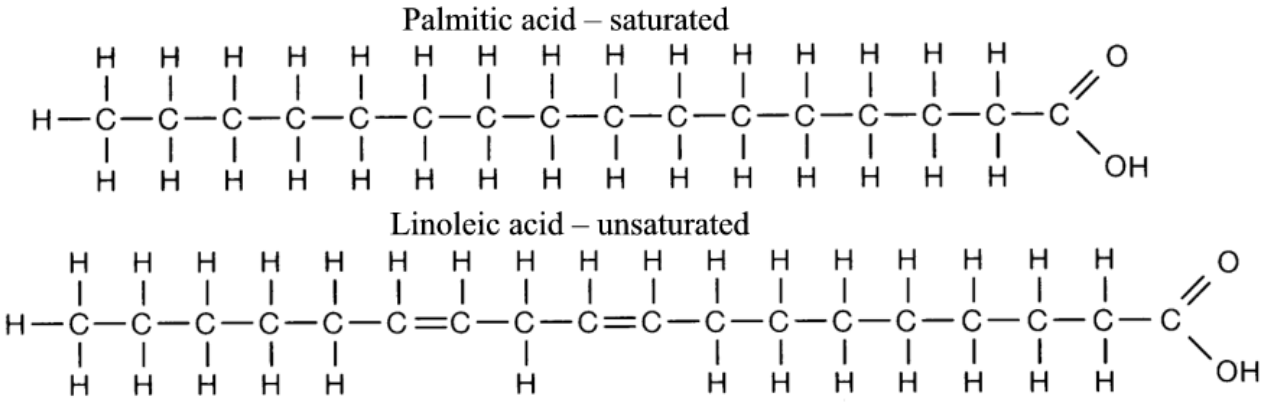


Diagram A shows what a chain of carbon and hydrogen looks like. Diagram B shows two carbons joined by a ***double bond***, the significance of which is described in the next section.

Solid animal fats are called ***saturated*** fats because the chain of carbon is completely surrounded or "fully saturated" in with hydrogen molecules. They have no double bonds as seen in the first stick model below:



Fatty acids, like that pictured directly above, are ***unsaturated***, and are made up of molecules which are not fully saturated in hydrogen – that is they contain fewer hydrogen atoms and one or more carbon double bonds, like in the second stick model above. Monounsaturated fatty acids like oleic acid (found in olive oil) have just one double bond. This type of structure and its one double bond produce a thick oil. It's not a solid animal fat like butter, but it's not runny like flax oil. The essential fatty acids have 2 and 3 double bonds making them thinner and ***poly***unsaturated. Fish oils and other oils have as many as 5 and 6 double bonds making them ***super*** unsaturated (see the section below).

These stick model diagrams above are simplified. The actual geometry and space displaced looks more like the first diagram **(a),** except that unsaturated oil molecules are slightly bent at each double bond site, as seen in the diagrams further below.

Unsaturated fatty acids carry a very slight negative charge, due to the higher energy level of the electrons in their double bonds. These electrons had their energy levels raised with additional energy from photon absorption from the sun. These double bonds make unsaturated oils chemically active, attractive to proteins and oxygen, and essential to vibrant health. Because of this they are critical to our cellular make up. We will discuss them in more detail a little later.

Saturated fats on the other hand are a less exciting and a sometimes problematic cousin. They are electrically neutral, slightly "sticky" to touch, solid at room temperature, and stable chemically. They are not as readily damaged by heat, and can be used for cooking. They produce lots of energy when burned as food, but long chain saturated fatty acids, like those found in beef and lamb require a lot of energy to digest as well.

Their inherently sticky nature can cause health problems when consumed in excess, as they glob onto passing molecules and clog up arteries and veins.

A Molecule's Structure Determines Its Shape And How It Fits In Our Cells

While saturated fatty acids are electrically neutral, they, like all fats and oils, are polar in structure. This means they are electrically neutral but have equal and opposite *concentrations* of one charge versus the other at different places within the molecule. For example, as with all fatty acids, at one end of a molecule you might find a structure with a slightly negative charge, on the other end, a slightly positive charge. Additionally, as is the case with fatty acids, you might find the outside of the molecule is slightly positively charged with lone hydrogen atoms, while further inside the molecule a greater build up of negative charge because of the number of electrons concentrated there.

These polar asymmetries occur when atoms of differing sizes and structure come together, causing distortions in the paths of electrons circulating about the two atoms. This is because certain atoms exert a strong attraction on the electrons of neighboring atoms.

An atom of Hydrogen has just one proton, with one positive charge, and one electron with one negative charge. Carbon has 6 protons and electrons. Because of this, when its bound to hydrogen, Carbon's larger core of 6 protons exerts a greater attractive force than the lone proton of hydrogen, pulling hydrogen's lone electron closer to the carbon. This pairing makes the carbon slightly electronegative and the hydrogen electropositive.

The electropositive nature of the surrounding hydrogen atoms in fatty acids causes them to slightly repel (or push against) each other. Such forces determine the shape of the particular fatty acid chain. If it is a saturated fatty acid, which is evenly surrounded in hydrogen, the repelling forces are balanced, forcing the carbon into a "straight" zigzag chain like that in diagram **(a)** above.

If it is an unsaturated fatty acid, which is ***not*** evenly surrounded in hydrogen the resulting molecule will be bent (see diagram below).

Certain sulfur-rich proteins contain sulfur-hydrogen bonds that also make hydrogen atoms slightly electropositive, making these proteins very attracted to the slightly negative overall charge of the polyunsaturated fatty acids. These proteins are often found bound to the essential fatty acids in Nature. Such combinations are found in healthy human cell membranes.

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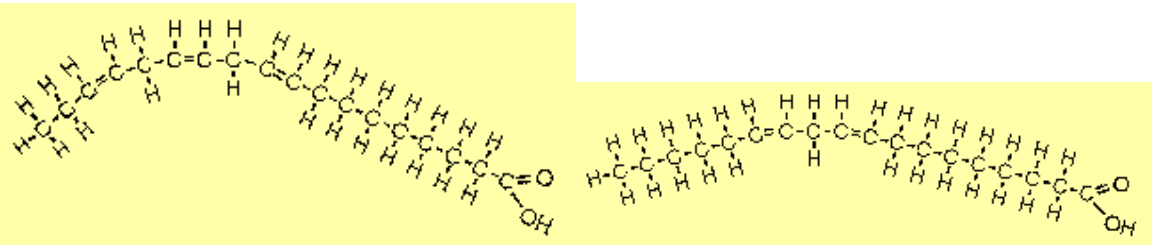
Omega (Ω) Double Bonds: Sunlight Transferred by Oil Through the Food Chain

As you can see from above, fats and oils have very similar chemical structures, the only difference being that oil molecules contain at least one or more higher energy ***double*** electron bonds that have a very slight negative charge.

Double bonds are created when sunlight is absorbed (via photosynthesis) in the oil of plants such as phytoplankton, vegetables, and seed plants. Energy from sunlight in stored in these higher energy bonds and is transported though the food chain by animals eating these plants.

These double bonds are known, or classified, as "omega" bonds in fatty acids chemistry. Different types of fatty acids are classified and named 1) according to the number of carbons in the chain, 2) how many double bounds exist in that chain (represented by a number next to a **w**), and, 3) by the location of the first double bond in the carbon chain.

For example 18-3w-3 designates the important "omega 3" fatty acid, linolenic acid (LNA), the primary component of Flax oil, which contains 18 carbons, 3 double bonds, with the first double bond situated between the 3rd and 4th carbons in the chain. 18-2w-6, represents linoleic acid (LA) an important omega 6 fatty acid, with one fewer double bond, and the first one starting between the 6th and 7th carbon. As can be seen in the example below, nature locates consecutive double bonds 3 carbons apart.



An Omega 3 - Linolenic Acid (18-3W-3) An Omega 6 - Linoleic Acid (18-2W-6)

Why Oils are Liquids and Fats are Solid

The double bonds in unsaturated fatty acids leave 2 extra hydrogens on one side of the molecule. This causes a bending of the molecule, as the hydrogen atoms missing on the one side are not there to repel, or push back against, the remaining hydrogen on the other side.

Those bent molecules do not pack together as tightly as straight chain fats. This combined with the slightly negative charge found in oil makes oil molecules repel each other very slightly, creating a liquid. The concentration of negative charge around the high energy double electron bonds is attractive to oxygen, making these oils dynamic and reactive. This is one of the main reasons essential fatty acids are so critical to good health.

The more double bonds there are in a particular type of oil molecule, the more negative the overall charge, the greater the bend in the molecule, the thinner the oil, the more exponentially chemically active it becomes, and the more attractive it is to oxygen.

These oils also form strong bonds with protein and result in healthier, stronger cellular structures and tissues. Because of the ability of various oils to attract oxygen, highly unsaturated oils are found in the most energy consuming parts of the body—the brain, the sensory organs, the sexual organs and glands, etc.

But these oils must be pressed and bottled properly to ensure they are not rancid by the time they reach you. The majority of polyunsaturated vegetable oils on the common grocery store shelf are laced with pesticides and other contaminants, have been damaged by heat, light and oxygen, and as a result are full of free radicals, making them carcinogenic with long time use.

Healthy polyunsaturated vegetable and seed oils are organic, unrefined, cold pressed in atmospheres free of oxygen and light, and are bottled in inert gas such as nitrogen. That way they arrive in your fridge fresh, and only begin to react and break down once the bottle has been opened.

Omega 3 Essential Fatty Acids Promote Health and Fight Most Cancers

Essential fatty acids are critical to proper cell membrane structure, function, and strength. They are also involved in oxygen transport through the body, and through the cell membrane.

Where there is cancer, there are usually problems regarding: acidosis, low levels of oxygen metabolism, cell membrane chemical structure and integrity, cell membrane division, and/or DNA replication. It's also known that most cancer will not survive in high oxygen environments, or in alkaline environments.

Dr. Johanna Budwig of Germany was a foremost researcher in the area of fats, skilled in applying the principles of physics and relativity, chemistry, biochemistry, pharmacology, and medicine. In 1953 she was the first to develop techniques to analyze fatty acid compositions from living patients.[132] Prior to this, because of the lack of techniques, problems of fat metabolism could only be identified after the patient had died.

Budwig undertook painstaking, meticulous, and time consuming work to develop new techniques to separate and determine the fatty acids found in blood. Once developed, thousands of blood samples from healthy and sick people were systematically analyzed and the findings tabulated. She recognized that samples from people who had cancer, diabetes, and some kinds of liver disease (a frequent forerunner of cancer) consistently lacked one of the essential fatty acids,

linoleic acid. The lipoproteins in the blood which contain linoleic acid combined with sulphur-rich protein were also missing. Instead she found they contained a yellow-green protein substance in the blood. As the lipoprotein which makes hemoglobin was missing, hemoglobin was low and the blood couldn't carry enough oxygen. When linoleic acid and sulphur-rich protein were added to the diets of such patients to this substance the yellow-green colour disappeared and the red blood pigment hemoglobin appeared. All healthy patients, on the other hand showed no deficiency of the EFAs. It appeared to Dr. Budwig that cancer, diabetes and some liver diseases involve, at a minimum, a deficiency of the essential fatty acids.

She developed the first treatments for cancer utilizing the high concentrations of Omega 3 fatty acids in Flax oil.

Dr. Budwig's full story is controversial and full of conflict. The problems began when she discovered toxic polymers produced by the hydrogenation of oils, known today as trans fatty acids, in the tumors of many of the ill. Realizing the danger to consumers, she decided to publish her findings. As the head of the research institute at which she worked held the patents for hydrogenation processes involved in the manufacture of margarine, he knew her discoveries would severely damage margarine sales, so she claims he tried to bribe her with money and the ownership of a drugstore to prevent publication. She refused and the strong-willed Budwig quickly found her research, access to laboratories, and work blocked. Blackballed, she privately published her work, and started her own clinic to help treat the terminally ill and claims to have reversed most cancers and many other degenerative diseases.

Most of her techniques, but not all (specifically those using dairy products), are used today as effective natural treatments for cancer and other degenerative diseases by alternative practitioners in the western world. For more on her interesting career and her contributions to our understanding of health and healing, see Udo Erasmus's *Fats that Heal, Fats that Kill*, as well as her own books which are now printed in many languages.

Problem Fats and Lipids

Much has been written about various fats that cause harm. Trans fatty acids, excess cholesterol, and excess saturated fatty acids (from animal fat) are associated with deaths from cardiovascular disease (43%), cancer (23%), diabetes (2%), and other degenerative diseases that kill 68% of all Western populations.[133] Only a 100 years ago, this was rare, further indicating that these deaths are lifestyle related, not genetic.[134]

Since the turn of the century, saturated fat in the diet has increased by 1,000%. Yet, essential fatty acids have decreased by 80%.[135] As discussed below, a diet, high in refined sugars and starches increases saturated fat in the blood. White sugar, white flour, white rice, pasta, corn starch, tapioca and most breakfast cereals convert very quickly and easily into saturated fat.

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Why Saturated Fats and Animal Fats Cause Disease and Healthy Oils Heal

The body runs at 98.6 degrees Fahrenheit, or a little warmer than room temperature. Now think of what happens to any fatty acid when it's subjected to various temperatures. Solid butter liquefies under high temperatures in a frying pan or oven, as do all animal fats. But what happens once the frying pan has cooled? They condense and solidify into a very sticky mess, as anyone who does the dishes knows.

They do the same thing in your blood, smearing every blood vessel, large and small, with sticky grease that combines with other minerals and compounds to form hard plaques. A build up of plaque reduces the natural flexibility of your blood vessels, necessary to accommodate the heart's pumping action, raising blood pressure, cutting off circulation, reducing oxygen, preventing healing, and causing disease. Too many saturated fats can also clog the liver, drastically reducing its ability to function

Fresh healthy oils, which are liquids at room temperature, do the opposite in your body, dissolving unwanted accumulations of saturated fats, softening blood vessels, lowering blood pressure, attracting & transporting oxygen, cleansing the liver, and promoting healing.

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Trans Fatty Acids

Trans Fatty acids are created anytime oils are exposed to higher cooking temperatures (above water's boiling point), or when oils are processed and bottled incorrectly. They are also created during hydrogenation, the synthetic conversion of vegetable oil into fat, such as with margarine or shortening. As mentioned above, this is because the double electron bonds found in oils are easily altered if they are exposed to excessive heat, light, or oxygen.

Trans fatty acids interfere with cellular reproduction, and many other biochemical functions, as they will fit into various biochemical structures because they have the same charge as healthy oils. Unfortunately they have the wrong shape and create weakened and unresponsive cell structures.

In 1911, Crisco marketed the first shortening made through hydrogenation.[136] Hydrogenation quickly became a big success because the process denatures oils and fats and kept them from going rancid. For the first time, manufacturers could make an oil or fat that could stay on the shelf at room temperature for months. However, it's precisely this stable & inert, or "dead", nature (along with other problematic properties) that makes such foods toxic to the body. They are not capable of dynamic reactivity necessary for proper biochemical activity.

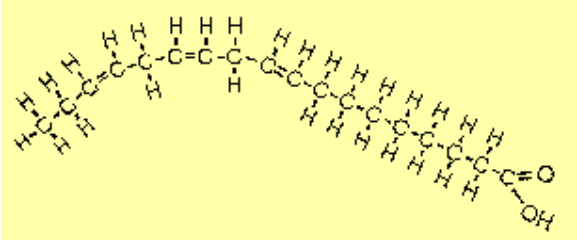
In the succeeding 80 years, the growing number of hydrogenated oil products has risen to make up 10% of North American caloric intake.[137] Hydrogenated oil is now found in donuts, muffins, cakes, salad dressing, candy, soups, breads, margarine, potato chips, fried foods, mayonnaise, cheese spreads, peanut butter and most processed foods. Even many raisins are coated with a layer of hydrogenated oil.

To hydrogenate an oil, hydrogen is bubbled through the oil with a nickel catalyst at more than 1,000 degrees Fahrenheit. These high temperatures cause the double bonds of oils to twist 180 degrees, as the repelling forces of side by side hydrogens on one side of the bond try to move away from each other, altering the molecules' configuration. *Trans-fatty acid* is the short form for *transformed fatty acid*. The body does not recognize that these twisted fatty acid molecules are harmful, and utilizes them.

They will slip into and fit cell membranes like broken keys, stopping the cell's proper function. An essential fatty acid molecule is curved like a "C", whereas a trans-fatty acid is broken in the middle of the "C" and spun around 180 degrees creating a straightened "S".

In the diagram below, this omega 3 essential fatty acid has several hydrogen atoms removed from just one side of the structure. Each dashed line represents a pair of electrons shared between two atoms. Anywhere there is a double bond between two carbon atoms, each carbon has contributed one of its electrons to form the additional pair necessary to form the new double bond. For this to occur in a fat, two hydrogens must be removed to free up the necessary carbon electrons required to create the double bond. As each hydrogen bound to carbon occupies one electron, two hydrogen atoms, one from either side of the double bond must be removed. This creates double hydrogen "gaps" on one side of the molecule.

Side by side hydrogen atoms repel each other, affecting the shape of the molecule. Removing hydrogens affects the normally balanced repelling forces existing in saturated fats, bending the molecule. Molecules in this shape do not stick together and remain fluid-like in the blood.



Heating an essential fatty acids can produce the necessary energy to cause one portion of the molecule to spin 180 degrees about a double bond. This results from two side-by-side hydrogens, which naturally repel each other, trying to get farther away from each other. In this transformed-fatty acid, one the side-by-side hydrogen atoms has been forced to the other side of the molecule. The trans-fatty acid molecule straightens, all be it, with a slight kink.

Now they easily lock together, causing them to stick to cholesterol and saturated fats. This stickiness increases fatty deposits in the arteries, liver and other organs. Platelet aggregation is increased, which in turn increases the chance of blood clotting, strokes and heart attacks. A trans-fatty acid cannot correctly perform the function of an essential fatty acid, thereby causing short circuits in the electrical flow responsible for heartbeat, nerve functions, cell division and mental balance. They create free radicals that have been linked to cancer. Trans-fatty acids act like saturated fats because they increase blood cholesterol.

It has been estimated that over 200 million have died prematurely because of the trans-fatty acids in refined oils.[138] They are a major cause of cancer, heart disease, immune system breakdown, depression, fatigue, and other disorders. Trans-fatty acids are highly toxic, appearing around tumors and other metabolic breakdowns. A diet consisting of 10% corn oil (highly processed, denatured oil) produced colon tumors in 36% of rats.[139] Back to Top

Eat Butter, Not Margarine

Margarines are processed synthetic foods, most of which contains at least some trans fatty acids. They should be eliminated from your diet.

Boiling vs. Baking vs. Frying

Unrefined organic olive oil is important for soft healthy skin and tissues. It contains many other synergistic micro-nutrients that make natural oil so good for you, and that are missing in the refined oils. It's best used uncooked as a dressing.

Sautéing in olive oil should be avoided, and if not, only done at very low heat. The heat damages the oil molecules single double electron bond (18-1w-9), causing the formation of trans fatty acids. It always better to sauté at low temperature in butter vs. oil, as there are no double bonds in butter which can be damaged by heat.

Adding some water to a pan will keep the temperature down to 212F/100C until the water boils off, at which point the temperature of the pan can rise to about 419F/215C, the boiling point of oil.

When boiling foods, even the most sensitive EFA–rich oils can be used without deterioration when cooking grains or steaming vegetables.

Baking fits somewhere between safe boiling in water and unsafe frying. The temperature of a baking pan and crusts gets very high, damaging the (browning) molecules of food. Butter, or saturated tropical fats should be used to line the baking pans and to brush the tops of what you are baking. The temperature of the inside of bread being baked only goes up to just above boiling, about 240F/116C, and the inside of the bread is protected from air and light while cooking. The inside of the bread is steamed at an acceptable temperature for the most sensitive oils. Only the crust is actually baked—the oils there are damaged or destroyed.[140]

Carbohydrates: Sugar & Starch—What Types You Need and When

The body's primary source of fuel are carbohydrates. While it can burn protein and fat if it has to, these are not optimum fuels for energy production. Protein, oil, and fat's primary uses in the body are for making cell structures and hormones that regulate our use of nutrients and control our bodily functions. However because the body can run out of its primary carbohydrate fuel, the body is designed to burn other materials as back-up fuels when the sugars run out.

Our muscle cells burn fat when they run out of sugar, but fat's energy is released more slowly, for a longer steady supply of lower level energy.

Any refined sugars or syrups are concentrated forms of sugar. These include:

- simple sugars—glucose (dextrose), fructose (levulose), and galactose,
- honey,
- disaccharides—sucrose (table sugar), maltose (in beer), and lactose (in milk),
- dextrins and syrups made from sugar cane, sugar beets, sorghum, and maple,

These are rapidly digested, quickly absorbed, and quickly turned into fat in people who cannot burn the readily available sugar fast enough. Excessive sugar consumption is the primary culprit behind obesity in western society. More on that below.

However proper types & amounts of sugar are essential to healthy living. Various combinations of glucose and other simple sugars, are the building blocks that make up simple and complex carbohydrates: i.e. sugars, honey, fruits, vegetables, grains, other starches, and their derivatives such as cereals, breads, pastas, etc.

Glucose, which results from the digestion of carbohydrates and other sugars, is the primary fuel for all cells in the body, and ***the only fuel our brains can use***.

The latter point is important, as the body must carefully regulate blood levels of glucose to make sure the brain gets only the glucose it needs—not too much, and not to little. If the brain gets too much sugar it becomes hyper-active (i.e. young kids on cookies and sweets); too little sugar—the opposite (dopiness, crankiness when you are hungry). Proper regulation of glucose levels is critical to maintaining physical health, a stable attitude, and good mental health.

To prevent the brain and bloodstream from becoming overloaded with glucose, excess sugar (digested from sweets, fruits, pastas and other starches) is immediately turned into fat by our body if we don't burn them as fuel for physical activity. Carbohydrates that you burn up are good fuel, and provide needed energy for thinking and moving. Carbohydrates that you don't burn up become immediate excess weight.

Understanding how the body uses sugar is critical to maintaining high energy levels and proper body weight.

Technically we could survive on simple carbohydrates as our only fuel for energy, but we would have to eat small amounts continuously through out the day, as they are burned very quickly. When we eat a larger quantity of sweets than we can use, we experience a sugar "high", followed by a crash as the pancreas rushes to secret insulin to convert the extra sugar to fat to prevent overloading the brain with sugar. Within a few minutes the all the sugar has been burned, or converted to fat, leaving you hungry again. This is why eating sweets alone causes craving for food, mood fluctuations and potential for headaches.

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Complex Carbohydrates

Carbohydrates differ based on the number of individual simple sugar molecules that are hooked together to make them up. The longer the chain, the more ***complex*** the carbohydrate, and the longer it takes to digest and provide its full energy.

The chains of sugar in complex carbohydrates, or starches, are digested by our bodies one sugar at a time. You can imagine them as a long log that needs to be burned in a small fire place. To burn the long log (complex carbohydrate) you need to cut off a shorter section of log (individual simple sugar) and then burn it. This way the long log will burn one short log at a time. Complex carbohydrates take longer to digest and spread out their fuel of simple sugars over longer digestion periods.

Because the body can only use sugar in its simplest form, you need to make sure you have an adequate supply of complex sugars which are gradually digested over several hours to provide a continuous supply of simple sugars between meals.

Organic vegetables are excellent sources of medium length complex carbohydrates that are rich in vitamins, minerals and enzyme. Fresh juices or soups made from these foods are also powerful healers.

You should choose your food based on the anticipated needs of your body over the following 3-4 hours.

When you get up on an empty stomach, you should ingest a little simple sugar for immediate energy, along with various forms of longer chain complex carbohydrates for sustainable energy. A breakfast containing a bit of fruit and oatmeal is one example. Poached or boiled organic eggs on wholegrain bread provide another healthy source of carbohydrates, essential fatty acids and protein.

At the end of the day, our bodies need to be replenished with some additional long complex carbohydrates for energy use the next day. It also needs more protein, oil, and fat for the cellular regeneration that is accelerated when you sleep.

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Unrefined Sugar VS Refined Sugars

All sugars require minerals and vitamins (co-enzyme factors) to be burned properly in the body. If grown from mineral rich soils (organic), natural forms of sugar—from fruits, vegetables and other unprocessed whole foods—contain optimum levels of minerals and vitamins to support normal digestion.

However, the refining of sugars and starches depletes these foods of fiber, enzymes, minerals and vitamins found in unrefined foods. Because all foods require enzymes and vitamins & minerals (enzyme co-factors) for digestion, depleted foods steal nutrients from the reserves in our bodies to burn them. Continuous over consumption of such foods eventually leads to a

depletion of the body's reserves. This can lead to depression, muscle cramping, seizures, digestive disorders and many types of chronic disease.

In addition because refined sugars and starches lack fiber and are already broken down to some degree, they are digested very quickly, usually causing too much sugar to be released into the bloodstream at once, resulting in weight gain for those who cannot burn the sugar quickly enough. Back to Top

Excess Simple Sugars Make People Fat

The primary simple sugars are: glucose (dextrose), fructose (levulose), and galactose.

Table sugars, syrups, fruits, natural fruit juices, sweetened fruit juices, cold breakfast cereals, jellies, candies, regular soft-drinks, cookies, ice cream, chocolate, most crackers, many commercial breads, ketchup and other commercial condiments, cakes, and many other foods are very high in ***simple sugars***.

Simple sugars are single molecules of sugar which require little digestion and provide energy instantly, but only for a short period. Ideally we want a constant trickle of this sugar into our blood from the steady digestion of various length complex carbohydrates for a regular even supply of energy throughout the day.

Most people who are too heavy are eating too many simple sugars, whether the know it or not. Many people also eat too much fruit. Fruits should be eaten in moderation and varied for a balance of the different enzymes, vitamin complexes, minerals, phytochemicals.

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Excess Double Sugars (Disaccharides) Make You Fatter

Disaccharides are combinations of two simple sugars. Examples are sucrose (table sugar), maltose (in beer), and lactose (in milk). There are usually heavy amounts of these sugars in processed and packaged foods, such as commercial breakfast cereals (cheerios, frosted flakes, raisin bran, corn flakes, etc.), fast food, chocolate bars, sport bars, sport drinks, etc.

When a complex carbohydrate is digested, only one simple sugar is broken off and burned at a time. However, digestion of 2 sugars joined together as disaccharides, releases two molecules ready to be used. Eating disaccharides creates a rush of simple sugars in the bloodstream. For less active people it is very hard on the pancreas, as it is forced to secrete extra insulin to convert the excess blood sugars to fat. Constant strain on the pancreas leads to diabetes.

If there is one food that causes more disease than others it is Sucrose, or common table sugar. In addition to causing weight problems in less active people, it also contributes to bacterial, viral and yeast overgrowth in those people, particularly if their bloodstreams are low in oxygen (oxygen debt) due to poor diet, and/or to little or too much exercise.

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Good Sugars/Problem Sugars

Good sugars consist of any whole sugar or complex carbohydrate consumed in moderation. These are found in vegetables, grains, and many other foods, and contain enzymes, vitamins and minerals necessary for their proper metabolism.

Bad sugars are refined or processed sugar and carbohydrate products which are deficient in enzymes, vitamins and minerals, and which leach your body of these important micro-nutrients when you digest these incomplete foods. Examples are table sugars, maltodextrin, corn starch, refined flours, refined pasta, any white bread, white rice, and other highly processed foods.

Deceptive Labelling: Hidden Sugars and Fats in Packaged Foods

Food processors are taking advantage of labelling laws to make it look as though there are far fewer sugars and unhealthy fats in their products.

Law requires that the most abundant ingredients be listed in order, with the most prevalent first. To make foods sweeter without labelling them as so, the manufacturers are putting in several different sugars so that no one by itself comprises the first or second ingredient. However when you add up the number of individual sugars you will it is often the first ingredient.

Low sugar processed food are often high in fats and oils which they will attempt to disguise in a similar manner, by adding smaller quantities of a myriad of fats and oils, many of which are highly processed toxic synthetics.

No-Fat Labels Usually Contain a lot of Sugar

The same thing is often done in the commercial marketing of low fats. Low fat yoghurts, ice-creams, cookies, and host of other products are almost always full of sugar.

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Continuous Eating of Refined Sugars Will Cause Disease

An excess of refined simple sugars causes severe health problems, as their metabolism not only leeches the body of vitamins and minerals, they also produce acids lowering the body's pH. In addition excess sugar usually stimulates the proliferation of unfriendly bacteria in the intestines, causing many problems including gas, bloating, lowered immune function, and many other problems. It also can cause yeast infections throughout the body.

Any, or all, of these factors can significantly contribute to many degenerative diseases, including heart disease, cancer, diabetes, bowel disease, MS, Lupus, Parkinson's, depression, ADD, acne, osteo and rheumatoid arthritis, etc.

In addition refined sugars and excess simple sugars provide readily available biochemical fuel for bacteria in other parts of the body, which eat the sugars, and for viruses which use the acetates of digested sugars for rapid genetic replication and spreading.

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Glycation & Disease: The Dangers Of Over Cooking Sugars With Proteins Or Fats

Glycation is the result of a sugar molecule, such as fructose or glucose, bonding to a protein or lipid molecule without the controlling action of an enzyme. It may occur either inside (endogenous) or outside (exogenous) the body. Enzyme-controlled addition of carbohydrates is termed glycosylation; this process is less haphazard than glycation. Much of early laboratory research work on fructose glycations used inaccurate assay techniques that drastically understated its importance in glycation formation (Ahmed & Furth 1992).

Exogenous Glycation

Exogenous glycations are typically formed when sugars are cooked with proteins or fats at temperatures over 120°C (~248°F). These compounds are absorbed by the body during digestion with about 35% efficiency. Browning reactions (usually Maillard type reactions) are evidence of pre-formed glycations. Indeed, sugar is often added to products such as french fries and baked goods to enhance browning. Glycation may also contribute to the formation of acrylamide (Stadler *et al* 2002), a potential carcinogen, during cooking.

Endogenous Glycation

Endogenous glycations occur mainly in the bloodstream to a small proportion of the absorbed simple sugars: glucose, fructose and galactose. The balance of the sugar molecules is used for metabolic processes. It appears that fructose and galactose have approximately *ten times* the glycation activity of glucose, the primary body fuel (McPherson *et al* 1988). Glycation is the first step in the evolution of these molecules through a complex series of very slow reactions in the body known as Amadori reactions, Schiff base reactions, and Maillard reactions; all of which lead to advanced glycation end products (AGEs). Some AGEs are benign, but others are more reactive than the sugars they are derived from, and are implicated in many age-related chronic diseases such as: type II diabetes mellitus (beta cell damage), cardiovascular diseases (the endothelium and collagen are damaged), Alzheimer's disease (amyloid proteins are side products of the reactions progressing to AGEs), cancer (acrylamide and other side products are released), peripheral neuropathy (the myelin is attacked), and other sensory losses such as deafness (due to demyelination) and blindness (mostly due to microvascular damage in the retina). This range of diseases is the result of the very basic level at which glycations interfere with molecular and cellular functioning throughout the body and the release of highly-oxidizing side products such as hydrogen peroxide.

Glycated substances are eliminated from the body slowly, since the renal clearance factor is only about 30%. This implies that the half-life of a glycation within the body is about double the average cell life. Red blood cells are the shortest-lived cells in the body (120 days), so, the half life is about 240 days. This fact is used in monitoring blood sugar control in diabetes by monitoring the glycated hemoglobin level. As a consequence, long-lived cells (such as nerves,

brain cells) and long-lasting proteins (such as DNA, eye crystalline, and collagen) may accumulate substantial damage over time. Metabolically-active cells such as the glomeruli in the kidneys, retina cells in the eyes, and beta cells (insulin-producing) in the pancreas are also at high risk of damage. The epithelial cells of the blood vessels are damaged directly by glycations, which are implicated in atherosclerosis, for example. Atherosclerotic plaque tends to accumulate at areas of high blood flow (such as the entrance to the coronary arteries) due to the increased presentation of sugar molecules, glycations and glycation end-products at these points. Damage by glycation results in stiffening of the collagen in the blood vessel walls, leading to high blood pressure. Glycations also cause weakening of the collagen in the blood vessel walls, which may lead to micro- or macro-aneurisms; this may cause strokes if in the brain.

Simple Sugars and High Stress Can Lead to High Cholesterol Levels

While healthy levels of cholesterol are essential to vibrant heath, as is discussed below, too much cholesterol can wreak havoc on your heath. Most people are not aware that we manufacture most of our cholesterol internally, much of that internal production in response to stress and from excess sugar and/or alcohol in the diet.

The more excess calories we consume — especially from sugars and saturated & non-essential fatty acids (see below) — the more pressure there is on the body to make cholesterol[141]. This is compounded by any stress we are under, as the body makes it stress hormones from cholesterol[142].

While many assume all cholesterol is bad for them, nothing could be further form the truth. Proper levels of cholesterol, and the vital role it plays in maintaining our health is discussed next.

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Cholesterol: Essential and Misunderstood

Cholesterol is the primary and essential building block for most hormones manufactured in the body. It is critical to health, as hormones are essential to the overall balanced function and regeneration of the human body.

Cholesterol is misunderstood by most in our medical community. How and why it is made in our bodies is not taught properly. For a complete review of cholesterol's function in the body, please refer to Fats that Heal, Fats that Kill, by Udo Erasmus, Appendix 4).

To quote Erasmus regarding cholesterol: *"There is no nutritional substance as controversial as cholesterol, and no substance about which there is more confusion. There is no other substance as widely publicized by the medical profession—and no bigger health scandal. Cholesterol can strike terror into the minds of misinformed people. The cholesterol scare is big business for doctors, laboratories, and drug companies. It is also a powerful marketing gimmick for vegetable oil and margarine manufacturers who can advertise their products to be cholesterol free.*

The fact is that 999 of every 1000 people can control their cholesterol level and, more importantly, their cardiovascular health, by nutritional means alone. The remaining 1 in 1000

people can also benefit from nutritional improvement. Medical professionals that are untrained in nutrition can not help us reach this objective."

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Some of the Essential Functions of Cholesterol

-Our bodies make Vitamin D from cholesterol and sunlight.
-As discussed above, our bodies make bile acids necessary for the digestion of fats from cholesterol.
-Cholesterol is secreted by glands in our skin to cover and protect it from dehydration, cracking, and exposure to sun, wind, and rain. As a skin covering, it helps to heal skin tissue and prevent infection by foreign organisms.
-Our bodies make the steroid male and female hormones, estrogen, progesterone, and testosterone from cholesterol.
-Our bodies make adrenal corticosteroid hormones from cholesterol. These include aldosterone, which regulates kidney function and water balance by increasing sodium retention by the renal tubes; and cortisone which promotes the synthesis of glucose in response to stress, and which also suppresses inflammation.

(**Important Note:** Many doctors use large doses of cortisone to suppress inflammatory reactions. The pharmacological doses used are much higher than that the body normally produces and produce powerful side effects that include water retention and immune system suppression, and as such are not recommended for long-term use[143]. I personally go further than that, and never recommend cortisone treatment. I have found inflammation can be treated better in more natural and healthy ways.)

-Our bodies use cholesterol to maintain cell membrane integrity. Every tissue cell in the body is made up of hundreds of different compartments housing different parts of the cell. These chambers are like different rooms in a house or factory. The walls, or membranes, of all these compartments are pliable, and constructed primarily of bi-lipid layers (two layers of various types of fat), and lesser amounts of protein, which among other things, help bind these two layers of fat together.

Depending on the state of the blood travelling through your arteries & veins at any given moment, tissue cells are continually adjusting the makeup of their cell membrane's construction, or chemistry, to maintain the optimum flexibility of cell walls.

One critical function of cholesterol is to compensate for changes in membrane fluidity, keeping it within the narrow limits requires for optimum membrane function. Adding cholesterol makes our cell walls stiffer, removing it makes them more flexible. This function is so important that nature has equipped each cell with the means to synthesise its own membrane cholesterol in response to its needs.

Our intake of dietary fatty acids, the building materials for the bi-lipid layer cell membranes, varies from day to day. Rich sources of unsaturated fatty acids like flax oil, and even more so, the cold water fish oils, make our membranes more flexible. On the other hand saturated fatty

acids harden membranes. Cholesterol internally synthesized by the cells, is used to regulate membrane stiffness.

Important Note: Alcohol dissolves our cell membranes making them more fluid. In response, our cells manufacture and inject cholesterol into the membranes to stiffen them, bringing them back to their normal less fluid state. As the alcohol is metabolized, the membrane hardens, and each excess membrane cholesterol is bound to an essential fatty acid and secreted into the bloodstream to be transported to the liver to be converted into bile acids (for the digestion of fats) if there are adequate EFAs, vitamins, and mineral for this transformation to proceed. If there are insufficient EFAs, vitamins, and minerals in the diet, a build up of this fat bound cholesterol will occur.

Assuming there are adequate nutrients for the conversion of this cholesterol to bile acids, our liver secretes the bile acids into the small intestine to assist in the digestion of fats. If there is adequate fiber and regular bowel action, it then moves into the colon to be eliminated from our body as solid waste.

If there isn't sufficient fiber, and/or if one is constipated, these bile acids can be partially reabsorbed and recycled. If fiber is absent, up to 94% of the cholesterol and bile acids are reabsorbed and recycled. This is one of the reasons low fiber diets increase blood cholesterol levels[144].

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Lowering High LDL Cholesterol Levels

Cholesterol is unique in that our body can make it, but not break it down. By contrast sugars, fatty acids, proteins and nucleic acids can all be taken apart and subsequently burned and turned into carbon dioxide, water, and ammonia. Cholesterol must be removed from our bodies in the stool in the form of bile acids and cholesterol molecules.[145]

As mentioned above, fiber and roughage are essential to removing unwanted LDL cholesterol from the body. Fiber from oats, apples, beans, peas, and flax lower LDL cholesterol. Wheat bran does not.[146]

One of the most effective nutrients for reducing cholesterol is krill oil. Clinincal studies done with NKO krill oil show on average it reduced LDL 35% and increased HDL 45%, results superior to those achieved by statins, as 1) HDL and LDL are better balanced, and 2) there are none of the very serious side effects that come with statin use. See this link for those studies: http://findarticles.com/p/articles/mi_m0FDN/is_4_9/ai_n9485702/pg_1?tag=artBody;col1

Reducing stress levels, simple sugar intake, and excess alcohol will also reduce internal cholesterol production levels.

Consumption of essential and other highly unsaturated fatty acids (like krill oil) is necessary for the delivery of excess cell membrane cholesterol to the liver and can lower high cholesterol levels by as much as 25%.[147]

Smoking and coffee both raise cholesterol. Quitting reverses the trend.[148]

Orthomolecular physicians lower high blood cholesterol levels simply by giving high doses of certain vitamins and minerals. Vitamin C and B3 can lower blood cholesterol of 260mg/dl by about 50mg each.[149] The minerals calcium, zinc, copper and chromium are also helpful. (Clinical evidence shows that atherosclerosis can be reversed by exercise, dietary manipulation and micronutrient supplementation.[150])

While animal proteins and fats raise serum cholesterol levels, fruits, vegetables, nuts, seeds, and beans cause it to fall. The Journal of the American Medical Association concluded, *A vegetarian diet can prevent 97% of coronary inclusions.* In the American Heart Journal, two people with heart disease were put on a vegetarian diet for six months. Chest pains disappeared and they were *able to engage in strenuous activities.* One patient decided to continue the vegetarian diet for another five years.[151] The symptoms did not return.

How Good Cholesterol in Food is Damaged

Cholesterol in foods is damaged by oxidation when heated in the presence of air. Scrambling eggs for example, oxidizes the cholesterol exposed to high temperatures and air in an open pan. Soft or hard boiling protects cholesterol while an egg is cooked. Barbequing beef would oxidize the cholesterol on the surface of the beef… however, frying loose ground beef in pan by itself is much worse.

For a more detailed look at issues related to cholesterol and disease please see Appendix 9A

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Infant Formulas

Imagine mixing water, liquid corn syrup, sucrose, soy protein isolate, soy oil, coconut oil, and modified corn starch. Those are the first seven ingredients of a hospital-recommended, best-selling, lactose-free formula.[152] Many newborns are eating these children formulas composed of liquid sugar, toxic oil, empty starch, and synthetic nutrients.

Breast milk contains active anti-infective properties to protect the child against disease and infections. Because bottle-fed babies do not have this advantage, many are constantly fighting infections or sickness. The beneficial bacteria in the stools of breast-fed infants are comprised of 100% bifidus, compared with formula-fed infants at only 30% to 40%.[153] Depletion of healthy bacteria causes bottle-fed infants to be prone to infections.

Scientific investigations by Ohio State University, Food and Technical Division, found that formula with added carrot juice encourages the growth of beneficial bifodobacteria. Their stool resembled more closely those of breast-fed infants.[154]

In a report published by Diabetic Medicine, in the November 1992 issue, 426 children with newly-diagnosed Type 1 diabetes were studied. They found the earlier an infant is started on cow's milk, the greater the risk of developing juvenile diabetes between the ages of 7 and 14.[155]

Milk has also been linked to arthritis.

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Cow's Milk is Not Good Baby Food

Whey, a water-soluble protein in mother's milk, is easily digested by an infant. Cow's milk has one quarter the amount of whey compared to mother's milk. Cow's milk has five times as much salt and seven times the phosphorous, but only one-tenth of the Vitamin E content and half the Vitamin A content of mother's milk. Cow's milk contains trans-unsaturated fatty acids—up to 6% in summer and 3% in winter.[156] Cow's milk has only three percent linoleic acid compared with mother's milk at seven percent. An insufficiency of this essential fatty acid in the maturing infant can cause diaper rash, diarrhea, and eczema.

There are also higher instances of Multiple Sclerosis in areas where children and infants were initially fed dairy products instead of breast milk. Cow's milk contains less lactose than human milk. Lactose contains galactose that is needed to develop the myelin sheath which insulates the nerves.

Human infants naturally have a high percentage of bifidus flora in their intestines to facilitate milk digestion. The beta-lactose in human milk maintains a pure culture of bifidus flora. The alpha-lactose of cow's milk cannot properly maintain a healthy culture of bifidus bacteria. This allows harmful bacteria freedom to multiply and create damaging by-products.[157]

Cow's milk has two to three times the protein content of mother's milk. Extra protein causes changes in the blood acid/alkali balance. These changes can set the stage for infections or a weakened immune system, especially if the infant is suffering from a genetic weakness. A cow secretes an enzyme called rennin that breaks down casein, one of the proteins in cow's milk. The majority of humans does not secrete rennin after infancy, which accounts for many digestive problems associated with milk. Although mother's milk does have casein, cow's milk has double that amount. Casein is the bonding agent that makes wood glue so strong that it will hold furniture together for two hundred years. Doubling the casein content makes cow's milk much harder to digest. It tends to curdle in the stomach, causing mucus and constipation.

Modern Dairy Farming

Cows naturally secrete 400 pounds of milk per year to be suckled by their baby calves. But now they are force-fed, implanted with hormones, and suckled by automated machines. These new modified cows are able to produce 3,200 pounds per year.[158] Eight times the amount of milk which they were created to produce.

Chlorinated hydrocarbons, which cause cancer, have been found in 75% of the milk tested by the Consumers' Union.[159] These toxic chemicals entered the milk through the animal's feed. Other toxic residues entered the feed fat in dairy products through the water, acid rain, chemically-grown, over-sprayed crops, or steroid, antibiotic, and hormone injections by the farmer. When a mother is nursing, doctors tell her to avoid drugs, alcohol, cigarettes, and coffee, because

whatever is in the mother's bloodstream will enter the milk. In the same way, every chemical or drug ingested by a cow contaminates milk. Even if the contamination is below government standards, this small amount accumulates and can have a detrimental effect on health.

In November 1993, the US FDA approved Bovine Growth Hormone. The hormone, when injected into nursing cows, increases milk production by 20%.[160] It also increases udder infections, causing a greater need for antibiotics. On February 4, 1994, a three-month moratorium on BGH ended. The company that developed BGH was given approval to start shipping to dairy farmers across the United States. BGH is both unnecessary and dangerous. Use of BGH greatly increases the amount of IGF-1 that has been associated with colon tumours and skin cancer.[161]

(Information from Canadian government researchers indicates that the Monsanto Company and/or the U.S. Food and Drug Administration covered up the results of a primary human safety study which found that rats exposed to rBGH experienced negative health effects: findings which should have led to long term human health studies before rBGH was approved. rBGH is banned in Europe, Canada, Australia, New Zealand, and other countries because of these potential threats to people and family farmers.)[162]

Through effective promotion, dairy products have become one of North America's major sources of nutrition. Yet more and more books are being written by noted doctors and nutritionists making frightening connections to the serious medical plagues rampant in countries with high-dairy consumption. Even Dr. Benjamin Spock, a child-care expert who was a strong advocate of dairy products for children, joined the many voices in questioning its nutritional value and even warning of serious possible dangers.[163]

Dairy Boards have been successful marketing cow's milk as a requirement for healthy development. Yet Earth's history has been full of isolated communities living on simple sparse diets. Many of those cultures were poor and had little or no dairy or meat products available. The Chinese, Japanese, Filipinos, Indonesians, Taiwanese, and Indians ate a simple diet of seasonal, local foods; a high-starch diet such as rice, with fresh vegetables, fruits and small amounts of fish.

Refined Food Ingredients to Avoid in Packaged Foods

This list is under construction and will be extensively expanded soon. I haven't deleted it from the paper because overly refined substances should be avoided.

Cornstarch: a refined white flour consisting of starch prepared from the grains of corn; used in cooking as a thickener

Glycerol: a sweet syrupy trihydroxy alcohol obtained by saponification of fats and oils

Maltodextrin: a refined cornstarch consisting of many double sugars which digest too rapidly. Commonly found in protein powders. Will rot your teeth and give you bad breath, as it digests too quickly in the mouth, feeding and allowing acid producing bacteria to flourish.

Corn syrup: is a syrup made from corn starch and composed mainly of glucose.

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Toxins in Food

The Serious Problems with Farmed Fish

Wild uncontaminated fish is hard to find, and I am concerned about the immediate effects of pollutants in farmed fish on the development of the fetus and young kids, as well as the longer term effects of pollutants in fish oils on healthy adults.

I recommend hair analysis, in part, to see what one's heavy metals contamination might be from prolonged exposure to regular consumption of small and large predator fish.

I'm researching what other inexpensive and pragmatic testing might be available for detecting other dangerous toxins, such as Persistent Organic Pollutants (POPs) discussed below. Most such toxins can be reduced or eliminated from the body in various manners once they have been identified.

Its well established that regular fish-eating northern peoples and animals have higher bioaccumulations of heavy metals and other toxins, and that they are suffering greatly.

Pollutants such as PCBs from distant industrial centres have been blamed for an alarming incidence of hermaphroditic polar bears in the Arctic Svalbard islands. Recent studies have shown that 1.2% of Svalbard's polar bear population now have the reproductive organs of both sexes, but that ten years ago the phenomenon was unknown in this Norwegian territory where the bear's population equals that of humans.[164]

Dr. Andrew Derocher, a research scientist at the Norwegian Polar Institute, says that effects of pollutants such as PCBs on polar bears could be tracked because of the short and simple food chain. Plankton contaminated by the chemicals is eaten by fish, which are subsequently eaten by ringed seals, the staple diet of polar bears. Polar bears are thought to be the animals most visibly affected by PCBs because they primarily consume seal fat, and such pollutants gather in fat tissue. PCBs are known to affect the endocrine system, which may explain conditions such as hermaphroditism taking place among the female bears.[165] Sexual malformation has also seen in many other life forms living in a polluted aquatic environment.

Northern peoples in Canada face a double whammy because many are turning to the highly processed packaged southern foods high in refined sugars, trans fatty acids, and depleted of minerals, vitamins, and enzymes. The combination of such problems is helping to produce cancer rates as much as 5 times higher than their southern counterparts.

I do not recommend eating any farmed fish species, including salmon. All salmon, trout and char available in commercial food markets is farmed unless otherwise marked, and most is between 10-15 times higher in toxins and heavy metals than wild fish, primarily because these farmed fish are being fed contaminated fish meal and are thereby further concentrating the toxins found therein. (There is some salmon farmed in Europe that is fed organic sources, but I don't have any figures on toxicity, and while the feeds may be organic, they are not natural to fish and

contain pigments, so the fish will be of a different biochemical make-up as compared to free foraging wild fish).

Large wild predator fish such as tuna, shark, marlin, opah, swordfish, king fish, should be avoided. Mercury pollution in some of these species has increased some 2000x in recent years, from parts/billion levels of contaminants, to parts/500,000 levels.

Hence the recent tuna alarm and government warnings in the United States as studies confirm these earlier findings. I have dramatically cut back my intake of smaller wild cold-water fish because they are polluted as well, as raised mercury levels in my own body confirm.

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Sourcing Cleaner Fish, Fish Oil, & Fish Liver Oils

Fish Oils: Not all fish oils are the same. There is a very big difference between ordinary fish oil and those that have been molecularly distilled, a process for cleaning oil which removes the vast majority of POPs, heavy metals, and other toxins. Ordinary fish oil is as dirty as the fish it comes from, but even worse, as it is in a concentrated form.

Many Molecularly Distilled Fish Oil Products May Still not be Clean

Because sourcing clean fish is so problematic (we need it for optimum health, but all natural sources are now polluted), I began sourcing the purified fish oils for potential use with my athletes. I found many different molecularly distilled fish oil products, such as fish liver oil, which claim to have no contaminants. That said, even "pharmaceutical" grade fish oils can cause serious increases in mercury retention.

After consuming pharmaceutical grade and/or ordinary fish oil supplements regularly (against my warning or without realizing these dangers), both athletes and individuals showed very high levels of mercury in hair samples which I had tested. After just a few months of regular supplementation they had mercury concentrations 10-20 times above normal levels.

While pharma-grade molecularly distilled oils appear to be "clean", as they usually have less than parts per million (ppm) concentrations of mercury and other toxins, because of the body's potential to biomagnify toxins by millions of times, they can still quickly build up in our bodies. Such supplements need to have concentrations of parts per trillion (ppt) or lower not to cause a build up of material concentrations in the consumer. Before recommending them, I would also need to be guaranteed these compounds can adequately be protected from trans fatty acid formation and oxygen-induced free-radical damage during manufacturing.

If important nutrients from clean fish are not available due to supply problems, people living in dark winter climates (or who are inside all day) needs to look carefully at how to get adequate quantities of various essential fatty acids and vitamin D in the diet, particularly during the winter time, as these foods transport high concentrations of absorbed sunlight found in the electron bonds within their super-polyunsaturated fatty acid molecules (4, 5, & 6x unsaturated).

These molecules contain either 4, 5, or 6 sunlight-storing double electron bonds which make the oils very bio-active and critical to physical and mental health for any animal living in low light winter climates. These oils are found in higher concentrations in the body where higher levels of oxygen are needed, such as the brain, sensory organs, sexual organs, etc. (Other less potent forms of the sunlight-rich oils are the 2 & 3x unsaturated omega 3 & 6 fatty acids found in primrose oil, flax oil, pumpkin seed, walnut, and many other vegetable, seed, and nut oils. These have to be further modified by our bodies to produce the oils found in cold-water fish.)

The electron bonds in fish oils originate in sunlight-absorbing phytoplankton in the sea, and then are passed on, and concentrated, by the various animals eating the plankton, and in turn by others eating them. Unfortunately the same goes for toxins in the water. As mentioned above, its estimated that salmon concentrate PCBs and other POPs 9 million times over that found in the water.

Vegetarians will have to stick to flax, hemp, walnut, and other oils rich in simple Omega 3 fatty acids. The more complex fish oil molecules can be synthesized internally from the less complex vegetable and seed oils. The only downside is that some people have limited ability to convert the vegetable oils to the more complex molecule, and it requires more energy, as it isn't as metabolically efficient as eating clean fish or fish oils.

Fish Liver Oils: Fresh uncontaminated fish *liver* oils are considered as good nutritional supplements for various health problems as they are an excellent source of Vitamins A, D, and hundreds of naturally produced synergistic compounds found in these substances. They are part of the overall vitamin complex generated by the animal, and which are not found in synthetic and/or plant based formulations. But because the liver is responsible for detoxification in animals, most fish livers oils are now contaminated with heavy metals, POPs, and other toxins.

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Polluted Oceans, Lakes and Rivers

Most people are not aware of how polluted the oceans have become due to petro-chemical runoff and other forms of toxic industrial pollution.

End users of petroleum oil—not the ships and pipelines that transport it—are responsible for 85 percent of the man-made petroleum pollution in the North American oceans, according to a study released May 23, 2002 by the National Research Council (NRC) in Washington.

Oil in the Sea: Inputs, Fates, and Effects reports that 29 million gallons of petroleum (109,800 kiloliters) pour into North American waters each year. Most of it comes from land-based run-off, polluted rivers, boats and other recreational watercraft. Massive oil slicks and blackened beaches caused by occasional shipping spills and accidents get the most attention, but sources emitting smaller amounts of petroleum day after day are the greater causes of oil pollution in the seas, according to a press release announcing the report's publication.

Oil spills account for 8 percent of the annual gush of petroleum into the seas while oil drilling and extraction is another 3 percent.

Besides these man-made petroleum sources, the US NRC study finds that 47 million gallons (almost 178,000 kiloliters) seep into the ocean from natural geologic formations on the sea floor. Worldwide, the report says, 210 million gallons (almost 795,000 kiloliters) of oil from manmade sources flow into the oceans, with another 180 million gallons (more than 681,000 kiloliters) coming from natural seepage.

Therefore fish from non-North-American waters is probably even worse than ours if the American study is right.

This American study claimed good news in that (according to their figures) there is less petroleum in the oceans than was reported in a similar 1985 study from the NRC. However the figures quoted in these American sponsored studies contradict those generated by other reputable international agencies, particularly as pertains to how much oil in the oceans is due to natural seepage from the ocean floor.

The 2002 US NRC report estimates the average total worldwide annual release of petroleum (oils) from all known sources is 1.3 million tonnes, but admits it potentially could be as low as 470,000 tonnes, and as high as 8.4 million tonnes per year. According to the report, the main categories of sources contribute to the total input as follows:

-Natural seeps: 46%
-Discharges from consumption of oils (operational discharges from ships and discharges from land-based sources): 37%
-Accidental spills from ships; 12%
-Extraction of oil: 3%

The Australian Petroleum Production and Exploration Association (APPEA) claims the following distribution of the inputs from different sources:

-Natural seeps: 7%
-Operational discharges from ships not within the oil industry: 33%
-Land-based sources (urban runoff and discharges from industry): 37%
-The oil industry - tanker accidents and offshore oil extraction: 14%
-Airborne hydrocarbons: 9%

In their 1993 report in, the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) estimated a total input of oils at 2.3 million tonnes per year and ranked the sources like this:

-Natural seeps: 11%
-Land-based sources (urban runoff, coastal refineries): 50%
-Oil transporting and shipping (operational discharges, tanker accidents): 24%
-Offshore production discharges: 2%
-Atmospheric fallout: 13%

Go to http://oils.gpa.unep.org/facts/sources.htm for more info on global marine oil pollution.

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The Oceans Will Clean Themselves of Spilled Oil if Given The Chance

While its very damaging, and discouraging, that so much oil is being spilled into the oceans due to human activity, I feel there is some good news that can be pulled out of all of this. Since substantial levels of oil gradually constantly seep into the oceans naturally, that means Nature has developed sustainable methods of converting and cleansing oil from the oceans, likely into non-toxic forms through natural processes Western science may, or may not yet, understand.

Oil, while a toxic substance in many of its forms, is still a natural substance for which Nature's evolutionary processes must have developed various enzyme-based cleansing/elimination methods — if not, with so much natural oil slowly seeping in from the ocean floor, the Oceans would have been a toxic soup since their creation and would never have supported life.

Because of this and other examples of the earth's ability to heal, I believe Nature has sophisticated cleansing methods that will rather quickly clean the planet, if we would just stop polluting and let these natural processes get a foot hold. Ohio's Cuyahoga River, which was so dirty it actually burned for several days in 1969 (helping force in the US 1972 Clean Water Act); the Thames River; Lake Erie; and many other body's of water have made remarkable comebacks when given a chance.

Unfortunately, the natural oil cleansing capability of the oceans is being overwhelmed by far greater man made contributions. Also, it would not yet have adapted to deal with any number of man-made toxic oil solubles and other derivative by-products being spilled as well.

Persistent Organic Pollutants (POPs) Are A Bigger Problem Though

Bigger, and even more discouraging, pollutant problems are Persistent Organic Pollutants like PCBs, DDE, and the many other non-natural toxic substances. Nature hasn't evolved the enzyme systems to deal with these "new" toxic chemicals, and consequently they are not breaking down in the environment. Even if man-made oil problems are solved, the persistent nature of POPs will prove to be a far bigger detriment to future normal genetic development and health.

As reported by Reuters (Dec 8, 2003), the Odyssey, a scientific research vessel circumnavigating the globe, has been tracking whales in the hope that they may hide in their bulk important clues to the state of the world's seas. Working for the U.S.-based Ocean Alliance, a whale conservation and research body, the Odyssey set out in March 2000 to quantify that toxicity, using tissue samples from sperm whales to indicate how polluted the waters really are.

"We chose to study the toxicity levels in sperm whales because they are one of the most abundant great whale species left on the planet and are found in all seas and oceans in the world," said Genevieve Johnson, Ocean Alliance's education director.

"We were surprised by the levels of pesticides like DDT found in our preliminary analysis of sperm whale tissue samples. We have completed almost four years of our five-year study and have so far taken tissue samples from about 900 sperm whales in various parts of the world." An adult male sperm whale can reach lengths of 60 feet and weigh more than 60 tons. It's believed to be the biggest toothed predator in the world.

There are about 350,000 sperm whales around the world, but Johnson said the pesticides found in their blubber are problematic for the species.

DDT is banned in many countries because of its harmful effect on humans and animals. It is still used widely in developing countries—sold on the black market because of its low cost and effectiveness as an insecticide.

Other toxic POPs like PCBs have been found in sperm whales. Made and used on land, these are released into the environment and eventually make their way into the oceans through rivers and rainfall.

Johnson said the toxins could prevent whale fetuses from developing properly, resulting in high levels of sexual abnormality, cancers, birth defects or sterility. "The toxicants that we are finding in these whales could have serious implications for humans as we are also feeding high on the oceanic food chain," Johnson said.

Additionally, toxic fish and oceanic plants have been found to contaminate land in Canada and other parts of the world. Part of this cycle is caused by polluted fish swimming back up river, where they further pollute streams, lakes, and wildlife when they die after spawning.

Other than heavily polluted agricultural land and various industrial sites, the oceans, and many of our rivers are some of the most contaminated areas of the ecosystem. Moreover, half the fish caught is turned into feed for farm animals where these toxins are concentrated further. Of course when we eat them they are concentrated further again.

As stated earlier, studies show toxins are showing up in the breast milk of nursing mothers who pass them on to their babies.

So, at home I am eating organic and looking for rich food sources grown or produced from uncontaminated land. When not eating organic at home, I eat lower on the food chain, and avoid foods potentially high in fat soluble petrochemicals and other toxins. Back to Top

Potential For Increased Viral Mutation in Intensively Farmed Animals

As first written in an earlier version of this paper 3 years ago, I think formal studies will eventually show cause & effect links between increased rates of genetic & viral mutation and intensive livestock farming, with such mutations ultimately being traced back to impaired cellular replication and immune system function in animals raised in this manner as a result of:

- inferior and unnatural livestock foods, which creates weaker mal-nourished animals with altered biochemistries and greater potential for genetic mutation,
- artificial hormone programs which further encourage altered biochemistries and greater potential for genetic mutation,
- highly confined conditions, which do not allow animals to exercise and cleanse their lymph systems through muscle contraction, and which additionally create low-oxygen, anaerobic conditions in the animals that allow bacteria and virus to flourish in these unhappy and sedentary animals,
- heavy use of antibiotics, vaccines, and pesticides, which compromises the lymph and immune systems of animals, as well as encouraging resistant forms of bacteria and virus,
- higher, damaging levels of cortisol secretion in many species due to the stressful conditions in which they live.

The summer of 2005 saw the Avain Flu virus begin to spread around the world. We can expect more of the same with other viruses and bacteria in the years ahead.

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Organic Free Range Meats, Dairy, and Eggs

Meat, dairy, and egg eaters, need to be aware of the dangers of livestock raised by intensive farming methods. Animals raised on hormones, antibiotics and deficient nutrients produce meats, eggs, and dairy of similar characteristics. Due to bio-magnification, an estimated 94% of pesticides sprayed on crops are concentrated at the top of the food chain in the animals fed these sprayed crops.

The growth hormones stored in these animal's fat are causing accelerated development in children eating these foods, resulting in increased percentages of premature sexual development and of very tall and large youth of both sexes.

Grass Vs. Grain

If buying beef, try to find free range grass fed beef, and preferably organic. Just as we are what we eat, so animals are what they eat as well. Animals normally raised on grass produce lean meat higher in essential fatty acids and much lower in saturated fat. However most animals are being fed various high carbohydrate grains to fatten them up. As a result their meat is less nutritious.

Eating Good Food on a Limited Budget

Even if you cannot always find or afford organic food, you can still make smarter choices that will ensure that you and your family obtain the healthiest possible supply of food by following a few simple rules.

-Buy healthy organic food staples in bulk: brown rice of any type, oatmeal, flax seed, other multi-grain cooking cereals, various beans, lentils, etc,

-If you are strapped for cash, don't buy expensive processed packaged foods like cold cereal, ready made dinners, crackers, cookies, cakes, white rice, pizza, ice cream potato products, chips. Read labels carefully and avoid packaged foods that are full of sugar (which is most of them).

-Eat foods that are lower on the food chain. Don't buy non-organic red meat, eggs, dairy, or fowl. 94% of all toxins, pesticides, hormones, antibiotics and other contaminants are biomagnified in these foods. While non-organic produce and grains are still contaminated and low in mineral, they are still much healthier than foods higher in the food chain.

-Don't buy soft drinks, sugar & fruit drinks, Tropicana (especially the "real pulp" version which contains added wood pulp), etc.

-Don't eat non-organic peanuts, peanut butter, or soy products. Cotton, peanuts, and soybeans are the most heavily sprayed crops. Skippy peanut butter, and others like it are some of the worst foods you can eat. Read the label and see why.

-Don't eat farmed fish. Eat wild pacific fish, canned wild salmon, etc.

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PART 3

Acidosis and Modern Factors Affecting Optimum pH Balance in the Body

Substances ***inside*** a cell are found in ***intracellular*** fluids. Nutrients and other substances in blood and lymph fluid ***outside*** a cell are found in ***extracellular*** fluids. Many nutrients and substances need to be transported from the blood into and around the cell, while waste, and manufactured by-products for use elsewhere, need to transported out. Our bodies use electrical forces of attraction and repulsion to move various biochemical substances from one part of the body to another.

Maintaining healthy transport of substances in and out of cells is critical to preventing degenerative disease such as cancer, diabetes and heart disease. However, many are unaware of how transportation can be disrupted by foods (or drugs) that make our body's cells too acidic, resulting in **acidosis.**

As discussed above, all foods are broken down from their electrically-neutral whole state, into smaller, oppositely charged parts, called acids and bases. These slightly charged molecules are easier to move around, as they are repelled or attracted to other substances.

Water, or H_2O, can be easily broken into its two oppositely charged parts, H+ and OH-. A certain number of such broken up molecules exist in any water based solution, either as H+ and OH-. Other compounds that dissolve in water can also split into their respective charged parts and easily moved about the body.

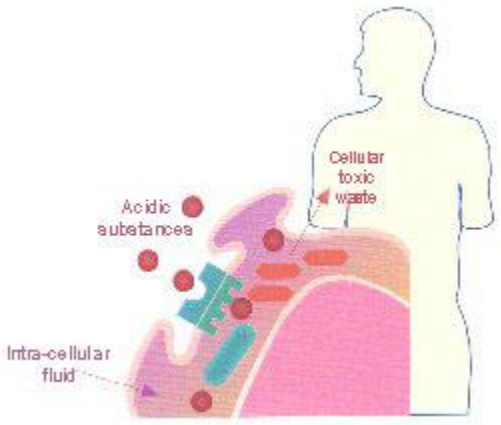
Because of differing electrical (voltage) potentials on the outside side of a cell membrane as compared to the inside (extracellular vs. intracellular), many nutrients and other substances can be electro-magnetically "pumped" across various cell membranes. For this dynamic and continuous cellular pumping activity to occur properly, the proper voltage difference between on one side of the cell wall and the other must be maintained at an optimum level. If a wide enough difference in voltage potential is not maintained, the repelling or attractive force between two compounds becomes too weak to move substances, causing biochemical stagnation.

To ensure proper voltage differences and "internal electrical function" is maintained, various parts of our body must remain within a certain pH range for normal biochemical reactions to occur. As discussed below, the types of food we eat determine if this "pH based" voltage differential is maintained.

Acid pH & Toxic Waste

Virtually all cellular functions are sensitive to alteration of the pH balance of fluids. The metabolic processes depend on a precisely balanced blood pH value of 7.35 to 7.45 (7.4).[166] pH in extracellular fluid is always close to that of blood.[167] If it waivers beyond those limits, either higher or lower, certain enzymatic reactions fail to occur and cellular metabolism becomes difficult to regulate. If the pH deviates too far to the acid side, cell metabolism stops. As connective tissue cells become poisoned in their own toxic wastes, these cells die.

When the range becomes too acidic, acid toxicity begins to permeate the tissues of the body. This encourages the growth of degenerative disease.



When connective tissue cells die, critical bridges and passageways between the cardiovascular system and the rest of the cells and organs of the body are cut off. Such an effect is very problematic, as when these bridges are closed, nutrients can no longer be supplied, nor can wastes be removed. This causes the waste to back-up and build upon itself, dumping acids back into the bloodstream and other critical organs.[168]

As more and more acid accumulates and storage capacity is exhausted, the body slowly begins to deteriorate in its own acidic poisonous wastes and degenerative disease thrives. Without warning, acid wastes begin to silently accumulate in cells and organs. The damage caused is compounded daily, becoming more aggressive and potentially deadly if no action is taken to reverse it.

Acidosis is so corrosively destructive that it's now considered the catalyst to most, if not all, degenerative diseases including: cancer, stroke, heart attack and other cardiovascular diseases, diabetes, arthritis, obesity, immune deficiencies, neurological dysfunction, gout, ulcers, colitis and other bowel disorders, acid reflux, blemishes and acne. This is because the first thing acidosis affects is the strength and function of our cell membranes, the defensive walls protecting all life forms.

As discussed above, health & healing is dependant upon cell division/replication and regeneration. If cell membrane function is disturbed, cell replication, which requires this membrane to divide properly, is drastically affected. In addition weak cell membranes leave our delicate DNA and other genetic material poorly protected and vulnerable to corrosion, infection and mutation.

Understanding pH...

As stated above, Water, or H_2O, can be easily broken into its two oppositely charged parts, H+ and OH-. A certain number of such broken up molecules exist in any water based solution, either as H+ and OH-.

If for any number of common reasons there is a build up of one charge over another in a fluid, that fluid becomes an acid or a base, or acidic or alkaline.

pH, is the abbreviation for "potential of hydrogen" or H+, and is a measure of the degree of acidity and alkalinity of a solution.

What actually is being measured is the amount of free hydrogen ions (H+) in solution: free H+ combines with certain metals to form acids. Therefore, acidic solutions have greater free H+ concentration potentials than those that are base or alkaline. Alkaline solutions have less free H+

concentration potentials, but greater than OH- concentration potentials which combine with metals to form bases or alkalines.

The pH scale ranges form 0 to 14, where anything with a pH value of less than 7.0 is considered acidic, and greater than 7.0 is considered alkaline or base. The higher the pH, the greater the degree of alkalinity or baseness. The lower the pH, the greater the acidity.

More importantly the pH scale is logarithmic (or exponential). That means a pH of 6.0 is 10 times (x) more acidic than 6.99, or a pH level that is practically neutral. 5.0 is 100x and 4.0 is 1000x. Same for alkaline solutions in the other direction.

Therefore, vinegar with a pH of 3.0 is 100,000x more acidic than sea water with a pH of 8.0. Oven cleaner with a pH of 13.0 is 3000x more alkaline or base than the water in the Great Salt Lake, which has a pH of 10.0. The blood prefers a very slightly alkaline solution of 7.4 and stays within a very narrow pH range at all times. If it falls below this for any length of time it is fatal. The lower limit of blood pH at which a person can live more than a few hours is about 6.8, and the upper limit is about 8.0.[169]

Range of pH Values

ACID	NEUTRAL	ALKALINE
pH = 0.0 to 6.99	pH = 7.0	pH = 7.01 - 14.0

What's normal pH...

There are a number of body systems which all have their own specifically preferred pH. Overall, the body's internal chemical environment normally changes from a weak acid to a weak base within a 24-hour period, usually more acid at dawn and most base at sunset. These physiological changes occur on a sine curve during this period. The slightly acid time period of early morning, a pH of less than 7.0, is optimal for the activity of the nerves, hormones and neurotransmitters such as adrenaline, thyroxine, histamine, acetylcholine and other biogenic (necessary for life) amines.[170] In this pH, acidic substances in connective tissue (stored acidic wastes) are dissolved by the enzyme hyaluronidase into liquid form and thereafter excreted from the body as wastes.

Blood pH:

The bloodstream is the most critically buffered system of the entire body, far more sensitive than any other. Arterial and venous blood must maintain a slightly alkaline pH: arterial blood pH = 7.41 and venous blood pH = 7.36. Because the normal pH of arterial blood is 7.41, a person is considered to have acidosis when the pH of blood falls below this value and to have alkalosis when the pH rises above 7.41.

Range of Arterial pH Values

ACIDOSIS	NEUTRAL	ALKALOSIS
pH = 0.0 to 7.40	pH = 7.41	pH = 7.42 to 14.0

Interstitial fluids and connective tissue pH:

A normal pH in these areas is 7.34 and 7.40, a slightly more acid profile, because body cells dump as much free hydrogen (H+) as possible, buffering the blood as much as possible. However, pH in these areas can dangerously drop to concentrations of pH = 5.0.

Urine pH values:

In a pH balanced body, urine is slightly acid in the morning, (pH = 6.0 - 7.0) generally becoming more alkaline (pH = 7.0 - 8.0) by evening in healthy people, primarily because no food or beverages are consumed while sleeping. Whereas, during the day the body buffers the pH of the food and beverages consumed by releasing electrolytes and the pH level goes up. This process allows the kidneys to begin the elimination process slowly.

Consistent readings outside the range implies that cells are being burdened with acidic or caustic pH fluids. Long term experience outside this range is unhealthy. However, the pH of urine can range from an extremely unhealthy low of 4.5 to a high if 8.5, which it tolerates a little easier, depending on the acid/base status of the extracellular fluids. A high pH value may also indicate the body is over buffering to compensate for a physiological system that is too acidic.

Range of Urine pH Values

UNHEALTHY pH < 6.0	NEUTRAL pH = 6.0 TO 8.0	UNHEALTHY pH > 8.0

Generally, when urine pH is 6.0 and below for extended periods of time, it is an indication that the body's fluids elsewhere are too acidic, and it is working overtime to rid itself of an acid medium. Thus, when urine pH is normal, then the blood pH is normal, but when the urine pH is overly acidic, the body has to release too many alkaline electrolytes to keep the blood pH level normal and maintain life. Easy to use pH test strips are available to indirectly determine the safety of all body fluids, including blood.

Saliva pH values

The human body will function normally when the pH of saliva is between a of 6.8 (slightly acidic) and 7.5 (slightly alkaline). A ***saliva*** pH of 6.8 - 7.2 is considered by many to be optimum. (Children are usually higher.) While our bodies will continue to function if the pH of internal fluids fluctuates, optimum function diminishes proportionately as pH rises or falls further out of the ideal range. (See below for information on how to test your saliva pH)

Range of Saliva pH Values

UNHEALTHY pH < 6.0	Heading For Disease pH = 6.0 TO 6.4	On the Low side pH = 6.4 TO 6.8	OPTIMUM pH = 6.8 TO 7.4	On the High side pH = 7.5 TO 8.0	UNHEALTHY pH > 8.0

How Tissue pH Is Affected By The Foods You Eat

When foods are metabolized (burned) in our body, an "ash" or residue is produced, just like that in a fireplace. Even though most foods are slightly acidic, the ash produced from various foods can be either alkaline or acidic.

A rough rule of thumb: the digestion of proteins (amino acids) and fats & oils (fatty acids) usually produces acids in the body. However digestion of mineral rich fruits and vegetables normally produces alkaline ash. It's these mineral rich carbohydrates that balance the acidic digestive byproducts of fat and protein metabolism and prevent the body from becoming overly acidic. Conversely, too many organic mineral rich vegetables and not enough acid forming foods can lead to an overly alkaline condition in the body.

The chart on the following page show which foods are produce alkaline residues and which foods create acid residues.

Many believe the healthiest diet is combination of foods that are 80% alkaline – 20% acid producing.

I believe that this is good advice for many, but that we are all individuals, and, as such, have varying personal requirements based on metabolism, levels of exercise & stress, and other factors.

My advise would be to monitor your pH and determine the proper balance of food best suited to you.

Note that a food's acid or alkaline-forming tendency in the body has nothing to do with the actual pH of the food itself. For example, lemons are very acidic, however the end-products they produce after digestion and assimilation are very alkaline, so lemons are alkaline-forming in the body. Likewise, meat will test alkaline before digestion, but it leaves very acidic residue in the body so, like nearly all animal products, meat is very acid-forming.

Saliva readings that are consistently too much lower than 6.5, or higher than 7.5, can be problematic. If too acidic, you will probably need to increase your intake of fresh organic vegetable juices, whole vegetables, fruits, and alkaline minerals such as potassium, magnesium and calcium.

The use of synthetic fertilizers, has led to a severe demineralization of conventional farmland (non-organic) over the second half of the 20th century. This is because such synthetic fertilizers do not contain a full range of important minerals normally found in natural fertilizers. Mineral levels in foods produced from such soils have fallen by as much as 60-99.9% (See Appendix 1). This is leading to serious mineral deficiencies, and increased acidosis, in any animal or person eating such foods, and is at the root of much degenerative disease in the Western world.

Alkaline vs. Acid producing Foods

Most Alkaline	Alkaline	Lowest Alkaline	FOOD CATEGORY	Lowest Acid	Acid	Most Acid
Stevia	Maple Syrup, Rice Syrup	Raw Honey, Raw Sugar	SWEETENERS	Processed Honey, Molasses	White Sugar, Brown Sugar	NutraSweet, Equal, Aspartame, Sweet 'N Low
Lemons, Watermelon, Limes, Grapefruit, Mangoes, Papayas	Dates, Figs, Melons, Grapes, Papaya, Kiwi, Berries, Apples, Pears, Raisins	Oranges, Bananas, Cherries, Pineapple, Peaches, Avocados	FRUITS	Plums, Processed Fruit Juices	Sour Cherries, Rhubarb	Blueberries, Cranberries, Prunes
Asparagus, Onions, Vegetable Juices, Parsley, Raw Spinach, Broccoli, Garlic	Okra, Squash, Green Beans, Beets, Celery, Lettuce, Zucchini, Sweet Potato, Carob	Carrots, Tomatoes, Fresh Corn, Mushrooms, Cabbage, Peas, Potato Skins, Olives, Soybeans, Tofu	BEANS VEGETABLES LEGUMES	Cooked Spinach, Kidney Beans, String Beans	Potatoes (without skins), Pinto Beans, Navy Beans, Lima Beans	Chocolate
	Almonds	Chestnuts	NUTS SEEDS	Pumpkin Seeds, Sunflower Seeds	Pecans, Cashews	Peanuts, Walnuts
Olive Oil	Flax Seed Oil		OILS	Corn Oil		
		Amaranth, Millet, Wild Rice, Quinoa	GRAINS CEREALS	Sprouted Wheat Bread, Spelt, Brown Rice	White Rice, Corn, Buckwheat, Oats, Rye	Wheat, White Flour, Pastries, Pasta
			MEATS	Venison, Cold Water Fish	Turkey, Chicken, Lamb	Beef, Pork, Shellfish
	Breast Milk	Soy Cheese, Soy Milk, Goat Milk, Goat Cheese, Whey	EGGS DAIRY	Eggs, Butter, Yogurt, Buttermilk, Cottage Cheese	Raw Milk	Cheese, Homogenized Milk, Ice Cream
Herb Teas, Lemon Water	Green Tea	Ginger Tea	BEVERAGES	Tea	Coffee	Beer, Soft Drinks

Food and Beverage Chart:

Source: http://www.chimachine4u.com/AA.html

ALKALINE (green) - ACID (grey)

* Excellent for preventing and combating cancer.

VEGETABLES

Alfalfa
Asparagus
Barley Grass
Green Beans
Beets*
Broccoli*
Brussel sprouts
Cabbage
Carrot*
Cauliflower*
Celery
Chlorella
Cucumber
Dandelions
Dulce
Edible Flowers
Eggplant
Fermented Veggies
Garlic*
Greens - Beet, Chard, Collard, Mustard, Wild
Kale
Kohlrabi
Lettuce
Mushrooms
Nightshade Veggies
Onions
Parsnips (high glycemic)
Peas
Peppers
Potatoes
Pumpkin
Radishes
Rutabaga
Sea Veggies
Spinach
Spirulina
Sprouts
Squashes
Sweet Potatoes
Tomatoes
Watercress

ORIENTAL VEGETABLES

Daikon Radish
Dandelion Root
Maitake, Reishi and Shitake Mushrooms
Sea Veggies - Kombu, Nori and Wakame Seaweed

VEGETABLES

Corn
Lentils
Olives
Winter Squash

FRUITS

Blueberries
Canned or Glazed Fruits
Cranberries
Currants
Plums
Prunes

GRAIN PRODUCTS

Amaranth
Barley
Bran, wheat
Bran, oat
Bread
Corn
Cornstarch
Crackers, soda
Flour, white
Flour, wheat
Hemp Seed Flour
Kamut
Macaroni
Noodles
Oats (rolled)
Oatmeal
Pasta
Quinoa
Rice (all)
Rice Cakes
Rye
Spaghetti
Spelt
Wheat
Wheat Germ

BEANS & LEGUMES

Beans - Black, Kidney, Lima, Pinto, Red, Soy, White
Lentils
Almond Milk, Rice Milk, Soy Milk
Peas - Chick and Green

DAIRY

Butter, Salted

Umeboshi (pickled plums)

FRUITS

Apple
Apricot
Avocado
Banana (high glycemic)
All Berries inc. - Blackberries, Raspberries*, Strawberries
Cherries, sour
Coconut, fresh
Currants and Raisins
Dates and Figs, both dried
Grapes*Purple
Grapefruit
Lemon and Lime
Melon - Cantaloupe, Honeydew, Musk, Water
Nectarine
Orange and Tangerine
Peach
Pear
Pineapple
Umeboshi Plums
Rhubarb
Tomato
Tropical Fruits

PROTEIN

Cottage Cheese
Chicken Breast
Nuts - Especially Almonds and Chestnuts
Seeds - Pumpkin, Sprouted, Sunflower - Millet
Tempeh (fermented)
Tofu (fermented)
Whey Protein Powder
Yogurt, Plain

SWEETENERS

Stevia

SPICES & SEASONINGS

All Herbs
Cayenne and Chili Pepper - Curry - Tumeric*
Cinnamon - Ginger
Miso - Tamari
Sea Salt

OTHER

Apple Cider Vinegar
Bee Pollen

Cheese - Cow, Sheep and Goat
Cheese - Parmesan and Processed
Ice Cream
Ice Milk

NUTS & BUTTERS

Brazil Nuts, Cashews, Peanuts, Pecans, Pistachio, Walnuts
Legumes
Peanut Butter
Tahini

ANIMAL PROTEIN

Beef
Corned Beef
Lamb and Veal
Pork and Bacon
Sausage
Turkey
Venison
Rabbit
Organ Meats
Fish - Carp, Cod, Haddock, Pike, Salmon, Sardines, Tuna
Shellfish - Clams, Lobster, Mussels, Oyster, Scallops, Shrimp
Eggs - Less acidic if natural feed, no hormones, no antibiotics.

FATS & OILS

Oil - Avocado, Canola, corn, Flax, Hemp Seed, Olive, Safflower, Sesame, Sunflower
Butter
Lard

SWEETENERS

Carob
Corn Syrup
Sugar

ALCOHOL

Beer
Hard Liquor
Spirits
Wine

OTHER FOODS

Catsup
Cocoa
Coffee
Mustard
Pepper
Soft Drinks

Lecithin Granules
Molasses, blackstrap
Butter, unsalted
Soured Dairy Products
Probiotic Cultures

Alkaline Antioxidant Water - Mineral Water
Tea - Bandi, Dandelion, Essiac*, Green*, Herbal, Ginseng, Kombucha
Fresh Fruit Juice - Green Juices and Wheat Grass Juice* **- Veggie Juices**
Organic Milk (unpasteurized)

ALKALIZING MINERALS

Cesium: pH 14
Potassium: pH 14
Sodium: pH 14
Calcium: pH 12
Magnesium: pH 9

Soy Sauce
Distilled Vinegar

DRUGS & CHEMICALS

Aspirin
Chemicals
Drugs - Medicinal and Psychedelic
Herbicides and Pesticides
Tobacco

JUNK FOOD

Beer: pH 2.5
Coffee: pH 4
Coca-Cola: pH 2

Most people are unaware of how and why foods affect the internal pH of our bodies, and why this can lead to serious health problems.

For example, most cancers are associated with extreme acidosis, as the chart below of an informal internet poll of people with cancer shows.[171]

Saliva pH of cancer patients [1518 votes total]

4.5 (723)	48%
5.0 (120)	8%
5.5 (139)	9%
6.0 (160)	11%
6.5 (157)	10%
7.0 (101)	7%
7.5 (118)	8%

Saliva pH falls as cancer progresses, often to as low as 4.5, or almost 1000x more acidic than the blood's normally slightly alkaline level of 7.4. This acidic condition shuts down important biochemical pumping within cells, burns & dissolves cell tissues and DNA, and contributes to the extreme pain in terminal patients. However, by reversing the acidosis this pain can be rapidly relieved, healing can take place, and in many cases the cancer will go into remission. This can be accomplished quickly with alkaline buffering, produced by consuming organic foods and supplements rich in alkaline minerals and other nutrients necessary for their proper absorption.[172]

Drinking freshly made organic vegetable juices is one of the best ways to rapidly raise the body's pH. Various blends of vegetables provide a potent well-balanced delivery of alkaline minerals, vitamins, and enzymes.

See Dr. Carl Reich, MD and Bob Bearfoot's book *The Calcium Factor* [173] for an in-depth look at the role of pH in transporting nutrients and waste in the body. They recommend the following supplement plan to raise pH to normal levels. However, this table is based on the suggested use of generic Calcium and Magnesium supplements from dolomite. Each 1400mg tablet contains 400mg of calcium and 230mg of Magnesium. For Vitamin D and A, he suggests fish oil, but I do not, for pollution related reasons discussed below (see Table of Contents). I would by Vitamin D and A separately, getting your Vitamin A as emulsified Vitamin A, dispensed by dropper. Other more absorbable forms of Calcium, Magnesium and/or Potassium may require smaller dosages of these minerals to achieve the desired results.

Reich's and Bearfoot's' Recommended Daily Supplement Program

PH	Calcium Magnesium	Vitamin D	Vitamin A
6.5 to 7.4	1200 mg 690 mg (3 Dolomite Tablets)	2400 IU	30,000 IU
6.0 to 6.5	2400 mg 1380 mg (6 Dolomite Tablets)	4800 IU	60,000 IU
4.5 to 6.0	3600 mg 2070 mg (9 Dolomite Tablets)	7200 IU	90,000 IU

Reich's work fails to recognize the importance of other minerals required to maintain normal metabolic balance. To correctly buffer the body requires a balance between the five macro minerals in the body – potassium, magnesium, calcium, sodium and phosphorus.

Determining the proper ratios of calcium, magnesium, potassium, sodium and phosphorus to help control acidosis, depends on your body's current mineral balance, or imbalance. This can be determined through metabolic testing, such as Hair Tissue Mineral Analysis (HTMA) or other acceptable forms of metabolic testing discussed in the section that follows. Blood tests are not appropriate because they do no show mineral levels inside the cells.

If a HTMA determines additional need for potassium and/or sodium as well, I would recommend taking these as potassium & sodium phosphates, which also buffer the body from excess acid and provide phosphorus for healthy bones and energy production (Stim-o-Stam is one good product, 1-800-562-7514). People who require additional potassium are often low in phosphorus too, as excess calcium in the body blocks both potassium and phosphorus uptake. (ATP, the most important source of energy in our bodies, is adenosine tri-***phosphate***).

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Metabolic Diagnostics to Determine Levels of Nutrients and Toxins

Conventional Blood and Urine Work

As conventional doctors are trained to treat disease, and are not as concerned with prevention, traditionally they have not been interested in determining nutrient levels in blood.

Instead, your doctor might requisition the most common types of traditional blood and urine testing to look for risk factors for disease. These can tell you about the condition of your arteries, pancreas, kidneys, and the blood that feeds your cells. While these are very helpful and can be used too detect many serious health issues, they only provide limited information about what is actually going on inside your cells themselves.

As discussed above, one reason these tests aren't more useful is that your blood is very carefully regulated to provide your various vital organs (brain, heart, etc.) with a flow of blood that is chemically stable.

To keep the pH and certain components of the blood at a constant level, the body will use its cells to buffer the blood, shuttling nutrients and toxins either in or out, and altering a cell's internal balance of various nutrients to do so. Harmful toxins are always moved as quickly as possible from the blood into storage within the cells. This is what happens with poisonous heavy metals like lead, cadmium, arsenic, mercury, and many others. Persistent Organic Pollutants (POPs) like PCBs, dioxins and other toxins & carcinogens are also stored this way.

Because of this, other more suitable forms of testing are better for determining nutritional status and exposure to toxins.

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Using Hair Tissue Mineral Analysis (HTMA)

Hair is formed from clusters of matrix cells that make up the follicles. During the growth phase, the hair is exposed to the internal metabolic environment such as the circulating blood, lymph, and extracellular fluids. As the hair continues to grow and reaches the surface of the skin, its outer layers harden, locking in the metabolic products accumulated during this period of hair formation.

This biological process provides us with a blueprint and lasting record of nutritional metabolic activity that has occurred during this time.

Hair is ideal tissue for sampling and testing. First, it can be cut easily and painlessly and can be sent to the lab without special handling requirements. Second, clinical results have shown that a properly obtained sample can give an indication of mineral status and toxic metal accumulation following long term or even acute exposure.

The sampled hair, obtained by cutting the first inch and one-half of growth closest to the scalp at the nape of the neck, is prepared in a licensed clinical laboratory through a series of chemical and

high temperature digestive procedures. Testing is then performed using highly sophisticated detection equipment and methods to achieve the most accurate and precise results.

Hair tissue mineral analysis (HTMA) is supported by an impressive body of literature in a variety of respected national and international scientific publications. Over the past fifteen years, hair mineral testing has been extensive. Each year in the United States alone, federally licensed clinical laboratories perform over 150,000 hair mineral assays for health care professionals interested in an additional screening aid for a comprehensive patient evaluation. This does not take into consideration the thousands of subjects used in numerous continuing research studies conducted by private and government research agencies.

Determining the levels of the elements in the hair is a highly sophisticated analytical technique. When performed to exacting standards and interpreted correctly, it may also be used as a screening aid for mineral deficiencies, excesses, and/or biochemical imbalances. A HTMA provides the doctor with a sensitive indicator of the long-term effects of diet, stress, and toxic metal exposure.

While many laboratories provide HTMA, the undisputed world leader is the Trace Elements Inc. laboratory in Texas. For the past 20 years Dr. David Watts, PhD and his team have worked with thousands of doctors in 46 countries. During that time they have collected a wealth of data from more than 650,000 people analyzed. That data allows them to determine probable metabolic issues from the sample provided that are usually amazingly accurate. It is one of the simplest and most valuable tools a doctor can use. It is also very inexpensive.

Why use the hair? Why not just use the blood?

A HTMA reveals a unique metabolic world: intracellular activity, which cannot be seen through most other tests. This provides a blueprint of the biochemistry occurring during the period of hair growth and development.

Examples:

- Thirty to 40 days following an acute exposure, elevated serum levels of lead may be undetectable. This is due to the body removing the lead from the serum as a protective measure and depositing the metal into such tissues as the liver, bones, teeth and hair.

- Calcium loss from the body can become so advanced that severe osteoporosis can develop without any appreciable changes noted in the calcium levels in a blood test.

- Symptoms of iron deficiency can be present long before low iron levels can be detected in the serum.

Why test for minerals?

Trace minerals are essential in countless metabolic functions in all phases of the life process. A few examples:

- Zinc is involved in the production, storage and secretion of insulin and is necessary for growth hormones.
- Magnesium is required for normal muscular function, especially the heart. A deficiency has been associated with an increased incidence of heart attacks, anxiety and nervousness.
- Potassium is critical for normal nutrient transport into the cell. A deficiency can result in muscular weakness, depression and lethargy.
- Excess sodium is associated with hypertension, but adequate amounts are required for normal health.

In the words of the late author and noted researcher, Dr. Henry Schroeder, trace elements (minerals) are in many ways "...more important factors in human nutrition than vitamins. The body can manufacture many vitamins, but it cannot produce necessary trace minerals or get rid of many possible excesses."

What can cause a mineral imbalance?

There are many factors to take into consideration, such as:

- Diet - Improper diet through high intake of refined and processed foods, alcohol and fad diets can all lead to a chemical imbalance. Even the nutrient content of a "healthy" diet can be inadequate, depending upon the soil in which the food was grown or the method in which it was prepared.
- Stress - Physical or emotional stress can deplete the body of many nutrients while also reducing the capability to absorb and utilize many nutrients.
- Medications - Both prescription and over-the-counter medications can deplete the body stores of nutrient minerals and/or increase the levels of toxic metals. These medications include diuretics, antacids, aspirin and oral contraceptives.
- Pollution - From adolescence through adulthood the average person is continually exposed to a variety of toxic metal sources such as cigarette smoke (cadmium), hair dyes (lead), hydrogenated oils (nickel), antiperspirants (aluminum), dental amalgams (mercury and cadmium), copper and aluminum cookware and lead-based cosmetics. These are just a few of the hundreds of sources which can contribute to nutrient imbalances and adverse metabolic effects.
- Nutritional Supplements - Taking incorrect supplements or improper amounts of supplements can produce many vitamin and mineral excesses and/or deficiencies, contributing to an overall biochemical imbalance.
- Inherited Patterns - A predisposition toward certain mineral imbalances, deficiencies and excesses can be inherited from parents.

Can vitamin requirements be determined from a mineral test?

Minerals not only interact with each other but also with vitamins, proteins, carbohydrates and fats. Minerals influence each of these factors, and they, in turn, influence mineral status.

Minerals act as enzyme activators, and vitamins are synergistic to minerals as coenzymes. It is extremely rare that a mineral disturbance develops without a corresponding disturbance in the

synergistic vitamin(s). It is also rare for a disturbance in the utilization or activity of a vitamin to occur without affecting a synergistic mineral(s).

For example, vitamin C affects iron absorption and reduces copper retention. Boron and iron influence the status of vitamin B2. Vitamin B6 affects the relationship between calcium and magnesium. Vitamin B1 enhances sodium retention, B12 enhances iron and cobalt absorption, and vitamin A enhances the utilization of zinc, while antagonizing vitamins D and E. Protein intake will affect zinc status, etc. Therefore, evaluating mineral status provides good clues of vitamin status and requirements. Continuing research at by Dr. Watts and Trace Elements Inc. involves the recognition of many synergistic and antagonistic interrelationships between minerals and vitamins.

What does your doctor receive when s/he orders a complete hair analysis profile?

After hundreds of thousands of hair analysis, Trace Elements has created a unique system of interpreting hair mineral analysis results.

Each test report provides the clinician with the most complete and comprehensive evaluation and discussion of significant mineral levels, ratios and toxic metals as tested in the hair. This includes a full analysis of that person's metabolism and hormonal function. It also provides a list of trends that may or may not be manifesting in the patient at that time. Each trend listed is a result of research including statistical and clinical observations. While this trend analysis is advanced merely for the consideration of the health professional, and should not be considered an assessment of a medical condition, I have been amazed to see how accurately one's health can be determined from such an analysis.

Also included is a listing of individual foods and food groups that the doctor can recommend to eat or avoid in accordance with food allergy indicators and individualized metabolic requirements. In addition, each analysis contains a highly specific listing of nutrients that the doctor may recommend to assist in balancing body chemistry.

If you are interested in having a HTMA, have your doctor contact the lab at the web address: http://www.traceelements.com or at 1 (800) 824-2314 (USA and Canada) . I would advise any doctor unfamiliar with the lab's research to order a copy of Dr. Watts' research text, *Trace Elements and Other Essential Nutrients - Clinical Application of Tissue Mineral Analysis,* which is inexpensive and extremely well written. Select published articles from the Journal of Orthomolecular Medicine, and TEI newsletters updates are available as well.

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Other Types of Advanced Metabolic Testing

Testing of hair provides one form of intracellular metabolic testing. However this can, and should be in serious cases, complimented with other forms of blood and urine analysis not done in traditional blood and urine work-ups.

Imbalances within critical metabolic pathways can be analyzed by looking at individual and combined concentrations of various nutrients and bio-chemical compounds in blood, red blood cells and urine.

The International Center for Metabolic Testing

The International Center for Metabolic Testing (ICMT) in Ottawa serves patients and health professionals worldwide by providing essential biochemical analytical data. www.icmt.com 1-888-591-4124

ICMT specializes in analytical testing of human metabolism, identifying nutritional influences on health maintenance and disease prevention. ICMT's focus is on high calibre testing, personalized interpretive analysis. To address any identified imbalances, they provide patient-centered solutions and in-house pharmaceutical compounding of customized natural supplements.

ICMT's full spectrum testing package features a selection of testing panels that includes analysis of: amino acids, essential fatty acids, urinary organic acids, antioxidants, oxidative stress biomarkers, neurotransmitters and a growing list of advanced panels. All test panels are performed in its state of the art laboratory under highly scrutinized methods by analytical biochemists.

The accumulated data is presented in a color report designed to ensure effective communication of test results. An interpretive analysis is provided by their in-house biochemists.

ICMT has collaborated with Canada's National Research Council and numerous private institutions. It maintains personalized relationships with doctors and clinics. Back to Top

Determining Toxic Metal Exposure

Hair is used as one of the tissue's of choice by the Environmental Protection Agency in determining toxic metal exposure. A 1980 report from the E.P.A. stated that human hair can be effectively used for biological monitoring of the highest priority toxic metals. This EPA report confirmed the findings of other studies which concluded that human hair may be a more appropriate tissue than blood or urine for studying community exposure to some trace metals.

A heavy metal may be elevated in a HTMA and yet no known environmental exposure can be ascertained at the time. This is not unusual, as exposure may have originated years earlier. Additionally, research has found that heavy metals can be inherited by the fetus during pregnancy. Heavy metals can be found in the body for years following the original exposure and will remain in body tissues until removal is initiated. For example, the half-life of cadmium in some tissues will range from ten to thirty years.

Further confirmation of heavy metal toxicity using a blood test may or may not reveal an elevated level. This is due to the protective response of the body, in which following a toxic

metal exposure, the element is sequestered from the blood and stored in various other tissues. Therefore, if the exposure is not ongoing or chronic, elevated levels in the blood may not be present. Should an HTMA reveal toxic metal accumulation, it is recommended that another analysis be performed in at least one year to monitor any changes in toxic metal accumulation.

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Preventing Toxic Metal Accumulation: The Heavy Metal Hazard

As discussed, our environment contains both toxic organic compounds (such as PCBs, dioxins, etc) and toxic metals (mercury, lead, etc). From an environmental standpoint, an important difference between toxic compounds and heavy metals is that organic compounds can be destroyed, while heavy metals can not. The only recourse for the disposal of toxic metals is to bind them to substances that make them less toxic, and to then sequester them where they cannot re-enter the environment. This is what your body try to do with these metals, either storing them in tissues, or binding them to substances that can be eliminated in urine or feces.

Heavy or toxic metals are trace metals with a density at least five times that of water. As such, they are stable elements (meaning they cannot be metabolized by the body) and bio-accumulative (passed up the food chain to humans). These include: mercury, nickel, lead, arsenic, cadmium, aluminum, platinum, and copper (the metallic form versus the ionic form required by the body). Heavy metals have no function in the body, and can be highly toxic because of this.

Once liberated into the environment, through the air, drinking water, food, or countless human-made chemicals and products, heavy metals can be taken into the body via inhalation, ingestion, and skin absorption. If heavy metals enter and accumulate in body tissues faster than the body's detoxification pathways can dispose of them, a gradual buildup of these toxins will occur.

High-concentration exposure is not required to produce a state of toxicity in the body, as heavy metals accumulate in body tissues and, over time, can reach toxic concentration levels. As biological levels increase, a point is reached where sub-clinical effects do become clinically significant. In a population whose mean exposure has reached this threshold, a small increase, 20% for example, can lead to a doubling in the number of symptomatic persons. [174] Though a relatively small increase in exposure to toxic metal may seem trivial, the chance that the metal is causing health problems increases significantly.

Heavy metal exposure is not entirely a modern phenomenon: historians have cited the contamination of wine and grape drinks by lead-lined jugs and cooking pots as a contributing factor in the "decline and fall" of the Roman Empire; and the Mad Hatter character in Alice in Wonderland was likely modeled after nineteenth-century hat makers who used mercury to stiffen hat material and frequently became psychotic from mercury toxicity.

However, human and animal exposure to heavy metals has risen dramatically in the last 50 years, as a result of an exponential increase in the use of heavy metals in industrial processes and products. Today, chronic exposure comes from industrial smoke-stack releases, mercury-amalgam dental fillings, fish, chocolate, lead in paint and tap water, chemical residues in

processed foods, "personal care" products (cosmetics, shampoo and other hair products, mouthwash, toothpaste, soap), and many, many other sources.

In addition to the hazards at home and outdoors, many occupations involve daily heavy metal exposure. Over 50 professions entail exposure to mercury alone. These include physicians, pharmaceutical workers, any dental occupation, laboratory workers, hairdressers, painters, printers, welders, metalworkers, cosmetic workers, battery makers, engravers, photographers, visual artists, and potters.

Studies confirm that heavy metals can directly influence behaviour by impairing mental and neurological function, influencing neurotransmitter production and utilization, and altering numerous metabolic body processes. Systems in which toxic metal elements can induce impairment and dysfunction include the blood and cardiovascular, detoxification pathways (colon, liver, kidneys, skin), endocrine (hormonal), energy production pathways, enzymatic, gastrointestinal, immune, nervous (central and peripheral), reproductive, and urinary.

Breathing heavy metal particles, even at levels well below those considered non-toxic, can have serious health effects. Virtually all aspects of animal and human immune system function are compromised by the inhalation of heavy metal particulates. In addition, toxic metals can increase allergic reactions, cause genetic mutation, compete with "good" trace metals for biochemical bond sites, and act as antibiotics, killing both harmful and beneficial bacteria.[175]

The Effects of Heavy Metal Toxicity

The toxicity of any heavy metal depends on its physiochemical properties. Those properties that increase its absorption and transport (i.e. its bio-availability) will determine its ability to move through the body to reach areas critical to health deep within our cells.

Potential targets within the cell include ***membrane or structural proteins***, ***enzymes***, ***membrane lipids*** (fats), and/or ***DNA*** molecules[176] (for a refresher of where these are in our cells, see cellular diagrams in How the Body Heals Through the Self-Organization of Nutrients).

Once at various target sites within our cells in sufficient concentrations, the heavy metal may substitute for or displace critical nutrient minerals from their binding sites, in what is known as ***molecular mimicry***. (Such binding sites are often inside important molecules like hemoglobin, and/or on enzymes necessary for so many different functions in the body) Yet because heavy metals have different chemical properties as compared to nutrient minerals, the heavy metal will not function as the desired nutrient mineral would, blocking that specific molecule's function. For example, mercury and lead can displace iron in the hemoglobin molecule, causing anemia.

To better understand how heavy metals can be a problem we need to consider how any metal moves through natural system.

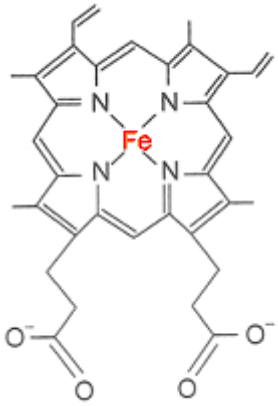
Most nutrient minerals we ingest ultimately come from rocks, earth, and/or mineral rich waters like oceans, lakes, rivers and streams. As is discussed again later in this paper, some of the best farmlands in the world are relatively close to large mountain ranges and large sources of rock and raw mineral which wash into the nearby soils through river systems and flooding. These raw

forms of mineral fertilize the soil naturally. They provide nourishment to plants, however humans and animals cannot utilize many minerals in these inorganic ore forms, as they are not in the ***bio-available forms*** required by our specific enzyme systems.

However, these raw ores, like magnesium oxide and calcium carbonate, can be dissolved by acids in the roots of plants, allowing the plant to then bind them to proteins and other organic compounds in ***chelated*** forms, which animals can absorb and use when the plants are eaten.

Chelation (from Greek χηλή, *chelè*, meaning claw) refers to the process where certain compounds are bound to metals. Such compounds are known as ***chelators*** or ***chelating agents***, and bind to a metal ion, forming a metal complex, called a **chelate**. This binding process is reversible, and allows certain compounds in plants and animals to pick-up, transport, and drop off minerals and nutrients as required for different cell functions. For example, hemaglobin can use iron to pick up oxygen in the blood and transport it in to the cells where it drops it off.

While most metals in their pure forms are either useless or toxic to life, small amounts of many metals are critical to specific aspects of normal metabolism in various parts of our cells. As a result, animals and plants developed the ability to transport such minerals through their tissues, hidden away from the immune system, in fully "sequestered" chelated forms.



The body uses various chelated molecules to do this. One the best known is hemaglobin, so we'll use it as an example. As discussed above, iron (**Fe**) is used to transport oxygen through out the body. The iron is suspended within the complex hemaglobin molecule ***inside*** a protein chelate, (as shown in this diagram illustrating a portion of the hemaglobin molecule). The iron readily binds with oxygen, allowing it to transport oygen to wherever the body needs it. However, as discussed above, if mercury and/or lead displace iron in the hemoglobin molecule, it can no longer transport oxygen, causing anemia.

In general, there are three primary ways heavy metals can invade and damage our tissue.

1) Less toxic inorganic forms can be transformed to highly toxic organic forms which are easily absorbed by the body. Biological systems, such as bacteria, have the ability to add lipid (fat and oil) soluble methyl groups to many metals. As such, inorganic molecules of heavy metal can also bind with these lipid soluble organic compounds, transforming them into organic compounds. This allows them to slip into our tissues more easily, particularly through the lipid membranes[177]. A lipid soluble heavy metal is many times more neurotoxic than aqueous forms as it can penetrate membranes and concentrate in lipid rich tissues like the brain[178].

2) Besides mimicry, heavy metal can interfere with other protein function in the body by binding on to them and altering their function. Many metals, such as lead, mercury, and arsenic can "chelate" or bind to sulfur rich proteins found in the cysteine amino acid family, changing their function[179]. (However, because of this chelating affinity for metals, the consumption of higher

quantities of foods and/or supplements rich in sulfur and cysteine related groups can be used to detoxify the body. See section on chelation below.)

3) Many metals are potent catalysts of free radical formation. Heavy metals can contribute to free radical formation by forming what are known as highly reactive oxygen species (ROS). Unchecked free radical formation leads to lipid peroxidation, cellular membrane degeneration, and ultimately to cell death.[180] Though cells have evolved defensive mechanisms to guard against free radical formation, or to repair the damage caused by them, metals in sufficient quanties will promote enough free radical formation to overwhelm these defenses.

A fourth mode of heavy metals causing toxic response is quite different.

Metals can also become bound or chelated to the ***outside*** of various proteins, often causing that protein to be altered enough that our immnune sytem no longer recognizes it, and triggering a full allergic response that altered protein[181]. Because of its propensity to form stable bonds with organic compounds, mercury is often suspects of causing such allergic responses.[182]

A metal doesn't always have to be a toxic heavy metal to cause this type of response. Molybdenum used in alloys to retain prosthetic devices, for example, has been found to cause metal hypersensitivity.[183]

Some Typical Toxic Metal Exposure Symptoms[184]

Metal	Symptoms of Toxocity	Protective Effect	
Aluminum	Abnormal speech, myoclonic jerks, osteomalcia, progressive encephalopathy, Alzheimer's	Phosphorus	Lowers intestinal absorption
Lead	Microcytic hypochromic anemia, renal dysfunction, hypertension, anorexia, muscle discomfort, constipation, metalic taste, low IQ (children)	Calcium	Lowers intestinal absorption
Mercury	Mental symptoms (Irritability, insomnia, fatigue, poor short term memory) tremor, stomatis, gingivitus, GI and renal disturbances, decreased immunity	Selenium	Protects against cellular toxic effects
Cadmium	Femoral pain, lumbago, osteopenia,renal dysfunction, hypertension, vascular disease	Zinc	Competes with cadmium for binding sites
Arsenic	Peropheral arteriosclerosis ("blackfoot disease"), "rice water" stools, proteinuria, hyperkeratosis, "milk and roses" hyperpigmentation, garlic breath odor, stomatis	DMSA, DMPS, DMPA, Embilica officinalis	Removes by competitive binding

As discussed, much of the damage produced by toxic metals stems from the proliferation of oxidative ***free radicals*** they cause. A free radical is any unbalanced molecule, containing an unpaired electron, that wants to "steal" an electron from another molecule to restore its balance. In doing so it solves its imbalanced electrical state, but creates a new one for the molecule from which it stole the electron. For this reason, free radicals can cause a domino effect of damage.

Free radicals result naturally when cell molecules react with oxygen (oxidation) but, with a heavy toxic load or existing antioxidant deficiencies, uncontrolled free-radical production occurs. Unchecked, free radicals can cause tissue damage throughout the body; free-radical damage underlies all degenerative diseases. Antioxidants such as vitamins A, C, and E curtail free-radical activity.

Heavy metals can also increase the acidity of the blood.[185] The body will often draw calcium from the bones to help restore the proper blood pH. Further, toxic metals set up conditions that lead to inflammation in arteries and tissues, causing more calcium to be drawn to the area as a buffer. The calcium coats the inflamed areas in the blood vessels like a bandage, patching up one problem but creating another, namely the hardening of the artery walls and progressive blockage of the arteries. Without replenishment of calcium (as well as magnesium, potassium and various other vitamins and nutrients required for the proper absorption of calcium), the constant removal of this important mineral from the bones can result in osteoporosis (loss of bone density leading to brittle bones).[186]

Minute levels of toxic elements can have negative health consequences, however, these vary from person to person. Nutritional status, metabolic rate, the integrity of detoxification pathways (ability to detoxify toxic substances), and the mode and degree of heavy metal exposure all affect how an individual responds. Children and the elderly, whose immune systems are either underdeveloped or age-compromised, are more vulnerable to toxicity.

Common Heavy Metals: Sources and Specific Effects

As aluminum, arsenic, cadmium, lead, mercury, and nickel are the most prevalent heavy metals, we will look at these in greater detail. The specific sources of exposure, body tissues in which the metal tends to be deposited, and health effects of each metal are identified below.

1. Aluminum

Sources of exposure: Aluminum cookware, aluminum foil, antacids, antiperspirants, baking powder (aluminum containing), buffered aspirin, canned acidic foods, food additives, lipstick, medications and drugs (anti-diarrheal agents, hemorrhoid medications, vaginal douches), processed cheese, "softened" water, and tap water.

Target tissues: Bones, brain, kidneys and stomach.

Signs and Symptoms: Colic, dementia, esophagitis, gastroenteritis, kidney damage, liver dysfunction, loss of appetite, loss of balance, muscle pain, psychosis, shortness of breath, and weakness.

The highest aluminum exposure is frequently due to the chronic consumption of aluminum-containing antacid products[187]. Research shows that aluminum builds up in the body over time; thus, the health hazard to older people is greater.

D.R. McLaughlin, M.D., F.R.C.P. (C), professor of physiology and medicine and director of the Centre for Research in Neurodegenerative Diseases at the University of Toronto, states, "Concentrations of aluminum that are toxic to many biochemical processes are found in at least ten human neurological conditions."[188] Recent studies suggest that aluminum contributes to neurological disorders such as Alzheimer's disease, Parkinson's disease, senile and pre-senile dementia, clumsiness of movements, staggering when walking, and inability to pronounce words properly. Behavioral difficulties among schoolchildren have also been correlated with elevated levels of aluminum and other neurotoxic heavy metals.

2. Arsenic

Sources of exposure: Air pollution, antibiotics given to commercial livestock, certain marine plants, chemical processing, coal-fired power plants, defoliants, drinking water, drying agents for cotton, fish, herbicides, insecticides, meats (from commercially raised poultry and cattle), metal ore smelting, pesticides, seafood (fish, mussels, oysters), specialty glass, and wood preservatives.

Target tissues: Most organs of the body, especially the gastrointestinal system, lungs, and skin.

Signs and Symptoms: Abdominal pain, burning of the mouth and throat, cancer (especially lung and skin), coma, diarrhea, nausea, neuritis, peripheral vascular problems, skin lesions, and vascular collapse.
The greatest dangers from chronic arsenic exposure are lung and skin cancers and gradual poisoning, most frequently from living near metal smelting plants or arsenic factories.

3. Cadmium

Sources of exposure: Air pollution, art supplies, bone meal, chocolate (non-organic), cigarette smoke, food (coffee, fruits, grains, and vegetables grown in cadmium-laden soil, meats [kidneys, liver, poultry], or refined foods), freshwater fish, fungicides, highway dusts, incinerators, mining, nickel-cadmium batteries, oxide dusts, paints, phosphate fertilizers, power plants, seafood (crab, flounder, mussels, oysters, scallops), sewage sludge, "softened" water, smelting plants, tobacco and tobacco smoke, and welding fumes.

Target tissues: Appetite and pain centers (in brain), brain, heart and blood vessels, kidneys, and lungs.

Signs and Symptoms: Anemia, dry and scaly skin, emphysema, fatigue, hair loss, heart disease, depressed immune system response, hypertension, joint pain, kidney stones or damage, liver dysfunction or damage, loss of appetite, loss of sense of smell, lung cancer, pain in the back and legs, and yellow teeth.

Current studies are attempting to determine if cadmium-induced bone and kidney damage can be prevented (or made less likely) by adequate calcium, protein (amino acids), vitamin D, and zinc in the diet.

4. Lead

Sources of exposure: Air pollution, ammunition (shot and bullets), bathtubs (cast iron, porcelain, steel), batteries, canned foods, ceramics, chemical fertilizers, chocolate (non-organic), cosmetics, dolomite, dust, foods grown around industrial areas, gasoline, hair dyes and rinses, leaded glass, newsprint and colored advertisements, paints, pesticides, pewter, pottery, rubber toys, soft coal, soil, solder, tap water, tobacco smoke, and vinyl 'mini-blinds'.

Target tissues: Bones, brain, heart, kidneys, liver, nervous system, and pancreas.

Signs and Symptoms: Abdominal pain, anemia, anorexia, anxiety, bone pain, brain damage, confusion, constipation, convulsions, dizziness, drowsiness, fatigue, headaches, hypertension, inability to concentrate, indigestion, irritability, loss of appetite, loss of muscle coordination, memory difficulties, miscarriage, muscle pain, pallor, tremors, vomiting, and weakness.

The toxicity of lead is widely acknowledged. The greatest risk for harm, even with only minute or short-term exposure, is to infants, young children, and pregnant women. A federal study conducted by the Centers for Disease Control and Prevention (CDCP) in 1984 estimated that three to four million American children have an unacceptably high level of lead in their blood. Dr. Suzanne Binder, a CDCP official, stated, "Many people believed that when lead paint was banned from housing [in 1978], and lead was cut from gasoline [in the late 1970s], lead-poisoning problems disappeared, but they're wrong. We know that throughout the country children of all races, and ethnicities and income levels are being affected by lead [already in the environment]." In their book, 'Toxic Metal Syndrome', Dr.'s R. Casdorph and M. Walker report that over 4 million tons of lead is mined each year and existing environmental lead levels are at least 500 times greater than pre-historic levels.

In 1989, the U.S. Environmental Protection Agency (EPA) reported that more than one million elementary schools, high schools, and colleges are still using lead-lined water storage tanks or lead-containing components in their drinking fountains. The EPA estimates that drinking water accounts for approximately 20% of young children's lead exposure.[189] Other common sources are lead paint residue in older buildings (as in inner cities) and living in proximity to industrial areas or other sources of toxic chemical exposure, such as commercial agricultural land. All children born in the U.S. today have measurable traces of pesticides, a source of heavy metals and chlorine-based chemicals, in their tissues.

The American Environmental Safety Institute purchased a wide array of popular, readily available chocolate products from retail stores in Los Angeles, and sent them unopened to a widely recognized and well regarded analytical laboratory, which used standard research techniques to document the presence of the toxic metals lead and cadmium in 68% of the chocolate products tested. Significant levels of lead were found in a wide array of chocolate products (including syrup/toppings, milk chocolate products, dark chocolate products, and chocolate products that contain nuts, rice and other "inclusions"), with the levels ranging as high as 0.105 parts-per-million ("ppm"), 67 times as high as the lowest amount of 0.00157 ppm. Similarly, cadmium levels in chocolate products vary significantly as well, with the observed levels starting at 0.00215 ppm and ranging up to 0.136 ppm – here the higher level is 63 times the lower level.[190]

(Sam Bock's Note: Hair samples of myself, my nieces and nephews, and others who were all eating higher amounts of chocolate all showed high lead and cadmium levels in their hair. My hair levels returned to normal once discontinuing the non-organic chocolate.)

Lead is a known neurotoxin (kills brain cells), and excessive blood lead levels in children have been linked to learning disabilities, attention deficit disorder (ADD), hyperactivity syndromes, and reduced intelligence and school achievement scores.

5. Nickel

Sources of exposure: Appliances, buttons, ceramics, cocoa, cold-wave hair permanent, cooking utensils, cosmetics, coins, dental materials, food (chocolate, hydrogenated oils, nuts, food grown near industrial areas), hair spray, industrial waste, jewelry, medical implants, metal refineries, metal tools, nickel-cadmium batteries, orthodontic appliances, shampoo, solid-waste incinerators, stainless steel kitchen utensils, tap water, tobacco and tobacco smoke, water faucets and pipes, and zippers.

Target tissues: Areas of skin exposure, larynx (voice box), lungs, and nasal passages.

Signs and Symptoms: Apathy, blue-colored lips, cancer (especially lung, nasal, and larynx), contact dermatitis, diarrhea, fever, headaches, dizziness, gingivitis, insomnia, nausea, rapid heart rate, skin rashes (redness, itching, blisters), shortness of breath, stomatitis, and vomiting.

The greatest danger from chronic nickel exposure is lung, nasal, or larynx cancers, and gradual poisoning from accidental or chronic low-level exposure, the risk of which is greatest for those living near metal smelting plants, solid waste incinerators, or old nickel refineries.

6. Mercury

Sources of exposure: Air pollution, batteries, cosmetics, dental amalgams, diuretics (mercurial), electrical devices and relays, explosives, farmed fish (salmon, trout, char, etc.), foods (grains), fungicides, fluorescent lights, freshwater fish (especially large bass, pike, and trout), insecticides, mining, paints, pesticides, petroleum products, saltwater fish (especially large halibut, shrimp, snapper, and swordfish), shellfish, and tap water.

Target tissues: Appetite and pain centers in the brain, cell membranes, kidneys, and nervous system (central and peripheral).

Signs and Symptoms: Abnormal nervous and physical development (fetal and childhood), anemia, anorexia, anxiety, blood changes, blindness, blue line on gums, colitis, depression, dermatitis, difficulty chewing and swallowing, dizziness, drowsiness, emotional instability, fatigue, fever, hallucinations, headache, hearing loss, hypertension, inflamed gums, insomnia, kidney damage or failure, loss of appetite and sense of smell, loss of muscle coordination, memory loss, metallic taste in mouth, nerve damage, numbness, psychosis, salivation, stomatitis, tremors, vision impairment, vomiting, weakness, and weight loss.

Farmed fish, contaminated wild fish, and fish oil supplements, are primary sources of mercury.

Another source of exposure to mercury is "silver" dental fillings (approximately 50% mercury when placed); over 225 million Americans have these fillings in their teeth. Mercury fillings release microscopic particles and vapors of mercury every time a person chews. Vapors are inhaled while particles are absorbed by tooth roots, mucous membranes of the mouth and gums, and the stomach lining.

In people with mercury amalgam fillings, measurements of the mercury level in the mouth ranges between 20 and 400 mcg/m3. Keep in mind that this is continuous exposure. The National Institute of Occupation Safety and Health places the safe limit of environmental exposure to mercury at 20 mcg/m3, but that is assuming a weekly exposure of 40 hours (the work week) and the mercury involved is outside the body. The Environmental Protection Agency's allowable limit for continuous mercury exposure is 1 mcg/m3 but, again, that is based on mercury sources outside the body. Neither figure addresses 24-hour-a-day exposure from mercury in one's mouth.

Hal Huggins, D.D.S., a specialist in the effect of mercury amalgams on health, reports that 90% of the 7,000 patients he tested showed immune system reactivity from exposure to low levels of mercury. In 1984, the American Dental Association (ADA), without providing scientific evidence, claimed that only 5% of the U.S. population is reactive to mercury exposure, and that this figure is insignificant. Meanwhile, the ADA mandates that dentists alert all dental personnel to the potential hazards of inhaling mercury vapors.

The Environmental Protection Agency (EPA) goes further, instructing dentists to treat mercury amalgam as a toxic material while handling before insertion, and as toxic waste after removal. [191]

Mark S. Hulet, D.D.S., who conducts research on amalgam fillings, wrote a pamphlet for his patients, in which he cites five categories of pathological reaction to mercury fillings, as identified by dentists, doctors, and toxicologists. The categories are:

• Neurological: emotional manifestations (depression, suicidal impulses, irritability, inability to cope) and motor symptoms (muscle spasms, facial tics, seizures, multiple sclerosis)
• Cardiovascular problems: nonspecific chest pain, accelerated heartbeat
• Collagen diseases: arthritis, bursitis, scleroderma, systemic lupus erythematosis
• Immune system diseases: compromised immunity
• Allergies: Airborne allergies, food allergies, and "universal" reactors.

One of the keys to mercury's effects on health may be its ability to block the functioning of manganese, a key mineral required for physiological reactions in all five categories, notes Dr. Hulet.[192]

Evidence of Mercury Toxicity in Children with Autism

In recent years there has been a great deal of controversy regarding the possible role of mercury as a causal agent in the current worldwide epidemic of autism. While the scientific and legal issues will not be settled for some time, there are many autistic children who need help now.

The Autism Research Institute has been evaluating various biomedical treatments of autism since 1967. One approach has been simply to have parents rate the effectiveness of each of the biomedical treatments they have tried. Over 23,000 parents have responded to its questionnaires. Of the 77 biomedical interventions rated for efficacy by parents (see www.AutismResearchInstitute.com, select Parent Ratings of Treatments), mercury detoxification received a far higher rating than any drug, supplement, or special diet. Mercury detoxification was rated helpful by 73% of parents, with the gluten/casein-free diet coming in second with 63%. A remarkable and encouraging finding that should not be ignored.[193]

During the last several years, there has been growing clinical and scientific evidence that most children with autism suffer from mercury/metal toxicity.[194] Briefly, the evidence shows that children with autism have low levels of glutathione and cysteine (the pre-cursor to glutathione), which is the major pathway for removal of toxic metals like mercury. The children also often had excessive use of oral antibiotics, which greatly inhibits excretion of mercury. Due to their limited ability to excrete mercury, they have low levels in baby hair (an excretory tissue), high levels in baby teeth, and higher excretion when given DMSA (a chelating agent discussed in detail below) compared to controls.[195] The symptoms of autism are consistent with that of mercury toxicity. The epidemiology studies are mixed, but several published studies show a strong link between autism and thimerosal in vaccines. Overall, it appears that most children with autism suffer from mercury toxicity, and may potentially benefit from detoxification therapy. Furthermore, there have been many reports from physicians and parents that removal of mercury and other toxic metals can be very beneficial to children with autism, sometimes resulting in a major decrease in autistic symptoms.[196]

In February 2005, the Autism Research Institute published its Consensus Position Paper: Treatment Options for Mercury/Metal Toxicity in Autism and Related Developmental Disabilities (See Appendix A for more details on mercury toxicity, and see Appendix B for more details on the strong evidence of mercury toxicity in children with autism).

This paper contains one of the best discussions I have read of various chelation techniques (discussed in greater detail below). http://www.autismwebsite.com/ari/vaccine/heavymetals.pdf It is a must read for any patient or doctor considering the use of various chelation detoxification methods. It discusses the pros and cons of a wide variety of detoxifying agents and protocols that have been used and are available. Overall, the consensus position of the Autism Research Institute is that removal of mercury and other toxic metals is one of the most beneficial treatments for autism and related disorders.[197] More research is needed, but effective treatments are available now. Each child is an individual, so this report presents general guidelines rather than specific recommendations.

Preventing Toxic Metal Accumulation

Logic would dictate that once the potential harm from heavy metals is understood, their production and use should be phased out and toxic storage heavily regulated. However this is not happening.

And even if all heavy metal production were to stop today, enough heavy metals have been released into our environment to cause chronic poisoning and numerous neurological diseases for generations to come. There are presently 600,000 toxic waste contamination sites in the United States alone, according to the U.S. Congressional Office of Technology Assessment. Of these, less than 900 have been proposed by the EPA for Superfund cleanup and approximately 19,000 others are under review.[198] While some of these toxic messes were likely caused by accidents or ignorance, the majority came from illegal dumping by hazardous product or waste distributors, manufacturers, transportation companies, or waste management companies. Such practices have not ceased, as focus on profit continues to override concerns about health, the environment, and a more promising future for all of our children.[199]

With the government moving very slowly to protect the public from the hazards of heavy metals, it is up to individuals to take measures to protect themselves.

Removing Toxic Metal Accumulation with Chelation Therapy

According to many in conventional medicine, there is nothing a person can do to address aluminum, arsenic, cadmium, lead, mercury, or nickel exposure, aside from avoiding known sources. Given the prevalence of these toxins in our lives, luckily this isn't the case.

Fortunately, there are several ways to get these harmful substances out of the body, some of which work faster than others. Various detoxification protocols, specific nutritional therapies, and intravenous and oral chelation therapies all can remove heavy metals and chemical toxins and reduce the toxic load our bodies.

As discussed above, chelating agents are substances which can chemically bond with, or ***chelate***, metals, minerals, or chemical toxins found in the body. Many chelating agents are found in large quantities in healthy foods and help to keep our bodies free of problematic metal build-u

Certain nutrients in food, as well as synthetic agents such as EDTA and other listed below, can be used to accelerate transport of metals out of the body. They do so by electro-chemically binding to a mineral more strongly than other substances in your tissues that may be currently binding such metals to your tissues. (For example a powerful chelating agent can bind to metastatic calcium which may be bound to fat and other substances causing a build up of fatty arterial plaque associated with heart disease and mental decline.)

The chelator binds to, or "traps" a mineral, or metal ion, whether its trapped in arterial plaque, floating in serum, or deep within our cellular tissues. The chelator and its metal is then carried out of the body via the urine and feces. Many organic acids found in the body or in foods act as chelating agents, including acetic acid, ascorbic acid (vitamin C), citric acid, and lactic acid. Natural chelation processes in the body are responsible for such things as the digestion, assimilation, and transport of food nutrients, the formation of enzymes and hormones, and detoxification of toxic chemicals and metals.

The following sections describes various synthetic the chelating compounds, and how they are used properly. This section should be read very carefully by anyone considering their use.

Chelation therapy with EDTA was first developed as a method of treating heavy metal poisoning and was introduced into medicine in the United States in 1948 as a treatment for the lead poisoning of workers in a battery factory. Shortly thereafter, the U.S. Navy advocated chelation for sailors who had absorbed lead while painting government ships and facilities. The FDA subsequently approved IV EDTA chelation as a treatment for lead poisoning.

Various methods of chelation therapy have developed over the past 60 years. This range of techniques, most of which are discussed to some extent below, provide the most advanced and effective way to rid the body of harmful metals that are interfering with normal metabolism.

Physicians administering chelation therapy for lead toxicity observed that patients who also had atherosclerosis (fatty-plaque buildup on arterial walls) or arteriosclerosis (hardening of the arteries) experienced reductions in both conditions after chelation. (In this application, as discussed briefly above, the chelator (EDTA in this case) is being used to bind to metastatic calcium, the problematic form of calcium which binds to fats and causes an accumulation of hardened plaque.) Since 1952, IV EDTA chelation has been used to treat cardiovascular disease.

However, it fell into medical political disfavour apparently because it was relatively inexpensive and threatened vested financial interests. As research has continued to emerge showing the benefits of properly applied chelation therapy, an increasing number of physicians are using this therapy for various uses described further below. More than 1 million people have received some 20 million EDTA infusions with no serious or lasting side effects.[200] Nobel Prize winning chemist Dr. Linus Pauling wrote the forward of Dr. Elmer Cranton's research text on EDTA therapy and said "EDTA chelation therapy makes good sense to me as a chemist and medical researcher. It has a rational scientific basis, and the evidence for clinical benefit seems to be quite strong."

There have been so many successes with chelation therapy in treating cardiovascular disease, that the United States National Institute of Health has set up a large 5 year study to determine the merits of EDTA treatment for cardiovascular disease.

I'm not convinced that this study will open the door for the FDA to endorse the treatment of cardiovascular disease with EDTA, or any other chelating agents, as political forces can be more powerful than science, both in the United States and elsewhere in the world.

While powerful and effective chelation products are available on the internet, any chelation program should only be administered by a health professional, after the appropriate metabolic testing has shown heavy metal poisoning. This research and other resources provided here can be presented to your doctor, or used by the reader to understand various options available should metabolic testing show you to be overly contaminated with heavy metals; should you be looking to remove metal-based plaque from your arteries, brain and other tissues; or should you be looking for alternatives to potential by-pass surgery.

More than 90% of the 100+ clients I have tested have overly high levels of at least one toxic metal in there bodies. That said, we have been very successful in lowering such toxic loads through various strategies each time the client has chosen to act upon the problem.

The fastest chelation therapies use powerful agents such as EDTA, DMSA, DMPS, or TTFD to bind tightly to heavy metals and transport them out of the body, generally through the urine. (A drawback to EDTA chelation therapy is that it does not bind with mercury.) The administration of chelating agents can be by mouth (orally), by intravenous drip, or by injection depending on the chelating agent and therapeutic goal.

Various foods and other substances in the body are also very effective chelators. Examples of chelating nutrients in foods are Vitamin C (Ascorbic Acid), Vitamin E, certain bioflavonoids, cilantro, coenzyme Q10, garlic, L-cysteine, flax oil, L-glutathione, lipoic acid, methionine, selenium, sodium alginate, zinc gluconate, malic acid, lithium, and many other substances. Other nutrients like lecithin will help to emulsify (or disperse) problematic build-ups of fat that maybe accumulating in arteries or elsewhere.

To learn more about natural chelators and emulsifiers in our foods and bodies, please see *Everything You Should Know about Chelation Therapy*, by Dr. Morton Walker, D.P.M. and Dr. Hitendra H. Shaw, MD. It and Walker's earlier book *The Chelation Way* are comprehensive looks a many different chelators and there affects on various health problems, from heart disease to dementia. The link below connects you with these books.
http://www.amazon.com/gp/product/0879837306/103-8905086-5990225?%5Fencoding=UTF8&v=glance&n=283155

Synthetic Chelating Agents

EDTA is a synthetic amino acid (as discussed, amino acids are the building blocks of protein) and is approximately one third as toxic to the body as aspirin. It is a powerful anti-oxidant is often used as a food preservative because of this.

DMPS (Sodium 2,3-dimercaptopropane-1-sulfonate) is an effective chelator, especially for mercury, and also for lead, cadmium, silver, tin, and arsenic. Many animal studies have demonstrated that it can lower the level of mercury in the kidneys and most other organs. A recent animal study by Pinegree et al.[201]demonstrated that repeated use of it could slowly lower the level of methylmercury in the brain, but had little effect on inorganic mercury. (Pinegree's study found that DMPS can initially increase the level of mercury in the brain if the body burden is high, presumably by transporting it from the body into the brain, and that could be related to transitory side effects before repeated use eventually decreases the level in the brain.)

While it is not an FDA-approved medication, physicians may have it individually compounded for their patients by a pharmacist, but should inform their patients of its experimental status in the US, and have a full disclosure/ informed consent document in the medical chart of each patient using DMPS.[202] It is widely available in Europe as a prescription medication, and in Germany it is available over-the-counter. In the US, physicians can ask a pharmacist to compound it for an individual patient. It is very effective in eliminating mercury from all parts of the body except the brain. It is usually used in the first step of a two step process to eliminate mercury.

It appears that oral absorption is approximately 39%, much higher than for DMSA.[203] The oral form seems to be less likely to cause gastrointestinal problems than DMSA, presumably because

much lower dosages are used and more is absorbed, leaving very little DMPS available to gut bacteria/yeast. It can be compounded into a suspension for children who do not swallow capsules. Children on DMPS sometimes complain of abdominal discomfort and/or cramping, especially with the oral form.[204]

The IV form is less likely to result in exacerbation of gastrointestinal dysbiosis. Several physicians have found IV DMPS safe and effective for treating children with autism. However, most are not experienced with the use of IV DMPS, so more experience and research is needed before it can be recommended for general use.[205]

There have been recent reports by Buttar[206] and other physicians regarding the benefit of transdermal use of DMPS. This is claimed to be an easy, non-invasive form of detoxification that appears to have a lower incidence of gastrointestinal side-effects (such as pathogen overgrowth) than the oral form. Some physicians have stated that roughly one-third of children with this treatment will temporarily have worsening behaviors after the first month of treatment, usually lasting a month or so before improving. There are several compounded formulations available, and the relative merits of the different formulations are unclear at the present time.

DMSA (Meso-2,3-dimercaptosuccinic acid) is a sulfhydryl-containing, water-soluble, non-toxic, orally-administered metal chelator which has been in use as an antidote to heavy metal toxicity since the 1950s. More recent clinical use and research substantiates this compound's efficacy and safety, and establishes it as a premier metal chelation compound, based on oral dosing, urinary excretion, and its safety characteristics compared to other chelating substances. (Altern Med Rev 1998;3(3):199-207)[207]

DMSA can cross the blood-brain barrier, which is why both lipoic acid and DMSA are used for chelation within the brain. However, because it can enter the brain, it should only be used once mercury in other tissues of the body has been eliminated with other chelators, such as DMPS, which ***can not*** pass into the brain. This is to prevent any unintended increase in toxicity to the brain.

DMSA in the oral form is approved by the FDA for treating lead poisoning in children (as young as one year of age) who have lead levels ≥ 45µg/100ml blood. Like any approved drug, physicians can prescribe it for "off-label" uses such as treating other types of metal toxicity.[208] It is also available as an "over-the-counter" supplement, but as stated earlier, I strongly recommend it only be taken under the supervision of a knowledgeable and ***experienced*** chelation physician, and only according to the methods described in the section below called Systemic Mercury Elimination. Keep in mind that very few doctors are aware of all the facts presented below.

TTFD (Thiamine Tetrahydrofurfuryl Disulfide) can also remove mercury. It is not approved by the FDA. Physicians may have it compounded for individual patients by a compounding pharmacist. The FDA has granted D. Lonsdale Investigational New Drug (IND) approval for the investigational use of oral TTFD for the elimination of mercury[209].

Natural Chelating Agents

Other chelation agents include Vitamin C (Ascorbic Acid), Vitamin E, certain bioflavonoids, cilantro, coenzyme Q10, garlic, L-cysteine, flax oil, L-glutathione, lipoic acid, methionine, selenium, sodium alginate, zinc gluconate, malic acid, and lithium. Many of these are often used in oral chelation formulas, as each chelating agent has a predilection for different chemicals, minerals and/or metal ions.

Often touted as an herbal remedy for mercury poisoning, chlorella has been claimed to be able to bind to heavy metals. Many studies have shown it to be effective when used in synergy with other components in a comprehensive mercury elimination strategy.[210] However, in a study recently conducted at the Southwest College of Naturopathic Medicine[211], they administered 10 g/day of chlorella to 15 people with mercury dental amalgams. The chlorella had no effect on fecal or urinary excretion of mercury after 3 or 8 days, based on a comparison of pre and post levels.[212] Therefore the use of chlorella on its own as a chelation agent is not recommended.

Both the practitioner and patient must be aware that any powerful chelating agent will bind to most metals in the body and is likely to remove essential trace minerals as well as toxic metals. As such, trace mineral replacement therapy is essential when doing any form of chelation.

Trace mineral therapy is also very important for helping to clear the body of heavy metals ***on its own***, since the essential trace minerals compete with toxic metals for bio-chemical binding sites within our bodies. In other words, when one's body is properly mineralized, the absorption and toxicity of heavy metals is greatly reduced.

Many doctors and researchers, including me, believe that the majority of us are malnourished in terms of minerals and trace minerals. This is another reason so many people are unwittingly exposing themselves to heavy metal poisoning, and one more very important reason to eat mineral rich organic vegetables and foods**. In my opinion this is one of the most important facts you can take away from this paper.** See Appendix 1 to see how little mineral is in conventionally grown food.

Intravenous (IV) Chelation Therapy

Intravenous chelation therapy involves injecting the chelating agent (usually EDTA) into the bloodstream for the purpose of eliminating from the body undesirable substances such as heavy metals, chemical toxins, mineral deposits, and fatty plaques (as in the arteries; the agent binds to the calcium in the plaques). EDTA is an effective and widely studied chelating agent. While it cannot chelate mercury, other substances such as DMPS and DMSA can.

Dr. Walter Blumer, M.D. of Switzerland has documented the results of EDTA heavy metal detoxification treatment for over 20 years. He showed that patients receiving a minimum of 30 treatments experienced an 85% reduction in cardiovascular events and a 90% reduction in new malignancies when compared to individuals in the same village who did not receive the treatments.[213] Prof. Johan Bjorksten, creator of the crosslinkage theory of aging, estimated that the average human life span could be increased by 15 years as a result of chelation therapy. This estimate was based on the results from animal studies. The theory is that removing heavy metals

reduces the crosslinking that contributes to the aging phenomena[214]. For a full report on Dr. Blumer's research see Appendix 11.

Over 1,800 scientific journal articles have been published on the use of EDTA in intravenous (IV) chelation. In the past 30 years, hundreds of thousands of patients have received this therapy, as delivered by over 1,000 physicians in approximately 3,300,000 IV infusions. EDTA's success rate in increasing blood circulation is 82%, provided the patients received sufficient chelation.[215]

How Chelation Can Aid Cardiovascular Patients

Chelation will also reduce calcium plaques on arterial walls. Such atherosclerotic plaques are not limited to arteries nearest the heart. Instead, they are widespread and can affect blood flow (oxygen delivery) to every cell, tissue, gland, organ, and system being served by the over 60-75,000 miles of blood vessels in your body. Chelating nutrients and molecules reach every blood vessel in the body, from the largest artery to the tiniest capillary and arteriole, most of which are far too small or too deep within the brain or other organ to be safely reached in surgery.

Other scientifically documented benefits of intravenous EDTA chelation therapy for the cardiovascular system include:[216]
• Stabilization of arterial intracellular membranes
• Maintenance of the electrical charge of platelets in the blood, reducing blood clumping (aggregation) and preventing blood clots.
• Marked improvement in nearly 100% of 2,870 studied patients with peripheral vascular disease
• Normalization of half of treated cardiac arrhythmias
• Reductions of cerebrovascular occlusion
• Improved cognitive function in people with memory and concentration deficits and improved visual acuity (when problems are caused by arterial blockage)
• Improved myocarditis due to lead poisoning.
• Reduction of blood fat levels and improved capillary blood flow.
• Increased peripheral blood flow to the extremities.
• Improved compliance of vascular tissues; decalcification of elastic tissues resulting in improved elasticity and resilience.
• Improved red blood cell membrane flexibility and permeability to potassium
• Decreased blood pressure levels, as a result of excretion of cadmium from renal tissues, diminished peripheral resistance, improved blood vessel resilience and pliability, decreased vascular spasm, and improved magnesium uptake.

In addition to the effectiveness of IV EDTA chelation therapy in treating cardiovascular disease and heavy metal toxicity, research has also documented its benefits for aneurysm, Alzheimer's disease and senile dementia, arthritis, autoimmune conditions, cancer, cataracts, diabetes (as seen in the photos at the beginning of this paper), emphysema, gallbladder stones, hypertension, kidney stones, Lou Gehrig's disease, osteoporosis, Parkinson's disease, scleroderma, stroke, varicose veins, venomous snake bite, and other conditions involving an interruption in blood flow and diminished oxygen delivery. [217]

The ten top killers of Americans (in the order of frequency) include heart disease, cancer, stroke, accidents, pneumonia, diabetes, cirrhosis, arteriosclerosis, suicides, and infant death. All but accidents, pneumonia, suicides, and infant death have an underlying connection to reduced blood circulation. More than 90 percent of Americans live in jeopardy of having a serious illness relating to the circulatory system.[218]

The human and financial cost of cardiovascular disease in the U.S. is astronomical. Every year, approximately 1.5 million Americans have a heart attack, 300,000 of whom die before receiving medical attention. The treatment of cardiovascular disease rings up a total of $100 billion dollars annually —$200,000 spent every minute. Coronary artery bypass surgery (bypassing the blocked heart artery with grafted leg artery, average cost $44,000) is the most frequently prescribed surgical procedure for heart disease, costing $10 billion per year. Numerous leading medical doctors and authorities have stated that coronary bypass surgery is over-prescribed and often unnecessary. Nearly 20,000 people die every year as a result of bypass surgery or angioplasty (ballooning of the occluded artery, average cost $21,000).[219]

Intravenous chelation is far safer, much less expensive, and less invasive than bypass surgery. Its benefits for cardiovascular patients is clear. Although nontoxic, EDTA can produce side effects in some people. These include burning, redness and swelling at the injection site, fever, hypotension (low blood pressure), joint pain, skin outbreaks or rashes, upset stomach, and, rarely, irritation of the kidneys and liver.[220]

Some cardiologists do not recommend intravenous EDTA chelation with patients who are debilitated, emaciated, have weak or diseased kidneys, or advanced cardiovascular disease (end stage). They believe the sudden, massive infusion of EDTA puts too much stress on the kidneys, liver and detoxification pathways in these patients and could be harmful or even dangerous. Other doctors and medical researchers disagree, contending that "transient kidney malfunction" is a normal physiological adaptation occurring during the passage of toxic products (chelated metals and chemicals) through the kidneys, and that properly administered IV chelation will not cause kidney damage.

A common misconception about chelation is that it lowers the levels of calcium in the bones and teeth as the body draws calcium from them to replace the calcium drawn from the blood by the chelation process. However, the calcium to restore blood levels is actually drawn from places in the body where calcium has built up unnaturally due to previous excesses, as in arterial plaques (which contribute to clogged arteries), calcified bursae (a source of bursitis), arthritic joints, and kidney stones.

Garry Gordon, M.D., D.O., co-founder of the American College of Advancement in Medicine (ACAM) and a pioneer in chelation therapy, states, "If calcium levels start to drop, the parathyroid glands kick in and start secreting parathormone which ‘steals’ back enough calcium from the EDTA (and other) chelates to keep the heart beating normally (serum calcium must stay at a constant level for normal heart function) and to activate cells called osteoblasts, which strengthen and rebuild bone. The more chelation we give people, the less osteoporosis they have and the less age-related calcium accumulation [arterial wall plaques] there is in the blood vessels."

IV chelation is safe for children as well as adults. People over 90 years old have benefited from chelation and more than 200,000 children in the U.S. have undergone IV chelation as treatment for lead poisoning.

IV EDTA chelation has certain drawbacks. Although much safer and less expensive than coronary bypass surgery or angioplasty: it is still relatively expensive (hundreds of dollars per visit); is not widely available, as there are comparatively few experienced medical doctors certified in IV chelation therapy; and it does not remove mercury. Cardiovascular patients with high mercury burdens must use other chelating agents to remove the mercury.

Oral Chelation

Oral chelation is a safe, inexpensive, and more easily obtained alternative to IV chelation. Oral formulations can contain both synthetic (EDTA, DMPS or DMSA) and natural chelating agents including; vitamins, minerals, amino acids, antioxidants, phytonutrients, and herbs.

Oral EDTA chelation has all the benefits of IV chelation, but is much slower acting because only 4% to 18% of an oral EDTA dose is absorbed (compared with 100% of an IV dose). Taken over a different and longer schedule, oral chelation will gradually accomplish what its IV counterpart does in a few administrations. According to Dr. Garry Gordon, oral chelation is useful in reducing heavy metal toxicity and calcification, lowering blood cholesterol, lessening lipid peroxidation (free-radical oxidation of metabolized fats), thinning the blood, and preventing the formation of blood clots (a cause of heart attack).

Oral EDTA should not be taken with meals, but away from other food. There is evidence that EDTA enhances the uptake of some nutrients such as zinc and iron, while limiting the absorption of others. Moreover, in theory it can enhance the absorption of toxic metals in food, and as such should always be taken on an empty stomach. If there are no foods containing heavy metals in the stomach when the chelating agents are introduced, there can be no absorption of heavy metals.

Removing Mercury with Chelation

As mentioned earlier, EDTA does not chelate mercury. Other chelating agents – DMSA, DMPS, cilantro, and lipoic acid – effectively act on mercury. Dr. Joseph Mercola has outlined what I think to be the most prudent manner for detoxifying the body of mercury. It is outlined in the sections that follow. (http://www.mercola.com/article/mercury/mercury_elimination.htm)

Particular attention must be applied to mercury detoxification, as lipid soluble methyl mercury can penetrate deeply into the brain and other parts of the central nervous system. (90% of our brains is made of oily fats that are required to insulate our nerves, making the brain particularly vulnerable to any lipid based toxins.)

The nervous system is more sensitive to mercury toxicity than any other organ in the body. Mercury has recently been documented to be associated with arrhythmias and cardiomyopathies. Hair analysis has shown mercury levels to be 20,000 higher in those with these cardiac abnormalities.[221] Mercury exposure has also been associated with other neurological problems

such as tremors,[222] insomnia, polyneuropathy, paresthesias, emotional lability, irritability, personality changes, headaches, weakness, blurred vision, dysarthria, slowed mental response and unsteady gait.[223]

Systemic Mercury Elimination

There are a number of agents that have been demonstrated to have clinical use in facilitating the removal of mercury with someone who has demonstrated clinical signs and symptoms of mercury toxicity. The urine and feces are the main excretory pathways of metallic and inorganic mercury in humans.[224]

The most important first step of any systemic elimination process is to remove the source of mercury. Many can achieve this by merely eliminating there intake of contaminated fish. For others this also involves the removal dental fillings containing mercury.

Individuals requiring amalgam removal should seek a dentist who is specially trained in this area as improperly removed amalgam may result in unnecessarily high exposure to mercury.[225] The following is a summary of what Dr. Mercola feels to be the most effective agents that have been documented in the peer-reviewed literature. Having read extensively on this subject, I concur.

DMPS

As discussed, DMPS (Sodium 2,3-dimercaptopropane-1-sulfonate) is an acid-molecule with two free sulfhydryl groups that forms complexes with heavy metals such as zinc, copper, arsenic, mercury, cadmium, lead, silver, and tin. DMPS was developed in the 1950s in the former Soviet Union and has been used to effectively treat metal intoxication since the 1960s there.[226] It is a water-soluble complexing agent.

Because it had potential use as an antidote for the chemical warfare agent, Lewisite, it was not available outside of the Soviet Union until 1978, at which time Heyl, a small pharmaceutical company in Berlin, Germany started to produce it. It has an abundance of international research data and an excellent safety record in removing mercury from the body63 and has been used safely in Europe as Dimaval for many years.[227]

DMPS is registered in Germany with the BGA (their FDA) for the treatment of mercury poisoning but is still an investigational drug in the United States.[228]

The best and only brand of DMPS that should be used is Heyl from Germany. Great care should also be exercised in making certain the DMPS is compounded properly from the pharmacist. If the DMPS contacts metal during it will be oxidized, so the compounding pharmacist must use nonmetal needles in preparing the product.

DMPS Can Be Used To Eliminate Mercury Systemically

The use of DMPS to treat mercury toxicity is well established and accepted.[229] DMPS has clearly demonstrated elimination effects on the connective tissue.[230] The DMPS dose is 3-5 mg/kg of body weight once a month which is injected slowly intravenously over five minutes.

DMPS-stimulated excretion of all heavy metals reaches a maximum 2-3 hours after infusion and decreases thereafter to return to baseline levels after 8 hours.[231]

DMPS Safety

DMPS is not mutagenic, teratogenic or carcinogenic[232]. Ideally intravenous DMPS should never be used in patients that still have amalgam fillings in place, although investigators have done this as diagnostically, as a one-time dose, without complications.[233] DMPS appears in the saliva and may mobilize significant amounts of mercury from the surface of the fillings and precipitate seizures, cardiac arrhythmias, or severe fatigue.

One should use DMPS with great caution and NEVER use it in patients with amalgam fillings. Ideally DMPS should be administered after 25 grams of ascorbic acid administered intravenously. This will minimize any potential toxicity from the DMPS.

Even though DMPS has a high affinity for mercury, the highest affinity appears to be for copper and zinc[234] and supplementation needs to be used to not avoid depleting these beneficial minerals. Zinc is particularly important when undergoing mercury chelation.[235] DMPS is administered over a five-minute period since hypotensive effects are possible when given intravenously as a bolus.[236] Other possible side effects include allergic reactions and skin rashes.

DMSA

As discussed, DMSA (meso-2, 3-dimercaptosuccinic acid) is another mercury chelating agent. It is the only chelating agent other than cilantro and d-penicillamine[237] that penetrates brain cells. DMSA removes mercury both via the kidneys and via the bile.[238] The sulfhydryl groups in both DMPS and DMSA bind very tightly to mercury.

DMSA has three distinct disadvantages relative to DMPS when removing mercury.

First, DMPS appears to remain in the body for a longer time than DMSA.[239]

Secondly, DMPS acts more quickly than DMSA, probably because its distribution is both intracellular and extracellular.[240]

Thirdly, preparations of DMPS are also available for intravenous or intramuscular use, while DMSA is available only in oral form.[241]

Since succinic acid is used in the citric acid cycle inside the cell, DMSA (which contains succinic acid) has been suspected for displacing mercury towards the inside of the cell[242] after binding mercury somewhere on its way from the intestine to the succinic acid deficient cell.

Therefore Dr. Mercola and others propose that DMSA be used late in the mercury elimination process, after the connective tissue mercury load has been reduced with DMPS. The standard dose of DMSA is 5-10 mg/kg twice a day for two weeks. The DMSA is then stopped for two weeks and then the cycle is repeated.

In Certain Situations Oral Formulations are Superior to IV

Because the digestive process prevents impurities in our food from entering the bloodstream, oral formulas can have additional chelating ingredients with the ability to chemically bond with and eliminate mercury from the body (as evidenced by mercury levels in urine samples before and after chelation).

Because any compound that is injected by IV directly into the bloodstream must be in a highly pure form, IV formulations are limited to just a few blood compatible compounds such as EDTA. For this reason, certain multi-ingredient oral formulations may actually outperform IV EDTA chelation.

The heightened benefits of oral chelation result from the synergistic effect of combining EDTA, DMPS, or DMSA with numerous natural chelating agents, such as certain bioflavonoids, cilantro, coenzyme Q10, garlic, L-cysteine, L-glutathione, lipoic acid, methionine, selenium, sodium alginate, and zinc gluconate. Each chelating agent has a predilection for different chemicals and mineral or metal ions.

The addition of nutrients known to support liver function and detoxification also increases an oral chelation formula's effectiveness. A companion formula of antioxidants and other nutrients enhances the chelation process by replacing beneficial minerals removed during chelation, promoting the healing of tissues, and preventing free-radical oxidative damage. As with chelating agents, different antioxidants work on different free radicals. For this reason, various formulas can contain a wide range of up to 30 different antioxidants.

Antioxidant activity may play a particularly important role in amplifying the benefits of chelation. Elmer Cranton, M.D., author of Bypassing Bypass, believes that the prevention of free-radical damage (which EDTA does) is the main action behind chelation's positive effects.

The effectiveness of oral chelation is debated by some proponents of IV chelation. However clinical research demonstrating oral chelation's benefits for atherosclerosis and heavy metal poisoning is emerging.[243]

That said, oral chelation is not a replacement for IV chelation when the cardiovascular patient's condition is too severe to wait for the slower-acting oral chelation to produce effects. Once such patients have completed the recommended number of IV chelation treatments, however, oral chelation can be of great benefit in maintaining their cardiovascular health.

In addition to heart patients, oral chelation can be used by anyone with a family history of heart disease, longstanding poor dietary practices, or a history of exposure to heavy metals or toxic chemicals. More generally, oral chelation is useful to those wanting to prevent cardiovascular disease and/or clear their body of the metals and toxins that may have accumulated and which can cause a variety of health problems.

As such, oral chelation can serve as a convenient, non-invasive, long-term health maintenance and preventative program. The gradual dosage delivery significantly reduces the risk of side effects; oral chelation is safe for children and adults.

Clinical Studies on Dr. Maile Pouls' oral chelation formulas show impressive results.[244] For example, in 1998, heavy metal urine analyses were conducted on 14 patients, ages ranging from 29 to 68 and from a variety of different occupations, before and after only one day's dose of the Dr. Pouls' formulas. Omegatech, King James Medical Laboratory, Inc., in Cleveland, Ohio, analyzed the urine samples. The results showed significant excretion of all six of the heavy metals most commonly encountered and damaging to health. The following are the average percentages of increase in the 14 patients' heavy metal excretions after just one day on the formulas:

Aluminum: 229%
Arsenic: 661%
Cadmium: 276%
Lead: 350%
Mercury: 773%
Nickel: 9,439%

Dr. Pouls' formulations have shown other very impressive results. You can go to his website to see these studies, however, once again, I would not follow any protocol other than that outlined above, and only under a qualified doctor's supervision.

Monitoring Detoxification

It is also important to remember that heavy metals can be stored deep in the tissues, brain, and nerve ganglion. When all heavy metals except one decrease after chelation, we know that this one was stored at the deeper levels and is finally being pulled out of those tissues and mobilized for excretion. Thus, the higher readings are a positive sign that chelation is under way. In individuals with chronic or longstanding exposure to high amounts of heavy metal, the hair analysis readings can remain high and even go higher for a period of six to twelve months depending on the amount of previous exposure.

Combining Chelation with Good Nutrition

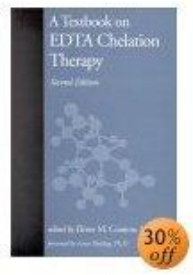
While chelation can be a life saver, I can't stress enough how important it is to modify eating habits to further prevent the build up of heavy metal toxicity of arterial plaques. Nutritional deficiencies can contribute to the accumulation of heavy metals in the body. However when sufficient levels of certain vitamins, minerals, and other nutrients are maintained in the body, the continued absorption of specific heavy metals is greatly reduced.

For three excellent overviews of how to deal with heavy metal or other mineral related health problems you should order the following books for you and/or your doctor:

1. Bralley, J. Alexander PhD, C.C.N, Richard S. Lord, PhD, *Laboratory Evaluations in Molecular Medicine, Nutrients Toxicants and Cell Regulators*, The Institute for Advances in Molecular Medicine, Norcross, Ga., 2001
   http://www.metametrix.com/Book/

2. Watts, David L. PhD, *Trace Elements and Other Essential Nutrients - Clinical Application of Tissue Mineral Analysis,* Addison, Texas, 1995
   http://www.traceelements.com/home.html

3. A Textbook on Edta Chelation Therapy by Elmer M. Cranton (Editor), Linus Pauling
   Amazon Reviewer: Michael Janson, M.D. : If you want to know the details of this therapy, don't ask your doctor--this is the book to read. In spite of opposition to chelation therapy by the mainstream medical community, this textbook tells the real truth about it. It is hard to find valid, scientifically backed information about chelation, and if you ask your doctor, you will likely be led away from this valuable therapy that is better documented than bypass surgery and angioplasty.



While you may need some scientific background to understand all of the material, most readers will be able to understand enough to get a clear picture. The book is well organized. For doctors interested in more information about chelation, this is a great place to start. With the protocol for treatment, you will have a good guide to this therapy. Other books strictly for the lay person do not go into such detail and show you how the treatment is done, although they may be less technical for the less serious reader.

Notice: These recommendations are intended to improve the nutritional status of the individual. These recommendations are specifically not intended to treat any disease. Anyone who has any form of kidney disease or any other health condition should consult a physician before engaging in any form of chelation.

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If You Are Not Feeling Well

If you think you are suffering from a particular ailment, or are unsure of why you are not feeling well, there are several simple diagnostic tools to help you and your doctor get you well as quickly as possible.

1) Test your saliva pH and make sure your tissues are not overly acidic or alkaline.

You need to purchase saliva pH testing paper ($10-15), known as regular pH "Dip and Read" paper. It is readily available in hundreds of places across Canada. If you do not know where to by it locally, call Greens+ Canada @ 1-800 258-0444 (Canada & US) to locate a local distributor for pH testing paper #6666. In Montreal you can find it at many locations, including Mission Thuy in Outremont.

In the US you can call Micro Essential Labs, the manufacturer, @ 1-718 338-3618 and ask for paper # 067. see http://microessentiallab.com/buffer/buf-unbuf.html

As mentioned above, the human body will function normally when saliva is between a pH 6.8. (slightly acidic) and 7.6 (slightly alkaline). Saliva pH is lowest in the morning and usually climbs throughout the day. Don't panic if your pH is too low or high at any given time. pH reading will fluctuate based on what you have eaten in the last 48 hours, and as aresult of immediate exercise or stress loads, and/or hydration levels. Look for an average. A saliva pH of 6.8 - 7.2 is considered by many to be optimum. (Do not confuse with urine pH which is normally lower between 5.5 and 6.5).

Athletes should keep their pH above 7.0, and as close to 7.4 as possible, at all times to ensure maximum regeneration and iron/oxygen transport.

For those with cancer, raising one's pH to between 7.2 - 7.4, with supplements and dietary changes, is considered by most to be a good idea as most cancer can not survive in a alkaline environment.

Saliva readings that are too much lower than 6.5 or higher than 8.0 can be problematic. If too acidic, you will probably need to increase your intake of fresh organic vegetable juices, whole vegetables, fruits, and alkaline minerals such as potassium, magnesium and calcium.

Saliva pH should be tested as follows: In the morning before breakfast prior to eating or drinking, or 15 minutes after rinsing your mouth with water 1-2 hours after eating. If doing the latter, check the pH of the water used to you rinse your mouth, as it can affect the reading. If it is too acidic, try testing bottled spring water, which is usually higher in alkaline mineral required to for a neutral pH of 7.0.

To get the most accurate reading:

- make sure your pH paper is kept well stored and dry,
- before testing, wash and thoroughly dry your hands,

- gather saliva from under your tongue,
- snap off a short piece of paper from the dispenser roll,
- do not touch anything to the end you will put in your mouth,
- dip the pH paper under your tongue closest to the saliva glands, as other things in your mouth (like phlegm if you are congested) can alter the reading,
- wet the paper adequately to get a strong reading,
- wait 15 seconds, check color of paper and record the reading. The paper will give an accurate reading for about 1 minute and then start to fade.

Do not panic if your reading is too low (pH can be quickly normalized with dietary changes and/or nutritional supplementation). Record the reading and check again later. If you are getting consistently low readings, you are probably lacking vegetables and minerals in your diet. If you are too alkaline (much rarer) you probably need fewer vegetables and more proteins and fats which produce an acid ash when metabolized.

If you are consistently too high or low, I would locate a well respected naturopath (see below) for help in correcting this.

Note: Re: Tap Water, Rain Water, Distilled Water, etc. (Low Buffered - Unbuffered Solutions)

Any solution such as tap water, rain water or distilled water with < .1% of dissolved solid is called a low buffered or unbuffered solution. If using the regular pH "Dip and Read" papers such as the ones listed above, the reading could be off as much as 2 whole pH units.

To correctly measure the pH of these unbuffered solutions, "Lo Ion" pH test kits are required. Item # LI 5900 from Micro Essential Labs is commonly used to test the pH level of tap, rain, or distilled water.

2) Consider getting a hair mineral analysis and other metabolic testing to help detect toxic metals, nutritional mineral deficiencies and other metabolic irregularities. I have affiliated with Trace Elements Inc. TEI provides premium lab work for doctors and many health related organizations. I am impressed with the quality of TEI's analysis and subsequent recommendations to the Doctor/Patient.

In the meantime, if you want this analysis done immediately, contact http://www.sanascan.com. Trace Elements Inc. does all the lab work for Sanascan. Sanascan provides thorough instructions, will bill your credit card $84US for the service, and will provide you test results within three weeks.

The International Center for Metabolic Testing (ICMT) in Ottawa serves patients and health professionals worldwide by providing essential biochemical analytical data. www.icmt.com
1-888-591-4124

3) Find a reputable Naturopath (ND), or an MD with supplemental nutrition training.

The Canadian Association of Naturopathic Doctors (CAND) is the national association for licensed Naturopathic Doctors across Canada. www.cand.ca.

United States Affiliate: American Association of Naturopathic Physicians (AANP) www.naturopathic.org

4) Avoid or eliminate refined sugars and processed foods from your diet. For some ideas regarding healthier food choices, look at the food charts above and the list below (Appendix 2).

5) Finally, if you are sick… Don't panic: Get help and remember the body usually heals itself with good food, rest and moderate exercise. Back to Top

Appendix 1: Mineral Depletion in Conventional Food

Natural Benefit of Organic Vegetables

Based on research conducted at Rutgers University

	Calcium	Magnesium	Potassium	Sodium	Manganese	Iron	Copper
Snap Beans							
Organic	40.5	60.0	99.7	8.6	60.0	227.0	69.0
Conventional	15.5	14.8	29.1	0.0	2.0	10.0	3.0
Cabbage							
Organic	60.0	54.6	148.3	20.4	13.0	94.0	46.0
Conventional	17.5	15.6	53.6	0.8	2.0	20.0	0.4
Lettuce							
Organic	71.0	49.3	176.5	12.2	169.0	516.0	60.0
Conventional	16.0	13.1	53.7	0.0	1.0	9.0	3.0
Tomatoes							
Organic	23.0	59.2	148.3	6.5	68.0	1938.0	53.0
Conventional	4.5	4.5	58.6	0.0	1.0	1.0	0.0
Spinach							
Organic	96.0	203.9	257.0	69.5	117.0	1585.0	32.0
Conventional	47.5	46.9	84.0	0.8	1.0	19.0	0.5

Equivalents per 100 grams dry weight. Trace elements ppm

The study concluded that while weight, colour and texture appeared similar, there were significant nutritional differences. Organically grown foods were richer in minerals than the "lookalike" commercially grown products. In fact by comparison, there were 87% less mineral and trace elements in today's commercially grown vegetables, as illustrated above.

Source: Journal of Applied Nutrition. Volume 45, No. 1, 1993.

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Appendix 2: Some Healthy Food Choices

All foods must be Organic

Drink lots of ph-neutral spring water, and chew your food very well.

Sprouts of all kinds: alfalfa, radish, safflower, etc.,
Mixed leafy greens
Spinach
Bok choy
Swiss chard
Celery
Onions of all kinds
Garlic
Leeks
Carrots cooked or very well chewed
Cucumbers
Zucchini
Tomatoes
Broccoli
Cauliflower
Turnip
Yams of all kinds
Squash of all kinds
Green Red and Yellow peppers
Cabbage
Ginger

Eggs, eaten poached, soft or hard-boiled. Avoid scrambled eggs temporarily. No fried eggs.
2% plain yogurt, (goat is preferable)
Wild salmon, trout
White fish
Beans of all kinds (Black, Kidney, Lima, Pinto, Red)
Chicken (must be organic)
Turkey (must be organic)
Tofu (must be organic)
Wild game meats

Feta cheese
Ricotta
Quark
Goat cheese
A little Cheddar is OK from time to time, but not more than once a week or so until you are better.

Butter
Flax oil
Essential Balance Oil
Olive oil

Goat Milk
2% Cow's milk
Soy milk

Honey
70%+ organic cocoa chocolate is OK from time to time, but no commercial chocolates

Almond Butter
Almonds
Sunflower seeds
Pumpkin Seeds
Cashews
Flax seed, milled and whole
Musili (no added sweeteners)
Brown Rice
Wild rice
Potatoes

Heavy weight organic breads
Flat bread… good for wraps
Note: Not much pasta, and organic only

Basil Pesto
Tomato Pesto

Bananas,
Orange,
Apples,
Grapefruit,
Lemon
Not too many raisins and other sweet fruits

Cayenne
Cinnamon
Sage, Basil, Rosemary

Helpful Vitamins and Minerals

Multi vitamin: top quality B Complex and mineral mix
Vitamin C 1000 mg Ester C
Vitamin E 400 IU natural form only
Vitamin D 400 IU (during winter when no sunlight)

Vitamin A 5000-10000 IU (emulsified, from lemon oil, or other clean sources)
Zinc as 20-50mg (as Zinc monomethionine, Zinc monomethionine/aspartate, Zinc aspartate, or Zinc citrate)
Selenium 200 mcg
Sublingual B-12, only if shown to have deficiency in tests

Goat whey powder: Capra Mineral Whey

Cal/Mag asporatates 240 capsules, Magnesium asporatates 120 capsules
(if you are Canadian you have to order these from the States. *Good Life Natural Foods,* in Savernah Park, MD. (410) 647 6602. Ask for Issac.)

C Salts (Vitamin C as mineral ascorbates from the US: Wholesale Nutrition, 1 800 325-2664)
and/or
Ester C available locally

Fresh vegetable juice, Green drink

Great Salads:

Dressing: Olive Oil, dash of balsamic vinegar, garlic

Large bowl of mixed greens, spinach, or romaine
Diced onion and celery
Sprouts of any kind
Sunflower seeds, pumpkin seeds

Eat as is or add:

Broken up or grated feta cheese, and/or hard boiled egg, or fish

Flax Shake

2 tablespoons Omega Nutrition's Essential Balance Oil, ¼ cup of plain yogurt (goat is best, but cow will do unless suffering from intestinal disorders), 1-2 ripe bananas, blue berries, other berries, or Kiwi. **(no citrus)** dash of cinnamon, or nutmeg when using banana for finicky types.

Blend and add water to achieve desired thickness. Drink as is, or pour over Musili for breakfast or lunch

Note: If suffering from cancer, Flax Oil should substituted for Essential Balance oil 6 days per week until the cancer is in remission. Once a week Essential Balance should be used.

Appendix 3: Problem Foods and Other Concerns

When sick:

Temporarily no sugar, alcohol, coffee, ice cream.

No predator fish (Tuna, Marlin, Swordfish, Opah, Shark, etc.,)

No red meat, pork, salami, or non-organic animal fats or vegetable/seed oils

No fatty cheeses, cream cheese, etc.

No commercial peanut butter, soft drinks, ketchup, commercial salad dressings, potato chips, french-fries, fast food of any kind.

No crackers, commercial breakfast cereals, cakes, cigarettes, sports nutrition bars

Clean out house of toxic cleansers

Do not dry clean clothes, linens or other household items

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Appendix 4: Additional Reading

Listed below are a few books everyone should have in their medical library. The first one is particularly helpful for treating most ailments. The last two are good cross references to it. The others are very illuminating reads that discuss key issues not discussed in most current books on nutrition.

1) *Prescription for Nutritional Healing, 3rd Edition*, Phyllis A. Balch, CNC, James F Balch, MD. Very solid guidelines for food choices, vitamin levels, therapeutic amino acid supplementation, and mineral levels for various degenerative conditions and illnesses. However, they also usually recommend a number of more exotic and expensive supplements that I consider over the top and do not use with my athletes or people seeking nutritional advice. If you ever have any questions, just call me and I'll give you my point of view.

2) *Foods that Heal*, Dr. Bernard Jensen, DC, PhD Nutrition. (Jensen has written a slew of books on a wide range of subjects related to health. One of the most knowledgeable nutritionists ever. Incredible knowledge of chemistry, anatomy, and bio-available sources of specific nutrients.

3) *Empty Harvest*, Dr. Bernard Jensen and Mark Anderson, (shocking read, you'll never trust the FDA again, and you'll only eat organic after reading this.)

4) *Food is your Best Medicine*, Dr. Henry Bieler, MD. Phenomenal read. Will open your eyes to the true healing potential of Nature and good food. Written in the early 60s, this book is still ahead of its time. Disillusioned with where medicine was heading at the time, Bieler scrapped all treatments with drugs and switched to treatment with nutrition. Full of incredible case studies. His arguments are even more powerful today than when the book was written.

5) *Fats that Heal, Fats that Kill*, Udo Erasmus, PhD Nutrition, Alive Books, (a sometimes arrogant, yet essential, presentation of fats & oils, carbohydrates, minerals, and other nutrients; their metabolism; and the effects of food processing, etc. on the bio-availability of foods.)

6) *Eating Alive, Prevention through Good Digestion*, Dr John Matsen N.D. Another terrific resource. Explains in lay terms the essentials required to maintain health, energy, and a healthy immune system, by making sure that your digestive systems is working as intended. A little religious in places, but very well written and full of interesting case studies.

Nutrition Almanac 4th Edition, Kirschmann & Kirschmann, McGraw Hill, Good cross-referencing source to Prescription for Nutritional Healing.

Encyclopedia of Natural Healing, Siegfried Gurshe, MH; medical editor Zolton Rona, MD, MSc, Alive Books. Another good cross-referencing source for P.N.H.

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Appendix 5: Medical Industry in Transition

The Emergence of Integrative Medicine

The majority of North Americans still turn to conventional channels for medical attention, via GP's or hospitals. Benefits associated with conventional medicine include:

- access to care through well organized, well developed channels,
- a body of trusted professionals who have obtained their qualifications through recognized institutions,
- exceptional trauma and acute care facilities,
- capability for large scale R&D projects including clinical testing, and,
- peer reviews for products and therapies prescribed.

This well-established and organized system works well for many health problems, however western medicine has struggled to reduce the increasing number of people suffering from degenerative illness and disease. Despite resources directed into research and treatment of diseases such as cancer, diabetes, and depression, the number of people suffering from these conditions has continued to rise.

There are other challenges facing conventional medicine. Drugs used in conventional medical practices are usually expensive, have long development timelines, and often negative side effects. As well conventional care typically focuses on treatment, rather than prevention.

Government funding of health care remains a very contentious issue both here in Canada and in the United States, as governments are struggling to balance budgets.

In Canada health care spending by governments has decreased substantially over the past several years. To cut costs the federal government reduced its transfer payments to the provinces, forcing the provinces to try to take up the slack. The net result is that the quality of patient care is declining in Canada, and a there is a growing feeling of frustration and mistrust with the conventional health care system. This situation has further encouraged many to explore alternative products and therapies and a more proactive approach to health care. Growing numbers of people are willing to become more involved and take responsibility for their own health as indicated above.

In the US the situation is a little different. Patients are equally frustrated with the failure of conventional medicine to treat degenerative disease and are turning to alternative care as discussed above. But because insurance companies and individuals pay the health bills, and not the government, this gives private doctors and the entire medical establishment more freedom to adapt to growing demands in the marketplace. Therefore many conventional medical clinics are rapidly expanding to become *Integrative Clinics*, offering a combination of conventional and alternative treatments.

The following provides a brief overview and definitions of various forms of treatment available to North Americans[245].

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Conventional Medicine

Traditional conventional care defines objective and subjective clinical findings as disease states. Therapeutic focus emphasizes overcoming suppression or destruction of disease. Aspirin is given to suppress a headache. Chemotherapeutic drugs are given to kill a malignant tumour.

Pluses: Conventional medicine offers exceptionally advanced technology particularly impressive in addressing acute conditions such as a life threatening heart attack. Solutions in acute situations are often quick, requiring relatively little skill and time to investigative the makeup of the individual. For example an antibiotic is frequently given for bacterial pneumonia without determining what needs to be done to strengthen the individual to better overcome the disease and prevent various others from manifesting in the future.

Minuses: Often overlooks underlying causation. Cardiac bypass surgery is used to overcome poor circulation to heart muscle by rerouting blood around the arterial obstructions but does not stop the progression of degenerative disease. The surgery, however, does not stop the processes that lead to clogging of other arteries and the reclogging of the bypassed ones. Conventional medicine often causes problems. For example, drugs are used to suppress, destroy and remove stress from some areas while causing stress in others, often leading further imbalances and unwanted side effects. The effectiveness in chronic degenerative diseases leaves much to be desired.

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Complementary and Alternative Medicine (CAM)

Conventional medicine in North America is generally considered to be that practice of medicine traditionally taught in American Medical Association (AMA) affiliated schools[246]. On the other hand, in China, acupuncture is considered traditional medicine rather than that which is prevalently practiced in North America.

In North America, alternative medicine is loosely defined as those remedial health care practices that use diagnostic methods or therapies that do not conform to standard medical practice, nor are taught at conventional medical schools.

Alternative medicine is also known as complementary medicine (CAM), another term for alternative medicine that does not sound so adversarial to proponents of conventional medicine. Alternative medicine may be used with or instead of conventional medicine to complement conventional care by augmenting its effects and decreasing its ill effects.

The distinction between what is alternative is becoming less clear. Alternative studies are being offered by over fifty AMA affiliated medical schools such as: Colombia University; University of California at Los Angles; University of Miami; University of Arizona; and Harvard University. [247] According to Dr. Gerald Trobough, who practices obstetrics and gynecology with Los Olivos Women's Medical Group in Los Gatos, about 60 percent of all medical schools in the United States are now teaching alternative medicine.[248]

Patients seek alternative care for a variety of reasons. The desire for personalized, natural, safe care is commonly sited. Frustration with side effects of conventional pharmaceutical drugs, dehumanizing physician attitudes and ineffectual in relief of illness is often mentioned. Frequently, presenting complaints include anxiety, neck and back pain, headache, fatigue and cancer.

In a recent US survey of board certified family physicians and internists 94% indicated willingness to refer for at least one form of CAM therapy. In this same survey, 22% reported personally providing relaxation therapy, 17% life style diet modification, 5% hypnosis, 3% massage or chiropractic, and 1% homeopathy or acupuncture[249]. As increasing numbers of conventional doctors incorporate alternative methods into their practices, such alternative methods become known as conventional.

Depending on circumstances, faster, safer, more economical, and more effective care may be provided with alternative approaches than by conventional means. Under other circumstances conventional care may be superior. Both alternative and conventional medicine have much to offer, much more so when integrated together so they complement one another.

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Integrative Medicine

Integrative medicine combines wisdom and technology form various schools of medical thought for better results with less risk and cost. Experience, skill and knowledge are increasing among practitioners of integrative medicine. As the majority of conventional medical schools today offer various forms of courses in alternative methods, what is alternative today may be conventional tomorrow. Integrative medicine is an evolutionary result of the information age's impact on modern health care and is being embraced and developed within the western medical community.

Pluses: Offers potentially the best options for effectiveness, reduced risk and cost in terms of expenditure of time, effort, and other resources.

Minuses: Some of the options may not be recognized by insurance.

Dr. David J. Blyweiss, a family practitioner in Miami, Florida, set up an integrative practice that incorporates conventional and alternative treatments. He became interested in alternative medicine when he realized his patients knew more about some of these therapies than he did. Self-taught on the merits of an assortment of alternative therapies, he points out that mainstream medical journals are publishing studies vindicating what was once considered alternative, such as the value of selenium in preventing cancer.

Blyweiss offers vitamin supplementation, aromatherapy, healing touch, and chelation therapy, which is used to remove metals from the blood. "I got tired of just treating symptoms, which is what conventional medicine does well," Blyweiss said. "I wanted to treat the whole person. I

think the way to do that is by blending the best of conventional medicine with the best of alternative therapies."[250]

Some conditions treated with integrative medicine include but are not limited to:

Acne
Adrenal problems
Asthma
Atherosclerosis: circulatory impairment due to hardening of the arteries
Allergies
Anxiety
Arthritis
Back pain
Bacterial imbalance
Bloating
Cancers
Chronic fatigue
Chronic obstructive lung disease
Crohn's disease
Constipation
Depression
Diabetes
Diarrhea
Disabling childhood illnesses; autism, ADD, traumatic brain damage, Down's syndrome
Eczema
Fatigue and tiredness
Flatulence
Gall and Kidney stones
Headache
Heartburn
Infections
Irregular heartbeat and heart palpitations
Irritable Bowel syndrome
Liver problems
Macular degeneration
Medical orthopedics
Memory disturbances
Migraine
Multiple sclerosis
Muscle cramping and spasms
Neck problems
Non-Hodgkin's lymphoma
Insomnia
Obesity
Other chronic degenerative diseases
Osteoporosis
Pain
Prostate problems
Seizures
Thyroid problems
Ulcerative colitis
Ulcers
Vision problems
Warts
Weight management
Yeast infection

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Appendix 6: August 1999 Canadian Senate Presentation and Discussion

MP/Energy 34973/November 17, 2010

THE STANDING SENATE COMMITTEE ON ENERGY, THE ENVIRONMENT AND NATURAL RESOURCES

EVIDENCE - UNREVISED

OTTAWA, Tuesday, August 31, 1999

The Standing Senate Committee on Energy, the Environment and Natural Resources, to which was referred Bill C-32, respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development, met this day at 9:00 a.m. to give consideration to the bill.

Senator Ron Ghitter (*Chairman*) in the Chair.

DF / August 30, 1999 / Energy 34973 (The Chairman continuing)

Colleagues, I would like to introduce you to Mr. Sam Bock, who came to see me in Calgary, highly recommended, I might add, from other sources. I found his approach to be very refreshing, interesting and of great background. He wanted to appear before the committee. I said that I would do what I could to have him appear and present a point of view from the citizens' aspect, albeit a very educated one.

Please proceed, Mr. Bock.

Mr. Sam Bock: Honourable senators, I really appreciate the chance to be here today. I would like to say, as I said to Senator Ghitter, that I think it is terrific that we have an appointed Senate, which I did not appreciate until I got a chance to look over many of the transcripts of past deliberations. I have been very impressed with everything I have read. I had been won over by a position in the West that we need an elected Senate, without really looking at it, and I do not feel that way any longer.

Senator Nolin: You do not mind if we use your testimony for other purposes, do you?

The Chairman: Perhaps you could begin by telling us about your background, experience and education.

Mr. Bock: I have been interested in the environment and sciences all my life. The study of particle physics, nuclear chemistry and health sciences has been a major focus of my work for the past 20 years. I have a B.A. in Economics/Environmental Studies, and my thesis was an economic/scientific analysis and forecast of North America's energy needs and technologies, focusing on fossil fuels, nuclear power and alternative sources.

After working several years on Wall Street and in Denver in energy-related project finance, I left business to become a full-time athlete and coach in the area of bobsledding

and track and field. To develop new coaching methods and training programs, I began research into nutrition chemistry and sports biochemistry and mechanics.

To improve our athlete's chances of success, I started Paragon Technologies, a little R&D company, to research, develop and manufacture new sports equipment for competition and training. This company has and continues to provide design and manufacturing consulting of high-performance sports equipment to the world's leading athletic shoe manufacturers.

Paragon's sport-related programs -- those are the ones we developed under an association and this company -- helped Canadian athletes win Olympic and world championship medals, as well as set many world records. Much of this was due to new equipment we developed but, just as importantly, applied nutrition chemistry, which allowed us to succeed naturally in sports that are still rife with steroid use.

I feel that 10 years of coaching and biochemical study, combined with finance, design and manufacturing experience, has exposed me to the concerns of environmentalists in industry alike. I firmly believe that two can and must operate in harmony if we are to successfully meet the challenges of the 21st century.

What I am here to talk to you about today are a few of the chemical issues that I think are important to the bill and how the wording of the bill affects that. There are two basic types of chemical activities and they work differently.

The first type, and the one used most in industry, is randomly occurring chemical activity, where one substance reacts with another when brought together under certain conditions. A car randomly mixes gas with oxygen and burns it to create carbon dioxide and water. If the fuel and oxygen ratios are correct, as we all know, the emissions are non-toxic to plant and animal life -- water and carbon dioxide. However, if there is only enough oxygen to combine one oxygen atom with every carbon, carbon monoxide is produced instead. As well, impurities in the fuel, such as sulphur compounds, might react with oxygen creating sulphur dioxide, for example.

The creation of chemical by-products in a car is random and essentially uncontrolled. This is a very important point. Most of the chemical activity used in industrial processes is of the same nature -- random and uncontrolled. We can control it to a degree, and we do a good job of that, but we are always creating something we do not necessarily want.

Random chemical reactions create random by-products. If this were the only way for chemicals to interact, there would be no life on earth, as life processes are orderly and require the recycling of specific by-products, not ones that are randomly produced.

To prevent the generation of random by-products and maximize nutrient use, all life uses enzyme chemical reaction as the basis for catalysing growth and maintaining health. Enzymes allow life forms to build precise and complex designs at very hide speeds. Enzyme reactions are up to 3,000 times faster than random reaction, allowing life to bloom and regenerate.

More important, enzymes only react to specific compounds in a distinct manner and do not normally produce random by-products. This is very important because a particular by-product of one enzyme is the fuel for the next. Because of this, we can reorganize chemicals over and over again in our bodies. The orderly progression of life would not be possible if enzymes produced random by-products, as these would clog up our systems by interfering with the complex matrix of interdependent enzyme action.

To clarify, we have hundreds of thousands of enzymes within our systems. They all work in a balance with each other. If you manage to screw up one, eventually it trickles down and affects all the others. It can take a long time, and we see this in a bigger picture in nature.

It is important to understand that the body recycles materials over and over again. It is only possible to do this because enzymes do not really pollute. They only produce a specific product that we can use again.

Because cars and most industrial processes do not recycle their fuel, as humans do or animals do, their randomly produced products do not affect them. However, synthetic or randomly produced chemicals often disrupt the enzyme-based chemistries of plant and animal life forms.

It has taken millions of years of evolution to develop enzyme systems. Plant and animal life are unable to adapt to the explosion of chemicals developed over the past 40 to 50 years, as they cannot evolve new enzymes to process new chemicals overnight. Enzyme systems have only evolved to work with natural compounds. This is why the billions of tonnes of synthetic chemicals produced have become problematic for healthy plant and animal life. Therefore, the 7 million chemicals we have created need to be used very carefully and controlled properly.

Our most current understanding of chemistry allows no other conclusion. Why, then, are Canadians spilling hundreds of millions of pounds of toxic substances all over our environment? Clearly, we do not understand the full ramifications of our actions.

In the U.S., annual production of organic chemicals soared from 1 million tonnes in 1930 to 500 million tonnes or one trillion pounds in 1990. As of 1994 in the U.S., there is approximately one tonne of municipal waste created per person per year. Incredibly there is also one tonne of hazardous waste created per person per year and, even more shocking, one tonne of industrial waste created per person each week.

The manner in which all developed nations are polluting the earth is turning out to be one of the most irresponsible actions mankind has ever committed. As reported on *CBC Radio* recently, of all the individual Canadian provinces and U.S. states, Texas and Ontario were the number one and two polluters. This was devastating but predictable news and indicates that our per capita pollution totals cannot be much different from those of the U.S. by any significant magnitude. I think we all know that Canada tends to use resources and energy along the same levels as our partners to the south on a per capita basis.

(take 0940 follows -- continuing with Mr. Bock -- Unfortunately, there is not a lot of data in Canada...) (Mr. Bock continuing)

Unfortunately, there is not a lot of data in Canada upon which I could draw for actual Canadian figures, so I have had to use U.S. data.

One drop of dioxin is enough to kill 1,000 people. In 1993, in the Great Lakes basin alone, Canadian companies reported that they dumped 111 million pounds of toxic chemicals. While reported figures are lower today, the actual figures for then and now known to be much higher. This is because Environment Canada's National Pollutant Release Inventory reporting excludes many large sources of toxic emissions. It is hard to believe, but the agriculture, forestry, fishing, oil well drilling and operations, and mining industries are exempt from basic reporting. Only downstream industries that process their products must report. Obviously, these primary industries are major contributors to pesticide and chemical pollution.

As a former worker on the oil rigs, I can tell you what I used to see. We would dump everything that we used on the rigs into a big pit and then cover it up. Into those pits went diesel fuel and half the chemicals used on those jobs. Having lived in Alberta for a large part of my life, it bothers me to know that there are such contaminated sites throughout the North.

The NPRI data also fails to show discharges of several very poisonous substances, such as dioxin and mercury, which are released in amounts below reporting thresholds. How many drops of dioxin are included in the above mentioned 111 million pounds of toxic waste? The government has essentially created pollution reporting rules that allow industry to covertly pollute, and is thereby misleading the public to believe that industry is accountable to Environment Canada.

To compound the problem, approximately 95 per cent of our industrial chemical production is petroleum derived. As a result, many of these compounds are fat soluble and get stored in our fat tissues. These petrochemically based residues concentrate in fat based animals at the top of the food chain. It is estimated that 90 to 95 per cent of all pesticides sprayed on conventional food concentrates in meat, fish and dairy products, or the animals highest in the food chain. We are the highest such animals.

Olympic performances by our athletes have been made possible by eating organic nutrition. I have been very careful to keep them away from conventional sources of food because they are laced with too many pesticides that will interfere with their performance. In addition, those foods have been depleted of required minerals by conventional fertilizers and chemicals.

The potential for concentration is alarming. The U.S. EPA estimates that fish can accumulate up to 9 million times the levels of PCBs in the water in which they live. That is a shocking figure. If this is not bad enough, consider the fact that half the world's fish catch is fed to livestock where toxins get further concentrated by the animals eating them.

Often we do not have the enzymes or capacity within our lymph system to properly process synthetic foods or other compounds that enter our body. A build-up of synthetic compounds can interfere with or block the body's normal biochemistry and lead to genetic mutation or degenerative disease.

It was not long after Monsanto began producing PCBs that it became apparent that these chemicals posed major problems to human life. Three years after production began, the faces and bodies of 23 of 24 workers in the Monsanto plant had become disfigured. That did not stop Monsanto. Since then, more than 1.5 billion pounds of the chemical have been produced by Monsanto and other producers. It is thought that PCBs can probably be found in the tissues of every fish on the planet.

Synthetics that closely resemble organic compounds can also fall into biochemical receptor sites and erroneously stimulate the body in undesired manners. This is the problem with endocrine mimickers and disrupters.

Health is normal. Disease is not. Genetic defects are normally very rare. Almost everyone's genetic design has been successfully passed on from generation to generation without interruption since the beginning of life on earth. It is estimated that one's chances of having a true genetic defect are about five in 1,000. Our genetic composition has been continuously re-engineered by nature throughout man's evolution. Nature's genetic engineering is so thorough and redundant in its ability to repair and regenerate that nothing man has designed comes even remotely close to being as sophisticated.

If the body works so well, why are so many people sick? Why is cancer now the leading cause of death in the country? Why are we spending $74 billion a year in health care, more than $2,000 per person per year? At this rate, we will spend $150,000 per person on health care throughout a Canadian's life, or almost $1 million for a family of six. We are in the process of bankrupting our society and our future.

The governments of the world have not properly regulated the chemical revolution that began in the 1930s. Cancer now kills more U.S. children than any other disease. Cancer in children was practically unheard of 40 years, as I am sure you all remember. Our agriculture and chemical industries are inadvertently ruining our soils and the foods generated there with chemical waste, chemical fertilizers, pesticides, and genetically altered crops.

Pollution in the form of contaminated air and water, chemically and genetically altered foods, chemical fertilizers which alter the mineral balances of the soils, pesticides sprayed on crops and yards, artificial food additives, electronic radiation, et cetera, is causing much of the degenerative disease and biological mutation among life forms. Many of us now get sick because our bodies are overwhelmed trying to eliminate non-natural substances that interfere with our own biochemistry.

Contrary to what experts and governments thought in the past, we are discovering that there are no safe levels of toxic chemicals. These chemicals have slowly spread themselves throughout the food chain and are weakening immune systems and causing illness to all life

forms. There is no reason for this to be happening. Short-term political and economic interests have created enormous environmental damage and are unnecessarily giving the chemical industry a bad name.

Most people do not understand how toxins make us sick. If they did, they would not be eating and or using so many of the products we buy today. Chemical pollution can take a long time to damage the genetics of an adult animal or human so that it almost looks as though there is nothing wrong until it is too late.

Worse, it creates immediate genetic damage in the unborn. In 1986, in Arkansas, the milk of 70 per cent of breast feeding mothers was found to be contaminated with heptachlor, a commonly used but toxic pesticide which had been banned several years before. Around the same time, a Hawaii study of 120 infants whose supply of breast milk was found to contaminated with heptachlor found the development of the infants' brains to severely retarded.

Unfortunately, these are not isolated cases. There are too many cases to include in brief, but they were widespread across the U.S. where these studies have been done.

Recently, more than a decade later, the U.S. Agency for Toxic Substances and Disease Registry finally confirmed that long-lived toxic chemicals have now been determined to definitely affect the intelligence of children exposed to chemicals in the womb. Examples such as this one show the need for a precautionary principle when evaluating new chemical compounds and deciding whether to use a substance.

I will now go to what I consider to be the most important part of the brief. Examined as a whole, all these facts and statistics present some very scary, yet unavoidable, conclusions. Even if we were to stop releasing toxins tomorrow, as a result of those spilled so far cancer rates should continue to get worse for several years to come as historical data shows that widespread environmental repercussions lag behind the actions that cause them. Since it is unlikely that we will be able to stop toxic polluting immediately, we can thereby further infer that cancer rates will most likely accelerate at an even faster rate than they are now. It is not unreasonable to forecast that we will lose a high percentage of our society to early cancer death. This has already begun, as evidenced by the changing mortality statistics.

While this is a horrifying prospect, an even greater threat to our society's future lies with the bigger problem of immediate genetic damage to the unborn, the future of our society. We can expect huge numbers of children with diminished intelligence, permanent learning disabilities, and weak immune systems, thereby lowering the overall intelligence and physical strength of our society. In a short period of time, we threaten to undo millions of years of evolution. It cannot be regained once lost. This is absolutely unacceptable. The decision to allow this destruction to continue lies in your hand and those of the other members of our government.

(Take 0950 follows -- Mr. Bock continues -- Most Canadians are not interested in environmental chemistry....)

DV/August 31, 1999 – Energy – 34973 (Mr. Bock continuing.)

Most Canadians are not interested in environmental chemistry and if Canadians do not understand enough chemistry to make the proper choices for themselves, government has to do the necessary research and classification needed to protect them. Canadians trust and expect their government to make the right policy choices.

CEPA must address basic chemical realities. It needs to develop principles for sustainable use of chemicals from which we can advance a viable economic and social framework. It needs to require immediate classification of any compounds we create so that we can properly regulate chemical use and eliminate the generation and use of dangerous substances.

How we use chemicals will significantly affect our economic and social welfare. It is backward to be considering short-term economic and social matters when building a foundation for long-term chemical policy.

Bill C-32, as presented by the standing committee in the House of Commons in May of this year, was a good starting point for Canada. While it leaves some environmental concerns unaddressed, it provides a framework for what is most important. It will provide a properly defined precautionary principle and an independent fast track for eliminating certain toxic substances based on their inherent toxicity.

The bill also provides classification of 23,000 of the 80,000 common chemicals in use today around the world with virtual elimination of those substances deemed toxic. The responsibility would be placed on the manufacturer to prove the safety of a substance prior to its introduction to the commercial marketplace. Power is given for the Environment Minister to implement the precautionary principle and to act quickly and independently when necessary to protect the environment and Canada's citizens.

These important features were nullified by subsequent amendments requested by industry and moved by the Minister of the Environment, which left it contradictory, ambiguous and ineffective. Each of these changes represents a significant barrier to quick and effective action to protect human health. I will provide a summary of how these features have affected the bill.

The definition of the precautionary principle was watered down by reinserting the words "costs-effective". A cost-effective precautionary principle is a contradiction in terms. Canada is already signatory to many environmental agreements in which this principle is reasonably defined; it does not include cost-effectiveness.

An independent fast track for eliminating certain toxic substances based on their inherent toxicity was removed. The virtual elimination provisions have been diluted. There is no longer a clear requirement to push towards the ultimate reduction of the most dangerous toxic substances. There is now an unnecessary emphasis on short-term economic considerations.

The Environment minister's power was reduced requiring the minister to get cabinet approval of many decisions when trying to take action against activity that endangers our environment and health. Instead of manufacturers having to prove the safety of a new

chemical as proposed by the House of Commons standing committee, the bill passed at report stage irresponsibly places the onus on the Environment minister to prove that a substance is toxic. The act as it is currently written relieves industry from behaving in a responsible manner and leaves Canadians potentially exposed to even more toxins than we have now. What kind of government would knowingly place business above the health and welfare of its citizens, including themselves?

For the exact wording changes to these important parts of the bill as proposed by the House standing committee, please see the compendium that you all have that I have attached as Appendix A.

The Senate should not allow Bill C-32 to pass without these critical sections returned to their full strength. Not to do this will merely condone the destruction of our environment.

A strong and effective CEPA should be the first step in getting our chemical house in order. To complement this bill, we should be creating new legislation to provide significant R&D tax credits and other tax-based incentives for Canada's industry to develop environmentally friendly industrial and transportation technologies for the twenty-first century.

Pollution induced health problems and global warning will leave society no choice but to develop such technologies. In our free enterprise system, technology is developed based on demands for it. Forward thinking governments and corporations recognize future demands and then implements programs to research and develop the technology to meet it.

The engineering expertise necessary to develop such technology lies within Canadian industry. Canada must help its industry invest in the future. These technologies will be as necessary to the twenty-first century as computers and communications systems have been to the latter half of this century. Their development will make the nations and companies developing them just as wealthy as the developers of those earlier technologies. Canada and its industry should be leading the way. There is no reason why we cannot be healthy and wealthy.

Thank you.

The Chairman: Thank you very much, Mr. Bock.

Senator Hays: Thank you very much. I think you reflect to some degree things we have already heard on the view of many Canadians about what is happening in their environment. The most disturbing thing is that we really do not know what the consequences of release of chemicals are over a very long term. Human life lasts on average now 75 years, let us say.

I am reminded a bit of the title to a play, "Stop the World, I Want to Get Off". Of course, we cannot get off. We are inextricably involved in a process that is trying to address the concerns that you have from many perspectives -- from your perspective as a concerned member of the human race, who has strong beliefs in terms of the consequences

of uncontrolled release or controlled release of chemicals about which we know nothing, and a desire to be, as you put it in your last sentence, wealthy as well as healthy.

This requires provincial governments to take positions they do. You did not say it, I can only imagine the reaction in my province of Alberta, which I gather is yours as well, if the federal government said that they were regulating the oil and gas exploration and production area, or if we went into Manitoba and said we are now going to take over on how you will exploit your forest products.

Senator Spivak: I wish they would.

Senator Hays: Of course, and some do, but I can only imagine the reaction that it would invoke. Other governments feel they have a responsibility there and feel that they are doing a good job carrying them out.

You portray business as many do. In the last bullet on page six you say that this bill is bad because it responds to business and in your last paragraph you say that it lies within Canadian industry, which is also business, to solve the problem.

I am being very general here to get an answer from you to the question that we have asked almost all of the witnesses. Given the point that we are at right now, where we have invested a huge amount of resources -- dollar and human and emotional -- in getting to where we are, is it a good idea to stop at this point or do we accept Bill C-32 as another step?

Mr. Bock: No. I have been thinking about this question. I have heard more and more that we are at a point now where we are considering whether we should take this legislation or go back to the 1988 legislation. Neither is acceptable.

In my opinion, you must do what I tell my athletes. We have done a heck of a lot of work to this point. I remember when I developed a Bobsled that had a big chunk of my life in it. It went down the track, and it did not go anywhere. But I kept trying with that silly thing and, believe it or not, with just a few more changes in that thing, it set a world record. They were minor changes to make for something that we worked on for a long time. When you look at, as arrogant as he may be, someone like Donavan Bailey or any number of our high performance athletes, they are continually running into hurdles. As you try to make your way to the top and try to make something the best possible, you are going to run into problems, and the key is not to quit.

You have done an amazing amount of work and I do not think we are far off from where we need to be with this bill. I am an environmentalist but my movement at times has embarrassed me because it comes off as being too extreme. We have run into this division. We have set up in our minds that there is no way for industry and environmentalists to get along, and there will be continual battles, and business is always against the environment. I do not buy that one bit.

We need new programs in place. We must recognize what drives our society. What is driving all those athletes? Money. What drives business? Money again -- tax.

(Take 1000 Follows -- Mr. Bock continuing: If we can set certain...)

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(tk 0950 ends--Bock cont. What drives business? Money again -- tax.)

If we can set up certain things up in a proper manner, we can stimulate our businesses to adapt and to meet their goals. Without that extra stimulus, like a coach pushing an athlete, that kind of thing often does not happen.

That is where we sit. This committee and the government needs to keep pushing. I know Mr. Anderson is in a difficult position. His party has taken a very solid position against moving any further on this legislation, but I think that will prove to be short-sighted. We are just about there. You had some terrific legislation proposed at the end of the May from the House of Commons subcommittee.

I do not think industry should be so concerned that they will suffer under such a bill. We need proper reporting of what is actually being spilled into the environment. This bill will at least help to gather that information. We need to control those substances. If we do not do that, we will be paying a high price for a long time. We may be jeopardizing the future of our whole country.

Senator Hays: On page 5 you have listed the important parts of the bill. If I read the bill correctly, we will see some action on those items. An attempt has been made to set out the precautionary principle, although it is not the definition preferred by the House of Commons committee nor by many members of this committee.

As I go through the list, something will happen on each of those items under Bill C-32 but nothing will happen on some of those items under the existing CEPA. This is a bit like your bobsled analogy. I do not know much about bobsleds. They are rather frightening and dangerous-looking.

What is the basis of success? Is it the bobsled? That is what we are talking about here -- the runners, the cabin, the aerodynamic configuration, all the important aspects. Or is it the team who uses the bobsled? I think both must work together. A good team on a bad bobsled can probably do very well but a poor team on a bad bobsled may not do so well. The real test of how Bill C-32 will work in law depends on how the government uses it.

I hear you and many other witnesses saying, please, run the department better; please ensure all these things happen which have not been happening.

Mr. Bock: I do not mean to interrupt but we need to work toward virtual elimination of persistent toxic substances. The writing is on the wall. I have not cited the studies which I have read in my work as a nutrition chemistry researcher, as a health field worker trying to figure out what is going wrong in our system.

I have seen so many young kids who are listless, who have no fire in their eyes. They are eating poor foods. They are eating junk. Countless studies now exist but they do not

get media attention because they just seem too scary. The scenario I presented here seems scary but we are living it right now. Twenty-seven per cent of our population is now dying of cancer. That is a huge percentage. We are living the nightmare. It does not seem too bad because we are surviving, but when we write it down and look at it, it looks bad.

We can get used to a lot of pain and hardship. That is what we are doing right now, but it will continue to get worse. There is no question the human race will survive but how many will survive and how strong will we be when we emerge from this in another 20 to 30 years?

We must provide certain incentives to industry to begin to change. Canada is always playing catch-up. Why? We have many innovative people in this country. We should have more faith in our industries and in our government to lead the way. We should not follow the U.S. and British systems that look like they may be working. Let us use our own initiative. We designed the Arrow. We have had any number of other great achievements in Canadian industry. Let us develop our new technologies and sell them to the world. Let us be the leaders and reap the rewards as well.

Senator Buchanan: Mr. Bock, you used the term "scary." We have heard a lot of comments around this table in the last week or so. Yours is probably the most scary in terms of what may or may not be happening out there in the world. I am not saying you are wrong. You state statistics about organic chemicals soaring from some 7 million tonnes in 1950 to a trillion pounds.

Mr. Bock: That is 500 billion tonnes.

Senator Buchanan: That is a big move.

Mr. Bock: That is right.

Senator Spivak: It is an industrial revolution.

Senator Buchanan: How do you explain that people are living longer in 1999 than they did in 1930, 1940, 1950?

Mr. Bock: It is a little complicated but there are good explanations for that. This is the best analogy I can give you. When you look in the mirror every morning, you see the same person. It looks like not much is happening, but your chemistry is turning over. This is debated but some say your entire chemistry turns over once every two to three years, and every atom in your body is replaced by others through your nutrition. Your genetic code is continually being copied over and over again and passed on.

You have an advantage being older on this planet. Anyone born before the 1950s has their entire chemistry built primarily on organic nutrition. You have a very strong base on which to begin.

I am 40 years old. I was born right in the heart of the chemical revolution. My generation is not quite as strong as your generation. We are seeing children born now with

greater numbers of deformities and general genetic problems which were not around before.

It takes a long time for your genetics to be hammered away by some persistent chemical. DNA is so well designed. The double-helix structure allows it to repair itself repeatedly, but that repair power can eventually be broken down. We may be living longer now but many of us are not living longer in good health.

Senator Buchanan: Are you saying that there will be a reversal of longevity?

Mr. Bock: I think so. I cannot prove that today but that is my position as a researcher. Yes, we will see that pattern. Look what happened in Russia. The life expectancy of a people can be knocked down. Absolutely.

Senator Buchanan: In North America do you see a reversal coming?

Mr. Bock: I see cancer statistics flying upward, yes, absolutely. I look at my parents' friends. My wife's grandfather has outlived several of his children. He is far healthier at 96 than his son is at 67.

Senator Cochrane: You cannot draw that conclusion.

Mr. Bock: Did I say I was? I am seeing certain things. I cannot prove what I am saying to you right now. I am just saying that there is evidence.

(tk 1010 follows--continuing with Mr. Bock--Statistics show that cancer rates are climbing)

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Statistics show that cancer rates are climbing and that the incidence of degenerative disease is climbing. If we want to live into long years with degenerative disease, that is one thing, but quality of life is very important.

Senator Buchanan: I realize that.

Someone mentioned politics a few minutes ago. I was a provincial politician for 25 years. During that time and up to the present we promoted fish for health reasons. Yet, as I read your brief, we should be doing just the opposite and tell people not to eat fish. My God, I would never go to Sambro again.

Senator Spivak: They say that to people in many places.

Senator Buchanan: No, they do not. We are still promoting fish as healthy food.

Mr. Bock: That is right. We are also promoting our conventionally grown agri-production as healthy food. If you were to ask me if that is healthy for my athletes, I would say no, it is not. I do not let them eat it.

Senator Buchanan: But athletes eat fish.

Mr. Bock: Yes, they eat fish, but you have to understand that it takes a long time to collect these toxins in our systems. They will not necessarily knock us down right away.

Particle physics is something I have been studying a long time. You can be radiated with beta radiation for a long time and not see the effects until 20 years later after the mutations in your DNA have caused changes.

I have a piece of property on the Stikine River, a beautiful part of remote Canada. I have recently learned what is happening to the fish there. It will be very hard for me to eat the fish that I love up there. It is driving me crazy to think that as an omnivore I am being pushed to vegetarianism of an organic source because I cannot get a good supply of meat in the country. It will have toxic compounds in it.

Ask Senator Adams what is happening in the North. We know what has happened to the food supply up there and the people who are eating it. We are at the top of the food chain. We are the strongest organism on the planet. We can take the most punishment before we get clobbered, but many of us are now feeling that punishment as the rising rates of death due to cancer show us. Heart disease was the number one killer just a while ago. Cancer has just crept past it now, and I think we can expect that to continue.

Senator Buchanan: Let me end by saying that in 30-years' time I will discuss this with you again.

Mr. Bock: There are ways to get around these tricky problems. As I sit here wanting to create a family and wondering if I should bring kids into this world, I am basically an optimist. I coach kids and try to get them to the Olympics. I am a positive thinker, generally. We have to think positively about a rather serious situation.

These statistics are alarming. If I had to bet on whether those statistics would turn out to be true, I would bet that they would. At the same time, I think there are ways we can begin to look to improve the situation. Nature has a way of healing itself, but not until you identify the problem and do something about it.

Senator Taylor: Mr. Bock, you paint quite a scary scenario, a little bit like those old revivalist preachers I used to see coming through the countryside when I was a kid. They said that we should repent or something terrible would happen to us.

You referred to new equipment and applied nutrition chemistry. In your coaching of athletes, do you prescribe certain herbs and vitamins?

Mr. Bock: We do prescribe certain food groups. We avoid certain types of fat.

I think you will see that what we consider good nutrition today will be changing. On the leading edge of nutrition research, there are many different views, as compared to what many of our governments are telling us what is good to eat.

Generally, we use more of certain chemical compounds than normal people do to fire our muscles and do certain things. We might enhance that, but, generally, I have all my athletes eat organic sources of food.

The name of the game in athletics, for example, is getting somewhere faster than someone else. To do that, you need to rest and recover and use your energy effectively. If your body is doing extra work to clean out toxins and your liver is having to work harder on keeping the body clean rather than build new tissue for athletic performance, you are just holding yourself up.

This was all triggered by Ben Johnson's positive tests. It became apparent to us that you could put a needle in yourself and stimulate one tiny part of your biochemistry -- your RNA -- to produce more muscle by using anabolic steroids; or you could look at the overall picture and stimulate your overall health. All of those different biochemistries are working to create the person you are. That is the approach we take.

We do not necessarily prescribe specific herbs. At times we might if it is deemed appropriate. However, we try to increase certain organic sources of minerals and rich oils, which help draw oxygen into your system and increase your metabolism. We also use certain types of protein that may be richer than others. Most definitely, we use a very specific diet.

Senator Taylor: In addition to your equipment, do you manufacture and sell any of these aids to nutrition?

Mr. Bock: No. I do a little consulting to help people who may not be doing so well and who might be sick in some manner. I help them work with their doctors to improve their nutrition.

We design specific types of running pants that allow us to maintain body temperature properly. Donovan Bailey wears those. We design bobsled equipment for our athletes, track and field spikes, and things like this.

Senator Taylor: I really enjoy my own workouts now, which are mostly jumping to conclusions, skipping the facts and labouring under misapprehensions.

Are your aware of the difference between the old CEPA and the new CEPA? The chairman put it well. I think he was being funny, but out of the mouths of babes comes truth and the ongoing saga.

We have discussed in the committee the concept of a five-year renewal. Of course, five-year renewals start a few years ahead and something goes on and on. I get the impression that you are critical that the bill has not moved along as fast as you would want it to.

You coach Olympic athletes, and trying to coach the House of Commons on an Olympic performance is hard, but you are right to do so. I get the impression that Bill C-32, although it has faults, is still a platform from which we move on to renew it for the next

four or five years. It would be wrong to slip back to square one and try to reinvent the wheel. Imperfect as we are, we have got this far in our training; therefore, we can go on a little further. You would like to see these improvements, but am I putting words in your mouth when I say imperfect as it is, it is still better than it was five years ago?

Mr. Bock: I have heard the argument you are making a lot recently in the press and from Minister Anderson. I think most of the work was done to get that bill to where it was prior to report stage.

Senator Taylor: We slipped back a bit.

Mr. Bock: That is right.

Senator Taylor: Did we slip back all the way to zero?

Mr. Bock: I think you slipped back much too far. To not have virtual elimination in that bill is unacceptable.

Senator Taylor: Let us pull virtual elimination out. What is your definition of "virtual elimination?"

Senator Hays: Take mercury for an example.

(take 1020 follows -- Mr. Bock: I am not an industrial chemist.)

Mr. Bock: I am not an industrial chemist. I am sympathetic to industry because of my experience with building a bobsled, for example. A bobsled is not only a piece of steel. It is a complicated chassis with fibreglass aerodynamics built with all of our modern industrial processes. I had acetone all over my hand when working on the bobsled. I was surrounded by fibreglass metal shavings and everything else you can imagine.

I know that we need to build and get on in life. However, there are certain compounds that we are generating. Mercury is a naturally found compound, as is radiation. Every brick in a building is throwing off some form of beta radiation because there are tiny amounts of radio nuclei in the earth from which the brick is made.

We cannot completely eliminate some substances, but PCBs are not normally found in nature and we can certainly move to reduce production of those substances. We will not be able to virtually eliminate them, having spilled them, but we will be able to virtually eliminate the use of them.

One can play around with those words. It may be scary for industry to start down the route that must be taken, but many things in life are scary. For example, it was scary for me to come and present a brief to you. Having never done this kind of thing before, I was heading into the unknown. I did not know what would happen when I got here. My athletes are another example. They do not know where they are going. Industries see the problem of environmental pollution in the same way. However, once you are forced to

begin taking steps in the direction that you need to go, you find that the route is not as difficult as you might have convinced yourself that it would be.

Industry is in a fuss over virtual elimination. The bottom line is that we will have to virtually eliminate these things at some point, so why not get started with it.

Senator Taylor: You may be closer to industry's definition than you think. They say down to the lowest measurable amount. Their concern is that measurement techniques will change and it becomes a moving target. They want virtual elimination, but they are worried about the definition. They want to eliminate as far as can be measured today and then have some security for four or five years. I think you are close to their position.

Mr. Bock: We need a strong CEPA to help us monitor. We are simply not monitoring the toxins that we are dumping. There are high thresholds on some of them and no reporting, in some industries, on others.

It was interesting to note, in the NPRI report put out in 1996 by the minister of the environment, how fast industries were reducing the numbers of toxins they were putting out, just based on the fact that they had to report them. When an industry realized that it was first on the list, there was an incentive to reduce so that they would not be the target of Greenpeace, for example.

The numbers were being reduced in two ways. First, they were being careful not to make errors in their reporting that might exaggerate the numbers. Second, the closure of one inefficient mine, which had become a PR headache for a company, resulted in a large reduction in pollutants.

It is very important that we get reporting up to speed and that we motivate industry to make the necessary changes.

Senator Taylor: I agree that reporting is the best tool we have because it enables the public to become sufficiently informed to make comparisons.

You said that the onus is on the minister of the environment to rule that something is toxic. I thought that was an advantage. Where would you prefer the onus to be?

Mr. Bock: I would prefer a reversal of responsibility. Under the earlier version of the bill, manufacturers had to prove that these substances are safe. I can understand industry's problem with this. If it is too difficult to prove that something is safe, nothing new will be introduced, which might not be good either. However, with the onus on the minister of the environment to prove that something is toxic, under the limitations of traditional scientific methods it may take 25 years to find out that something is toxic. In the meantime, we may have deformed embryos as a result of heptachlor in the womb.

Senator Taylor: It may be good to make the minister of the environment responsible because political pressures would keep him on his toes.

I represented the minister of health in Rome at the Codex Alimentarius, the international body that rules on what is safe and what is not in food. There is a new trend toward labelling. Labelling would give the minister the opportunity to warn that a product is new, with no evidence that it is either good or bad.

What do you think of that process?

Mr. Bock: I do not think that will protect the worker in the plant, or Canadians. Much is known about acetone, yet no one told me to keep my hands out the acetone I was working with. I will never put my hands in acetone again.

I have worked at different levels. I was fortunate to do some white collar work, but I really enjoyed my blue collar work and seeing what goes on in the blue collar work place. We cannot expect an oil rig worker to know what is safe. I climbed into a big mud tank one time to retrieve a wrench. To keep my clothes from getting soaked, I went in my underwear. I went right up to my neck and reached down for a wrench. I was saturated in diesel and I did not even know it.

Luckily, I am still healthy. We will see how my health is in a few years after all this work in various pretty tough areas. Our workers are too busy trying to get the job done without getting fired to be checking what particular substance they should be using. That applies to labs and plants.

Senator Taylor: I was referring to unknown substances.

Senator Adams: Your brief is very interesting. I was especially interested in your comments about the build-up of toxins in the fat of animals. My concern is that Bill C-32 says nothing about the country food that we live on in the North. You mentioned mercury in the fat. Our greatest concern is PCBs and mercury in breast milk.

At this time of the year, we usually make oil from the fat of whales and seals. We use that in the winter time to heat our homes. I am concerned about how those chemicals are affecting the people of the Arctic. People in communities in the high Arctic are sending me petitions on their concerns about Bill C-32.

How can we reduce air pollution and mercury pollution in the water?

(Take 1030 follows Sen. Adams continuing: Right now, our people are out hunting caribou...)

*** end ***.

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(**Senator Adams:** continuing.)

Right now, our people are out hunting caribou. There are toxins in the fat, which is what we like to eat. When you go to the store to buy beef, the butcher cuts the fat off. That

does not apply in the North. The same applies to seal meat. We use the oil from sea to heat and cook our food. That is very typical or me.

The minister is not saying that he will protect us from pollution which affects the country food which we eat. That is my main concern with Bill C-32. The minister promised me that, perhaps, he will work together with Mr. Rock. However, Mr. Rock does not work in the Senate.

My concern is with really how much of these substances are detected in the body. People up North tell us that meat is affected by the chemicals. As you say, more people are contracting more cancers every year.

We want to know how the system works and how the fat from animals gets into the system.

Mr. Bock: I live within a native community up north when I am up there. I try to get up there several months a year. It is discouraging to see native communities eating food that has been shipped from the U.S. all the way up north. It is no longer fresh. It is often processed in many ways. Instead of eating the traditional foods that are sitting right there, they are eating those foods, although now the traditional foods, as you know, are so contaminated by airborne pollution and from the waters that so much of the food ultimately comes from.

Personally, I think your people will have to be eating a lot of root, which does not help you very much in the winter when you need the oils and the fat. It is a very tricky problem.

We have the same problem in the diet of non-aboriginal North Americans who are eating this traditional western diet. They have very little understanding of what has happened to the fats within this diet. Margarines and other modified fat compounds are full of pretty nasty things. It is not well known. There are big lobby groups within the food processing industries to try to keep some of that information down as long as possible. It is starting to come out. You see it at the fringes of society, for example, where athletes require the best nutrition and they are out looking for the answers. They have access to that kind of information.

It is not just the diet of traditional peoples but the diet of the rest of North Americans that has been altered. We are finding more and more that there is a big problem. Traditionally, doctors are not trained in nutrition chemistry. I have talked to many doctors about this. In fact, I lecture to doctors on nutrition chemistry. They get six hours of in nutrition chemistry training in their 4,400 hours of training to become a doctor. That seems a little crazy when you consider they are trying to deal with human biochemistries. If you are not studying nutrition chemistry for human biochemistry, I do not know how you can look at the whole situation.

That is changing now. More and more doctors are going out and getting private educations on these areas. They are doing their own research and becoming aware of the problems with the current food supply and what you need to do to try to minimize the effects of any detrimental things that might be in there.

Let us keep in mind, too, that the human body is very tough. Our lymph system is the garbage can of our bodies. As long as that garbage can is not full, you can operate. As it starts to fill up and overflow and starts to spill toxins into the other parts of your system, it puts an even greater demand on your body. It is not great to have these things in your system. They concentrate in your liver and any number of places. They can cause problems.

It is not like we have been exposed to carbon monoxide for the first time since the creation of engines. It is created in fires. We have been breathing smoke and any other number of other things. The human and other animals are very strong. They are designed to deal with a certain amount of crud and to be able to get on with it. I think we are now starting to hit the limitations. We are seeing that in any number of government studies. For example, how much more dioxin can our environment take? There are groups thinking not much. These are scientific groups which think that we are just about at that threshold now, that the overall world environment cannot handle any more.

Senator Spivak: Thank you, Mr. Bock, for a very interesting presentation. I know what you are talking about when you talk about nutrition chemistry because my family physician is into that right now. It is quite enlightening.

Environmentalists know what you are saying. Most are very aware of it. You are challenging an entire civilization and life-style and therefore many people are in denial. It is the same thing Galileo went through. The church persecuted him for his views. It is quite understandable what is happening. It will eventually percolate through. The only thing is: Will we have enough time to repair the damage?

As you know, most of the important things are not covered under this bill; they are covered under other legislation which deals with pesticide products, seeds and foods and drugs. All new food, drugs and cosmetics will be handled by the Canadian Food Inspection Agency. The interesting thing about that is that they will not have to assess anything. They will not have to do any assessment at all. First, most of the assessment will be done by the companies and then someone will look at it and say, "Oh, that is great," and pass it.

Apart from that, if there is substantial equivalency, that is, if you look at a potato and it seems to look like a potato, there is no need to assess it. That whole concept of substantial equivalency was introduced by, I am sure, the companies to ensure that their products are not challenged.

It was said in one of our briefs that the notion of substantial equivalency is not at all scientifically based. It has never been tested. The scientific process for evaluating things like biotech products is quite different. Could you comment on that, since you are a nutritional expert?

Mr. Bock: It is a tricky area because I do respect the scientific method enormously; however, at the same time, I see its limitations. I was trying to explain to Senator Ghitter when we first met that if we approached athletic performance just using the tools that scientific analysis allow us, we would not be able to get anywhere. We just would not get

any data in time. As a result, we have to use the precautionary principle when we are trying to develop athletes. We have to quickly recognize whether something is working for them or not. Sometimes you are using science and sometimes you are using your gut instinct and common sense. You are reading all the signals around you and you might not have absolute proof for something, but history has shown us some things work like this and we see seem to have a trend here. You base a decision on that. I do not know how we will get around some of these loggerheads.

(take 1040 follows: **Senator Spivak:** Maybe I can be more specific.)

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Senator Spivak: Maybe I can be more specific. I am asking whether if you have a food, in which one gene has been altered, that that food is then not the same as the natural occurring substance.

Mr. Bock: Absolutely.

Senator Spivak: That is the point. However, the practice is that that food it is just the same as the natural substance, so we do not have to test it.

Mr. Bock: We know that is just not right.

Senator Spivak: We got that argument in the rBST hearings constantly from the companies, that rBST was the same as the natural occurring BST. This is a very difficult problem.

Mr. Bock: I have a way of trying to explain this when people come to me with diet problems or health problems that might be rectified by diet. One of the big problems we have with our food supply, of two or three major ones, is pesticides. There is a highly contaminated or altered numbers of fats in our diet that many people do not know about. Very importantly, our soils have become demineralized because plants need 24 to 25 nutrients and our chemical fertilizer have three or four. They use the three or four and they leech the ground for the others. This has been going on for 40 years. There are studies showing that these foods that we are buying in the store do not have anywhere near the minerals they once had. In fact, you need five basic minerals in your body and most people do not know this. But sodium is the most important one – bioorganic sodium, not table salt. If you listen to conventional wisdom, you would not be touching sodium; it will give you hypertension and any other number of problems. In truth, sodium is the mineral you require the most. Next are chlorine, then potassium, calcium and magnesium.

Sodium has been reduced to almost nothing in the ground. It is down by 2,000 times in many soils where fertilizers have been used. Plants need sodium. Life comes from the oceans. It is obvious why sodium and chloride are a big part of our chemical composition. However, there is no longer sodium in the ground in many places. It differs by soil test in one place to another.

A nice head of romaine lettuce at your convention store, refrigerated properly, looks terrific but if you put that up against an organic head of lettuce, the two will look essentially the same. However, if you chemically analyse them and one is very different from the other.

To try to get this point across to people, who may not understand this, I put it this way. Imagine that you are the head of lettuce and you are looking at two human babies. One happens to be born with Down's Syndrome and the other is "normal". You look at those two babies and they look essentially the same. You cannot tell there is anything different from one to the other. There are subtle differences from one to the other, but they are important differences, as we know.

Many people do not know this. This is not supposed to be nutrition briefing but the lack of mineral in our foods is causing many problems with degenerative diseases and any other biochemical factors in our lives. This point which you are making about the small changes to foods often being significant and not remaining the same is important.

The Chairman: Thank you, Mr. Bock for appearing. You have come here not as a lobbyist for either side. You come here as an interested citizen with an amazing background and you have made quite an impact on the committee.

I, like you, am an optimist. Mankind has been able to overcome many things in its evolution, and we will do the same here. We need some help. Judging from what you have said, and help me on this, your bottom line is that neither of the suggestions by Senator Hays to either get on with it or go back to where we were, are acceptable to you. You are telling this committee that there are areas in which we can improve the bill. We should go ahead and do our work.

Mr. Bock: That is right. I have been so impressed with what government has been able to do for Canada. I was not so impressed prior to looking into any number of issues but when I saw the body of work that had been accomplished by the standing committee at the house level, it is remarkable. It is remarkable that so many people from different backgrounds could agree on something. A very diversified group agreed that this was the best way to proceed. They were our experts looking at this issue for the House of Commons. I am surprised that we did not have the guts to listen to our experts, and I hope that the Senate listens to this panel that has been put together based on their expertise as well when going forward.

You have put in charge with a difficult job of assessing this legislation, but much work has been done. It is good work and I just think we should be listening to what our house committee members had to say in the first place. They did a very good job. We should continue that.

The Chairman: Thank you.

THURSDAY, September 9, 1999

The Standing Senate Committee on Energy, the Environment and Natural Resources has the honour to present its

SEVENTH REPORT

Your Committee, to which was referred the Bill C-32, An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development, has, in obedience to the Order of Reference of Tuesday, June 8, 1999, examined the said Bill and now reports the same without amendment, but with observations which are appended to this report.

Respectfully submitted,

Le président

RONALD D. GHITTER

Chair

Le JEUDI 9 septembre 1999

Le Comité sénatorial permanent de l'énergie, de l'environnement et des ressources naturelles a l'honneur de présenter son

SEPTIÈME RAPPORT

Votre Comité, auquel a été déféré le Projet de loi C-32, Loi visant la prévention de la pollution et la protection de l'environnement et de la santé humaine en vue de contribuer au développement durable, a, conformément à l'ordre de renvoi du mardi 8 juin 1999, étudié ledit projet de loi et en fait maintenant rapport sans amendement, mais avec des observations qui sont annexées au présent rapport.

Respectueusement soumis,

MINORITY OBSERVATIONS

Observations of Progressive Conservative Senators of the Standing Senate Committee on Energy, the Environment and Natural Resources on their study of Bill C-32, *An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development*

OBSERVATIONS MINORITAIRES

Observations des sénateurs progressistes-conservateurs du Comité sénatorial permanent de l'énergie, de l'environnement et des ressources naturelles sur leur étude du Projet de loi C-32, *Loi visant la prévention de la pollution et la protection de l'environnement et de la santé humaine en vue de contribuer au développement durable*

BACKGROUND

Bill C-32, the *Canadian Environmental Protection Act, 1999* has had a long and sometimes tortuous history. While the Bill was introduced in the House of Commons on March 12, 1998 by the Minister of the Environment, its predecessor Bill C-74 was actually tabled in the House on December 10, 1996. Bill C-74 died on the Order Paper when the last general election was called.

HISTORIQUE

Le Projet de loi C-32, la *Loi canadienne sur la protection de l'environnement de 1999*, a connu une longue et parfois tortueuse histoire. Il a été présenté à la Chambre des communes le 12 mars 1998 par le ministre de l'Environnement, mais son prédécesseur, le Projet de loi C-74, a en réalité été déposé à la Chambre le 10 décembre 1996. Le Projet de loi C-74 est mort au Feuilleton lorsque les dernières directions générales ont été convoquées.

What is at stake here is the health of Canadians. Young people who are increasingly suffering from asthma, allergies and cancer, our Inuit people who are afraid to eat their traditional food, babies who face the risk of ingesting toxic pollutants in their mothers' breast milk and inside the womb are at risk.

Ce qui est en jeu ici, c'est la santé des Canadiens. Les jeunes qui sont de plus en plus nombreux à souffrir d'asthme, d'allergies et de cancer, nos Inuit qui ont peur de manger leur nourriture traditionnelle, les nourrissons qui risquent d'ingérer des polluants toxiques dans le lait maternel et dans le sein de leur mère sont en danger.

Mr. Sam Bock, a well known Canadian Olympic coach who has worked with top athletes and studied nutrition for many years, painted a bleak picture before the Senate Committee on Energy, the Environment and Natural Resources:

M. Sam Bock, un entraîneur bien connu de l'équipe olympique canadienne, qui a travaillé avec des athlètes de haut niveau et étudié la nutrition pendant de nombreuses années, a dépeint un sombre tableau au Comité sénatorial de l'énergie, de l'environnement et des

ressources naturelles :

Pollution in the form of contaminated air and water, chemically and genetically altered foods, chemical fertilizers which alter the mineral balances of the soils, pesticides sprayed on crops and yards, artificial food additives, electronic radiation, et cetera, is causing much of the degenerative disease and biological mutation among life forms. Many of us now get sick because our bodies are overwhelmed trying to eliminate non-natural substances that interfere with our own biochemistry.

La pollution sous la forme d'air et d'eau contaminés, d'aliments chimiquement et génétiquement modifiés, d'engrais qui altèrent l'équilibre des minéraux des sols, de pesticides pulvérisés sur les récoltes et les terres, d'additifs alimentaires artificiels, de radiation électronique, et cetera, est la cause d'une grande partie des maladies dégénératives et des mutations biologiques dans les formes de vie. Nombreux sont ceux d'entre nous qui aujourd'hui tombent malades parce que nos corps n'arrivent plus à éliminer les substances non naturelles qui perturbent notre propre biochimie.

Contrary to what experts and governments thought in the past, we are discovering that there are no safe levels of toxic chemicals. These chemicals have slowly spread themselves throughout the food chain and are weakening immune systems and causing illness to all life forms. There is no reason for this to be happening. Short-term political and economic interests have created enormous environmental damage and are unnecessarily giving the chemical industry a bad name.

Contrairement à ce que les experts et les gouvernements croyaient dans le passé, nous découvrons aujourd'hui qu'il n'y a pas de niveaux sûrs de produits chimiques toxiques. Ces produits chimiques se sont lentement répandus dans la chaîne alimentaire et ils affaiblissent le système immunitaire et entraînent des maladies pour toutes les formes de vie. Il n'y a aucune raison qui justifie cela. Des intérêts politiques et économiques à court terme causent de graves dommages *à* l'environnement et salissent inutilement la réputation de l'industrie chimique.

Most people do not understand how toxins make us sick. If they did, they would not be eating and or using so many of the products we buy today. Chemical pollution can take a long time to damage the genetics of an adult animal or human so that it almost looks as though there is

La plupart des gens ne comprennent pas comment les toxines nous rendent malades. Si c'était le cas, ils ne mangeraient pas et n'utiliseraient pas un grand nombre des produits que nous achetons aujourd'hui. La pollution chimique prend parfois bien du temps à

nothing wrong until it is too late.

endommager les gènes d'un animal ou d'un humain adulte de sorte qu'on ne s'aperçoit de presque rien avant qu'il ne soit trop tard.

Worse, it creates immediate genetic damage in the unborn. In 1986, in Arkansas, the milk of 70 per cent of breast feeding mothers was found to be contaminated with heptachlor, a commonly used but toxic pesticide which had been banned several years before. Around the same time, a Hawaii study of 120 infants whose supply of breast milk was found to contaminated with heptachlor found the development of the infants' brains to severely retarded.

Pire encore, elle entraîne des dommages génétiques immédiats chez l'enfant à naître. En 1986, dans l'Arkansas, on a constaté que le lait de 70 p. 100 des mères qui allaitaient était contaminé à l'heptachlore, un pesticide toxique utilisé couramment qui avait été interdit plusieurs années auparavant. À peu près au même moment, à Hawaii, une étude de 120 nouveau-nés qui avaient été nourris de lait maternel de toute évidence contaminé à l'heptachlore a révélé un grave retard de développement du cerveau de ces nourrissons.

In addition, Senator Willie Adams of the new territory of Nunavut described for the Committee the issues facing the people of the North:

En outre, le sénateur Willie Adams du nouveau territoire du Nunavut a décrit au Comité les problèmes devant lesquels se trouvent les résidents du Nord :

Right now, our people are out hunting caribou. There are toxins in the fat, which is what we like to eat... The same applies to seal meat. We use the oil from seals to heat and cook our food.

Présentement, nos gens chassent le caribou. Il y a des toxines dans le gras, la partie que nous aimons manger… C'est la même chose pour la viande de phoque. Nous utilisons l'huile de phoque pour réchauffer et faire cuire nos aliments.

The Minister is not saying that he will protect us from pollution which affects the country food we eat.

Le ministre ne dit pas qu'il va nous protéger de la pollution qui détériore les aliments locaux que nous mangeons.

My concern is with really how much of these substances are detected in the body. People up North tell us that meat is affected by chemicals. More people are contracting more cancers every year.

Je me demande quelles quantités au juste de ces substances sont détectées dans l'organisme. On nous dit que la viande contient des produits chimiques. Il y a plus de gens qui se retrouvent avec toutes

sortes de cancers chaque année.

Protecting the environment is a serious matter. That is why Progressive Conservative Senators wished to give Bill C-32 serious, detailed consideration.

La protection de l'environnement est une affaire sérieuse. C'est la raison pour laquelle les sénateurs progressistes-conservateurs souhaitaient un examen sérieux et détaillé du Projet de loi C-32.

Bill C-32 represents the culmination of the five year review mandated by the first Canadian Environmental Protection Act passed by Parliament in 1988. This five year review began in 1994 with hearings held by the House of Commons Standing Committee on Environment and Sustainable Development which resulted in a Report released by the Committee in June 1995 entitled "It's About Our Health! Towards Pollution Prevention." The theme of the report was pollution prevention. The government's response to this Report was released in December 1996 and it disagreed with some of the basic premises of the House Committee Report.

Le Projet de loi C-32 est le point culminant de l'examen quinquennal exigé par la première *Loi canadienne sur la protection de l'environnement* adoptée par le Parlement en 1988. Cet examen quinquennal a débuté en 1994 lorsque le Comité permanent de l'environnement et du développement durable de la Chambre des communes a tenu des audiences qui ont débouché sur un rapport publié en juin 1995 sous le titre « Notre santé en dépend! Vers la prévention de la pollution ». Le thème du rapport était la prévention de la pollution. Le gouvernement a rendu publique sa réponse à ce rapport du comité de la Chambre en décembre 1996 et il était alors en désaccord sur certaines des hypothèses de base qu'il renfermait.

Bill C-32 was referred to the House of Commons Standing Committee on Environment and Sustainable Development on April 28, 1998. It was before the Committee for almost one year. The clause-by-clause examination of the Bill in the House Committee took 93 hours. Over 500 amendments were considered and 150 accepted, with 90 of those having been put forward by the government members of the Committee. The final report of the Committee on the Bill was approved with all Liberals on the Committee voting in favour of the Report. At Report Stage in the House of Commons over half of the Committee amendments were reversed by the government, sometimes by amendments which had never been considered by the Committee previously.

Le Projet de loi C-32 a été renvoyé au Comité permanent de l'environnement et du développement durable de la Chambre des communes le 28 avril 1998 et il y est demeuré pendant près d'un an. L'étude article par article du projet de loi par le comité de la Chambre a exigé 93 heures. Plus de 500 amendements ont été examinés et 150 d'entre eux ont été adoptés, dont 90 avaient été proposés par les membres du gouvernement au Comité. Le rapport final du Comité sur le projet de loi a été adopté, tous les députés libéraux ayant voté en faveur de celui-ci. À l'étape du rapport à la Chambre des communes, plus de la moitié des amendements du Comité ont été rejetés par le gouvernement, amendements qui n'avaient parfois même jamais été examinés par le Comité.

The Senate of Canada gave second reading to Bill C-32 on June 8, 1999 and the Standing Senate Committee on Energy, the Environment and Natural Resources held hearings on June 15 and 16, 1999 prior to the summer recess and sat for only 7 more days in late August and early September. Due to scheduling conflicts the Committee was not able to meet again until August 24, 1999. However, we believed that we would be able to sit for as long as it took to hear as many witnesses as necessary to enable us to understand the Bill and, where necessary, consider and perhaps pass amendments which would in turn be considered by the full Senate.

Le Sénat du Canada a procédé à la deuxième lecture du Projet de loi C-32 le 8 juin 1999 et le Comité sénatorial permanent de l'énergie, de l'environnement et des ressources naturelles a tenu des audiences les 15 et 16 juin 1999 avant l'ajournement d'été, et n'a siégé que sept jours additionnels à la fin du mois d'août et au début du mois de septembre. En raison de conflits d'horaire, le Comité n'a pas pu se réunir de nouveau avant le 24 août 1999. Cependant, nous avons cru que nous pourrions siéger aussi longtemps qu'il le faudrait pour entendre autant de témoins que nécessaire pour pouvoir bien comprendre le projet de loi et, au besoin, examiner et peut-être adopter des amendements qui seraient ensuite examinés par le Sénat en séance plénière.

THE INVOCATION OF CLOSURE ON COMMITTEE PROCEEDINGS

During its hearings on June 15 and 16 and on August 24, the Committee heard only from officials from the Department of the Environment in order to gain background knowledge of the Bill and to obtain answers to technical questions posed by the Senators. The Committee had not yet heard from the Minister of the Environment nor from a single witness representing the public interest when the following motion was presented:

> That with respect to Bill C-32, An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development, the Committee shall follow the agreed upon schedule of witnesses and complete its examination of those witnesses no later than Wednesday, September 1, 1999;

L'INVOCATION DE LA CLÔTURE À L'ÉGARD DES DÉLIBÉRATIONS DU COMITÉ

Au cours de ses audiences des 15 et 16 juin et du 24 août, le Comité n'a entendu que des représentants du ministère de l'Environnement qui devaient lui donner des renseignements sur le projet de loi et répondre aux questions de détail posées par les sénateurs. Le Comité n'avait encore entendu le témoignage ni du ministre de l'Environnement ni d'un seul témoin représentant l'intérêt public lorsque la motion suivante a été proposée :

> Que, relativement au projet de loi C-32, Loi visant la prévention de la pollution et la protection de l'environnement et de la santé humaine en vue de contribuer au développement durable, le Comité se conforme au calendrier convenu de comparution des témoins et termine l'interrogation de ces témoins au plus tard le mercredi 1er septembre 1999;

That if any further witnesses are found to be necessary by the Committee following the completion of the said schedule of witnesses, they shall be heard no later than Thursday, September 2, 1999;

That any vote on any motion dealing with the disposition of the said Bill be held no earlier than at the completion of the hearing of all witnesses; and

That the Chair put all questions necessary to dispose of the Bill and report the Bill to the Senate no later than 12:00 o'clock noon on Tuesday, September 7, 1999.

Que, dans l'éventualité où le Comité estimerait nécessaire d'entendre d'autres témoins après l'échéance du délai convenu, ces témoins soient entendus au plus tard le jeudi 2 septembre 1999;

Qu'il ne soit pris aucun vote sur une motion portant sur la manière dont il sera disposé dudit projet de loi avant que ne soit terminée l'interrogation des témoins conformément au calendrier convenu;

Et que le président mette aux voix toutes les questions nécessaires à la prise d'une décision à l'égard du projet de loi et présente le rapport sur le projet de loi au Sénat au plus tard à midi le mardi 7 septembre 1999.

Despite the outrage and vigorous opposition by Progressive Conservative Senators, the motion was supported by all of the Liberal Senators and passed. The motion prematurely judged the work of the Committee and effectively limited the time which could be spent with witnesses discussing the Bill as well as a detailed clause-by-clause review. It demonstrated the unwillingness of the Senators representing the government to carefully consider evidence which would be heard by the Committee during its hearings and their further unwillingness to consider amendments.

Malgré l'intense indignation et la vigoureuse opposition des sénateurs progressistes-conservateurs, la motion a été appuyée par tous les sénateurs libéraux et adoptée. La motion a jugé prématurément les travaux du Comité et effectivement limité le temps qui pouvait être consacré à la discussion du projet de loi avec des témoins et à une étude détaillée article par article. Elle a démontré que les sénateurs représentant le gouvernement n'étaient pas prêts à examiner soigneusement les témoignages qui auraient été entendus par le Comité durant ses audiences et qu'ils n'étaient pas prêts non plus à envisager des amendements.

Progressive Conservative Senators on this Committee have taken their work seriously and believed they were involved in a meaningful process which might result in better legislation. PC Senator Ghitter, Chair of the Committee stated at the outset of the hearings:

Les sénateurs progressistes-conservateurs du Comité ont pris leur travail au sérieux et croyaient qu'ils participaient à un processus valable qui permettrait peut-être d'améliorer la loi. Voici ce qu'a dit le sénateur progressiste-conservateur Ghitter, président du Comité, au début des audiences :

> Honourable senators, this morning we are embarking on what will probably be the largest task this Committee has faced in

> Honorables sénateurs, ce matin nous entamons ce qui sera probablement la tâche le plus lourde qu'a dû accomplir

the years I have been a member of it. Our task is to examine Bill C-32, respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development.

notre comité depuis que j'en suis membre. Nous devons étudier le projet de loi C-32, Loi visant la prévention de la pollution et la protection de l'environnement et de la santé humaine en vue de contribuer au développement durable.

It is, indeed, an important bill which I know members of our Committee will very much want to have explained to them. It is not a simple bill. I look forward to some enlightenment from our witnesses today and from, I am sure, others who we will hear in the future.

Il s'agit en effet d'une mesure législative importante, au sujet de laquelle les membres de notre comité voudront des explications. Ce projet de loi n'est pas simple. Heureusement, nous allons dès aujourd'hui entendre des témoins qui nous aideront à mieux le comprendre.

The invocation of closure on the proceedings of a Committee, especially before it has heard any public witnesses goes against the traditions and conventions of the Senate and indeed the very purpose of its review of legislation.

L'invocation de la clôture à l'égard des délibérations d'un comité, surtout avant qu'il n'entende des témoins représentant l'intérêt public va à l'encontre des traditions et des conventions du Sénat et, de fait, de l'objet même de son examen de la législation.

In the Confederation Debates, Sir John A. MacDonald was quoted as saying:

Sir John A. MacDonald aurait dit ceci lors des débats sur la Confédération :

There would be no use of an Upper House, if it did not exercise, when it was thought proper, the right of the opposing or amending or postponing the legislation of the Lower House. It would be of no value whatever were it a mere chamber for registering the decrees of the lower house. It must be an independent House, having free action of its own, for it is only valuable as being a regulating body, calmly considering the legislation initiated by the popular branch.

Une Chambre haute ne serait d'aucune utilité si elle n'exerçait pas, quand elle le juge à propos, le droit de rejeter, de modifier ou de reporter à plus tard une mesure législative adoptée par la Chambre basse. Elle aurait tort de se borner à enregistrer les décrets de la Chambre basse. Elle doit être une Chambre indépendante et libre d'agir comme bon lui semble, car elle ne vaut que dans la mesure où, véritable organisme de réglementation, elle examine calmement les projets de loi proposés par la branche populaire.

It should also be noted that the work of

Il conviendrait aussi de signaler que les

Senate Committees has received praise from virtually all commentators on Parliamentary activities. For example, Robert and Doreen Jackson in "Politics in Canada: Culture, Institutions, Behaviour and Public Policy" (1986) have written:

> ... aspects of Senate Committee work have often been cited as beneficial to Canadian Society and have increased the status of the upper house. From time to time, the Senate establishes special committees to investigate key social issues and to make recommendations for new policy initiatives ... Senate Committees ... helped to build consensus around particular problems and alternate responses. (Pp. 345-346)

As well, Professor F. A. Kunz, of McGill University, author of the "Modern Senate of Canada, 1925-1963," made the following comment:

> The role of the Committees in the Senate is a reflection of the composition of the Senate and the manner in which it is composed. We all know the structure includes both standing and special committees. Some committees have been of the highest quality and importance throughout the years... (Keynote Address: Senate Committees Professional Development Workshop, 1991, p.5)

Senate Committees can only be a credit to the Senate if they are allowed to function properly without undue interference and unreasonable time limits. It was the belief of the

travaux des comités sénatoriaux ont été louangés par presque tous les commentateurs des activités parlementaires. Par exemple, Robert et Doreen Jackson ont écrit dans « Politics in Canada: Culture, Institutions, Behaviour and Public Policy » (1986) :

> ... certains aspects des travaux des comités ont souvent été reconnus comme étant profitables à la société canadienne et ont permis de rehausser le statut de la Chambre haute. Il arrive de temps à autre que le Sénat mette sur pied des comités spéciaux qu'il charge de faire enquête sur certains problèmes sociaux d'importance et de formuler des recommandations en rapport avec de nouvelles politiques… Les comités du Sénat… ont contribué à l'établissement d'un consensus social autour de certains problèmes particuliers et de réponses nouvelles. (p. 345-346)

M. F. A. Kunz, professeur à l'Université McGill et auteur de « Modern Senate of Canada, 1925-1963 », a fait le commentaire qui suit :

> Le rôle des comités sénatoriaux est le reflet de la composition du Sénat et de la façon dont les sénateurs sont désignés. Nous savons tous qu'il y a des comités sénatoriaux permanents et spéciaux. Certains d'entre eux ont accompli un travail remarquable au fil des ans… (Principales allocutions prononcées aux ateliers de perfectionnement de la Direction des comités du Sénat, 1991, p. 5-6)

Les comités sénatoriaux ne peuvent être utiles au Sénat que s'ils sont autorisés à fonctionner adéquatement sans ingérence indue et délais déraisonnables. Les sénateurs

Progressive Conservative Senators that sufficient time had to be taken by the Senate Committee to study the work done in the House of Commons Committee on Environment and Sustainable Development. A number of the amendments put by the government and passed at Report Stage in the House of Commons introduced new elements into this Bill which have not been studied in detail. While the study and amendments put in the House Committee may have swung the pendulum towards the protection of the environment, the amendments passed by the government, under extreme pressure from industry, essentially gutted the work of the House Committee and created an imbalance towards industry which we believed through reasoned amendments could be bridged by the Senate Committee.

progressistes-conservateurs étaient d'avis qu'il fallait que le Comité sénatorial prenne suffisamment de temps pour examiner les résultats des travaux du Comité de l'environnement et du développement durable de la Chambre des communes. Un certain nombre d'amendements proposés par le gouvernement et adoptés à l'étape du rapport à la Chambre des communes ont introduit dans ce projet de loi de nouveaux éléments qui n'ont pas été étudiés en détail. Il se peut que l'étude et les amendements proposés au Comité de la Chambre aient eu l'effet d'un mouvement de pendule vers la protection de l'environnement, mais les amendements adoptés par le gouvernement, sous les intenses pressions exercées par l'industrie, ont essentiellement réduit à néant les travaux du Comité de la Chambre et créé un déséquilibre en faveur de l'industrie, que pourrait selon nous redresser le Comité sénatorial au moyen d'amendements motivés.

However, it became clear after questioning the Minister of the Environment and through the comments made by Liberal Senators that these types of amendments would not be tolerated.

Néanmoins, il est clairement ressorti du témoignage du ministre de l'Environnement et des observations faites par des sénateurs libéraux que ces types d'amendements ne seraient pas tolérés.

THE 1988 CEPA

LA LCPE DE 1988

This has left the Committee in the unprecedented position where a number of witnesses, including the Minister of the Environment have stated that the present legislation is better than Bill C-32, or in the case of Minister Anderson, in response to a question by Senator Spivak, he stated:

Le Comité s'est retrouvé dans une position sans précédent lorsqu'un certain nombre de témoins, dont le ministre de l'Environnement, ont dit que la législation actuelle est préférable au Projet de loi C-32 ou, dans le cas du ministre Anderson, en réponse à une question de la sénatrice Spviak, il a dit que :

> ... I respect your comment that perhaps the existing Bill C-88 is better ... I think we can live with the 1988 legislation if we have to, yes.

> … Je ne nie pas que la loi actuelle soit préférable… Je pense que nous pouvons nous accommoder de la loi de 1988 s'il le faut, oui.

…

It is always possible to work under the old legislation.

…

Il est toujours possible de s'en remettre à la vieille loi.

This view was reiterated by Mr. Wayne Fraser from the Mining Association of Canada. He concluded his statement to the Senate Committee by saying:

C'est ce qu'a dit également M. Wayne Fraser de l'Association minière du Canada. Il a terminé sa déclaration au Comité sénatorial en disant :

In summary, the Mining Association of Canada is not certain that Bill C-32 as it stands will provide any improvement over the existing Act in benefit to the environment or cost to the economy ... We feel our proposals are the minimum alterations that must be made.

En résumé, l'Association minière du Canada n'est pas certaine que, sous sa forme actuelle, le projet de loi C-32 représentera une amélioration par rapport à la loi existante pour l'environnement ou les coûts économiques… Nous estimons que nos propositions correspondent aux changements minimums qu'il faudrait apporter.

This view was also shared by those representing "environmental groups." Paul Muldoon, Executive Director, Canadian Environmental Law Association reflected that "the legislation process has gone awry ... At the end of the day I have to attribute this to lack of leadership by the government in the area of the environment and the lack of hard decisions."

C'est aussi le point de vue des représentants des « groupes environnementalistes ». Selon M. Paul Muldoon, directeur exécutif de l'Association canadienne du droit de l'environnement, « le processus législatif a mal tourné… En fin de compte, je dois attribuer cela au manque de leadership de la part du gouvernement dans le domaine de l'environnement et à l'absence de décisions fermes. »

Ms. Elizabeth May, Executive Director of the Sierra Club of Canada, summed up her views by stating: "it would be a big mistake to pass the Bill as is. If the choice is this Bill or the 1988 Act, we would take the 1988 Act."

M^{me} Elizabeth May, directrice exécutive du Sierra Club du Canada, a résumé ses vues en disant : « Ce serait une grosse erreur d'adopter le projet de loi sous sa forme actuelle. Si nous avions le choix entre ce projet de loi et la loi de 1988, nous opterions pour la loi de 1988. »

Mr. Michael Anderson, Research Director, Manitoba Keewatinowki Okimakanak Inc. cautioned against passing this Bill unamended:

M. Michael Anderson, directeur des recherches, Manitoba Keewatinowki Okimakanak Inc., a fait une mise en garde contre

l'adoption de ce projet de loi sans amendements :

> I believe the suggestions I am making today will make the Bill stronger. Passing it today, ... will cause great difficulty if it is not restructured. I do believe that it is important to restructure the intent of the Bill to recognize Canada's obligations to First nations under treaty and to make many of the other changes that I suggested.

> Je crois que les suggestions que je vous ai faites aujourd'hui renforceront le projet de loi. Son adoption aujourd'hui… entraînera de grandes difficultés s'il n'est pas restructuré. À mon avis, il serait important de le remanier de manière à reconnaître les obligations du Canada envers les Premières nations en vertu des traités et d'y apporter un grand nombre des autres modifications que j'ai proposées.

But perhaps it was professor Bill Leiss of the Faculty of Management, University of Calgary and President Elect of the Royal Society of Canada who described the situation best when he said: "it is an unbelievably ugly can of worms which has been sealed into this Bill."

Mais c'est peut-être M. Bill Leiss, professeur à l'École d'administration de l'Université de Calgary et président élu de la Société royale du Canada, qui a le mieux décrit la situation en disant que ce projet de loi était un véritable guêpier.

With all of these comments on the deficiencies of Bill C-32 as reported out of the House of Commons and with the Minister of the Environment stating categorically that he can live with the existing bill, it is beyond the comprehension of Progressive Conservative Senators as to why the government insisted on cutting off these hearings and refused to consider amendments. The evidence of its own Minister would indicate there is no rush.

Étant donné toutes ces observations au sujet des lacunes du Projet de loi C-32 tel qu'il en a été fait rapport à la Chambre des communes et la déclaration formelle du ministre de l'Environnement qui dit pouvoir s'accommoder de la loi actuelle, les sénateurs progressistes-conservateurs n'arrivent tout simplement pas à comprendre pourquoi le gouvernement a insisté pour mettre un terme à ces audiences et refusé d'envisager tout amendement. D'après le témoignage de son propre ministre, rien ne presse.

The Minister of the Environment insisted in his reasons for not wanting amendments to Bill C-32 that this would mean re-opening the debate on this Bill in the House of Commons. He said: "if we put this back in the House, it might take another two, three, or four years. I would say that probably there is not enough time on the House side to bring all this back together once again."

Le ministre de l'Environnement a mentionné parmi ses raisons de ne pas vouloir que des amendements soient apportés au Projet de loi C-32 que cela voudrait dire qu'il faudrait rouvrir le débat sur ce projet de loi à la Chambre des communes. Il a dit : « Si nous le renvoyons à la Chambre, il faudrait probablement y consacrer deux, trois ou quatre ans de plus. Je dirais que la

Chambre ne dispose probablement pas d'assez de temps pour en reprendre l'étude. »

Progressive Conservative Senators disagree with this analysis of the situation. Only the amendments passed by the Senate would have to be considered by the House of Commons and they could be dealt with in an expeditious fashion.

Les sénateurs progressistes-conservateurs ne sont pas d'accord sur cette analyse de la situation. Seuls les amendements adoptés par le Sénat nécessiteraient un examen de la part de la Chambre des communes qui pourrait rapidement en venir à bout.

The Minister was also concerned about the effect of prorogation on the Bill if it is not passed by both Houses. First, the timing of prorogation is entirely in the hands of the government. There is nothing compelling the government to terminate this session of Parliament. Second, even if the government does prorogue this session, there is a process by which this Bill could be brought back to the stage it was at in the House of Commons prior to prorogation, which in this case would mean that the Bill would be returned to the Senate immediately. There is ample precedent for this occurring in the last Parliament.

Le ministre s'est aussi dit préoccupé par l'incidence de la prorogation sur le projet de loi s'il n'est pas adopté par les deux Chambres. Premièrement, c'est le gouvernement seul qui décide du moment de la prorogation. Rien ne l'oblige à mettre fin à cette session-ci de la législature. Deuxièmement, même si le gouvernement choisissait de proroger la session, il lui serait possible de présenter de nouveau ce projet de loi à l'étape à laquelle il se trouvait à la Chambre des communes avant la prorogation, ce qui veut dire, dans ce cas-ci, qu'il serait immédiatement renvoyé au Sénat. C'est ce qui a été fait dans de nombreux cas au cours de la dernière législature.

For example, Bill C-7 died on the Order Paper in the 1st Session of the 35th Parliament on prorogation while it was before the Senate Standing Committee on Legal and Constitutional Affairs. It was re-introduced in the 2nd Session of the 35th Parliament on March 6, 1996 as Bill C-8, when it was read the first time and then, pursuant to Government Motion #1, was deemed adopted at all stages and to have been passed by the House. The Bill took only one minute in the House of Commons before it was returned to the Senate.

Par exemple, le Projet de loi C-7 est resté en plan au Feuilleton lors de la première session de la 35e législature au moment de la prorogation après que le Comité sénatorial permanent des affaires juridiques et constitutionnelles en eut été saisi. Il a de nouveau été présenté lors de la deuxième session de la 35e législature sous la forme du Projet de loi C-8, le 6 mars 1996; il a alors franchi l'étape de la première lecture, après quoi, conformément à la motion no 1 du gouvernement, il est réputé avoir été adopté à toutes les étapes et il a été adopté par la Chambre. Il n'a fallu qu'une seule minute à la Chambre des communes pour l'adopter avant qu'il ne soit renvoyé au Sénat.

The arguments raised by the government

Les arguments invoqués par le gouvernement

concerning the problems of sending this Bill back to the House of Commons with amendments or the length of time which would be required to bring the Bill back following prorogation are specious at best.

au sujet des problèmes que poserait le renvoi de ce projet de loi à la Chambre des communes avec des amendements ou du temps qu'il faudrait pour remettre le projet de loi en discussion après la prorogation sont spécieux, au mieux.

SPECIFIC ISSUES RAISED BY WITNESSES

QUESTIONS PARTICULIÈRES SOULEVÉES PAR LES TÉMOINS

A a result of the numerous amendments made in Committee in the House of Commons and the fact that many of these were reversed at Report Stage, with new concepts added, some confusion has resulted as to the real intent and purpose of the Bill. It was the hope of Progressive Conservative Senators that all matters would receive a full and fair hearing before the Senate Committee and that amendments proposed and adopted in the Senate Committee would bridge the obvious gaps in the legislation and among the views of all parties interested in this legislation.

Une certaine confusion règne quant à la fin réelle et à l'objet du projet de loi en raison des nombreux amendements apportés en comité à la Chambre des communes et du fait qu'un grand nombre de ceux-ci ont été annulés à l'étape du rapport, de nouveaux concepts étant venus s'ajouter. Les sénateurs progressistes-conservateurs espéraient que toutes ces questions feraient l'objet d'une audience en bonne et due forme devant le Comité sénatorial et que les amendements proposés et adoptés par celui-ci combleraient les lacunes évidentes de la mesure législative et concilieraient les opinions de toutes les parties intéressées.

This, because of the closure motion imposed on the Committee by Liberal Senators, has become impossible. It is our purpose here to outline seven of the substantive areas of Bill C-32 which we believe should be looked at in greater detail than the Senate Committee was allowed to because of time constraints.

Cela s'est avéré impossible en raison de la motion de clôture imposée au Comité par les sénateurs libéraux. Notre intention ici est d'exposer sept des dispositions de fond du Projet de loi C-32 qui, à notre avis, devraient faire l'objet d'un examen plus détaillé que celui auquel a pu se livrer le Comité sénatorial en raison de contraintes de temps.

1) Virtual Elimination

1) La quasi-élimination

Through amendments made at Report Stage in the House of Commons to clause 65(3) the government changed Bill C-32 from one which would eliminate toxic substances to one where control of emissions of toxic substances is the primary intent of the legislation. The government

En apportant des amendements au paragraphe 65(3) à l'étape du rapport à la Chambre des communes, le gouvernement a modifié le Projet de loi C-32 de telle manière qu'au lieu de prévoir l'élimination des substances toxiques, il a pour principal objet le

through its amendments is saying that there are actually acceptable levels of toxins which may be allowed to contaminate our world and everything within it. When the government amended the preamble to take out the goal of phasing out toxic substances, it changed the whole basis of Bill C-32. Now we are faced with a so-called environmental bill which actually permits toxic substances to be released up to certain specified levels.

contrôle des émissions de substances toxiques. Par ses amendements, le gouvernement dit qu'il y a en vérité des niveaux acceptables de toxines qui peuvent contaminer notre environnement et tout ce qui s'y trouve. Lorsque le gouvernement a modifié le préambule pour en éliminer l'objectif qui consistait à éliminer graduellement nos substances toxiques, il a modifié tout le fondement du Projet de loi C-32. Nous nous retrouvons maintenant avec un prétendu projet de loi environnemental qui permet en réalité que des substances toxiques soient rejetées pourvu qu'il y ait respect des maximums fixés.

This amendment clearly weakens the Bill and, as Ms. Elizabeth May stated, "creates a loop from section to section and never arrives at the goal of virtual elimination." In her questioning of the officials from Environment Canada on this issue Senator Spivak referred to an internal departmental memorandum prepared by Mr. Steve Mongrain which detailed the desire of industry representations to bring significant changes to clause 65(3) in the House of Commons. Changes were made to this clause and, in the words of the Chair of the Standing Committee of the Senate, they watered down the meaning of virtual elimination so that the clause "talks only in terms of control."

Cet amendement affaiblit de toute évidence le projet de loi et, comme M[me] Elizabeth May l'a indiqué, « on risque de tourner en rond et de ne jamais atteindre l'objectif de la quasi-élimination ». Lorsqu'elle a interrogé les représentants d'Environnement Canada à ce sujet, la sénatrice Spivak a fait allusion à une note de service interne rédigée par M. Steve Mongrain dans laquelle il était question du désir des représentants de l'industrie d'apporter des changements importants au paragraphe 65(3) à la Chambre des communes. Des amendements ont été apportés à cet article, amendements qui, pour reprendre les paroles du président du Comité sénatorial permanent, ont affaibli le sens de la quasi-élimination de sorte qu'il n'est plus question que de « contrôle ».

Ms. Stephanie Meakin, an advisor to Inuit Tapirisat, endorsed the comments of Senators Spivak and Ghitter in her testimony when she stated:

M[me] Stephanie Meakin, conseillère de l'Inuit Tapirisat, a souscrit aux observations des sénateurs Spivak et Ghitter dans son témoignage lorsqu'elle a dit :

> What we need in the new CEPA is that provision in clause 65 which stipulates that those worst substances will be eliminated, not interim steps which are set out in this new CEPA that would in essence allow producers to move towards an acceptable release or use of a

> Ce qu'il faut dans la nouvelle LCPE, c'est que l'article 65 précise que les pires substances seront éliminées, pas des mesures provisoires qui autoriseraient en fait les pollueurs à évoluer vers une limite acceptable de rejet ou d'utilisation d'une substance.

substance.

2) Precautionary principle – cost effectiveness

During Report Stage in the House of Commons the meaning of the precautionary principle, which is found in the preamble and its definition within clause 2 of Bill C-32, were changed by adding the phrase “cost effective.” Therefore, in order to invoke the precautionary principle the measures taken must be “cost effective.” This virtually stands the precautionary principle on its head. There is no definition of cost effective in the Bill. The introduction of the cost effective element brings ambiguity, confusion and ineffectiveness to the very heart of the Bill.

However, added to this problem is the fact that the French and English texts of the Bill differ. In the French text, the word “cost” is not found and the measures simply have to be effective. Progressive Conservative Senators believe this is clearly a flaw in the Bill which must be corrected. Unfortunately, an amendment put in Committee by Senator P.C. Nolin to harmonize the English and French text was defeated by the Liberal majority.

In order to clarify this situation, the Senate Committee heard from Mr. François Blais, the Director of the Centre for Translation and Legal Documentation at the University of Ottawa. He was asked to compare the wording in English with the wording in French. His opinion was “I said that they are contradictory…they simply do not say the same thing."

2) Le principe de la prudence – rapport coût-efficacité

À l’étape du rapport à la Chambre des communes, on a modifié le sens du principe de la prudence, mentionné dans le préambule et défini à l’article 2 du Projet de loi C-32, en ajoutant le terme « cost effective measures » en anglais, traduit par « mesures effectives » en français. Donc, pour que le principe de la prudence puisse être invoqué, les mesures adoptées doivent être « effectives ». Cela va presque à l’encontre du principe de la prudence. Il n'y a aucune définition des « mesures effectives » dans le projet de loi. Ceci introduit un élément d'ambiguïté et de confusion au coeur même du projet de loi et on réduit ainsi son efficacité.

Le problème est d’autant plus complexe que les versions française et anglaise du projet de loi ne concordent pas puisque que la notion de « coût » n’a pas été rendue dans la version française selon laquelle il suffit que les mesures adoptées soient « effectives ». Les sénateurs progressistes-conservateurs croient qu’il s’agit nettement d’une lacune qui doit être comblée. Malheureusement, un amendement proposé au Comité par le sénateur P.C. Nolin pour harmoniser les versions française et anglaise du texte a été rejeté par la majorité libérale.

Pour clarifier cette situation, le Comité sénatorial a entendu le témoignage de M. François Blais, directeur du Centre de traduction et de documentation juridiques à l’Université d’Ottawa. On lui a demandé de comparer les textes français et anglais. Son opinion était la suivante : « J’ai dit qu’ils étaient contradictoires… il y a vraiment une divergence. »

When questioned by Progressive Conservative Senators, departmental officials responded that they had simply used the words of the Rio Declaration. Questioning on this subject gave rise to the following exchange:

Lorsque les sénateurs progressistes-conservateurs ont posé la question aux fonctionnaires du Ministère, ils leur ont répondu qu'ils avaient simplement utilisé le libellé de la Déclaration de Rio. Voici l'échange qui a suivi :

> The Chairman (Sen. Ghitter): If a Francophone comes before you and argues that the Bill calls for cost efficiency and not cost effectiveness, you say that will not give trouble for your department? ... Have you no answer?
>
> Mr. Duncan Cameron (Legal Counsel, Justice Department): I have nothing to add, Mr. Chairman.
>
> The Chairman: That is the position of the department? There are no further answers?
>
> Mr. Lerer (Director General): That is correct, sir.

> Le président (le sénateur Ghitter) : Si un francophone vous dit qu'il est question dans le projet de loi d'efficacité et non de coût-efficacité, selon vous, cela ne posera aucun problème à votre ministère?… Vous n'avez pas de réponse à nous donner?
>
> M. Duncan Cameron (conseiller juridique, ministère de la Justice) : Je n'ai rien à ajouter, monsieur le président.
>
> Le président : C'est là la position du ministère? Vous n'avez rien d'autre à ajouter?
>
> M. Lerer (directeur général) : C'est exact, monsieur.

We deplore the inconsistent use of the two official languages in this Bill as it establishes a dangerous precedent which violates the rules which govern the construction and interpretation of federal statutes.

Nous déplorons l'incompatibilité des deux langues officielles dans ce projet de loi puisqu'elle crée un dangereux précédent qui viole les règles qui régissent la rédaction et l'interprétation des lois fédérales.

3) Aboriginal issues

3) Questions autochtones

While this Bill acknowledges the experience and knowledge of Canada's aboriginal peoples in relation to the environment, it excludes the Métis from taking part in the National Advisory

Bien que ce projet de loi reconnaisse l'expérience et les connaissances des peuples autochtones du Canada en ce qui concerne l'environnement, il exclut les Métis du comité

Committee established by clause 6 as the Métis are not governed by the *Indian Act*. Senator Chalifoux pursued this at length with departmental officials, pointing out to them that under the wording of the Bill the Métis are not covered in that they do not have a treaty, and most do not have a land base. In fact, Senator Chalifoux at one point suggested that the term "aboriginal" in the Bill would be amended to explicitly include the Métis and the Inuit.

national consultatif dont la création est prévue à l'article 6 puisqu'ils ne sont pas régis par la *Loi sur les Indiens*. La sénatrice Chalifoux a longuement discuté de la question avec les représentants du ministère et leur a fait valoir que le libellé du projet de loi n'englobe pas les Métis parce qu'ils n'ont pas conclu de traité et que la plupart d'entre eux n'ont pas d'assise territoriale. En fait, la sénatrice Chalifoux a même proposé à un moment donné de modifier le terme « autochtone » dans le projet de loi pour qu'il englobe explicitement les Métis et les Inuit.

This point was also raised in an extended exchange between Senator Nolin and Mr. Bob Stevenson, Advisor, Endangered Species and Harvesting, Métis National Council. There was general agreement from the Métis witnesses that they would like to be explicitly included in clause 6 and would also like to receive some finanacial help so that they could do the environmental work which is so necessary on their land.

Cette question a également été soulevée lors d'un long échange entre le sénateur Nolin et M. Bob Stevenson, conseiller (espèces menacées d'extinction et chasse et pêche) du Métis National Council. Les témoins métis étaient d'accord pour dire qu'ils aimeraient être explicitement inclus à l'article 6 et recevoir une aide financière pour pouvoir procéder aux travaux environnementaux tellement nécessaires sur leurs terres.

Mr. Michael Anderson, Research Director of the Manitoba Keewatinowki Okimakanak Inc., raised another concern of the aboriginal people. He stated:

M. Michael Anderson, directeur des recherches, Manitoba Keewatinowki Okimakanak Inc., a exprimé une autre préoccupation des Autochtones :

> I am concerned that this bill does not recognize the obligation to protect lands for the continuing pursuit and protection of traditional harvesting activities. In numbers, this is the single largest activity conducted by First Nations within our region.
>
> If authorization for the release of substances into the environment affect the environment such that harvesting cannot take place, then that is a prima

> Je suis préoccupé par le fait que ce projet de loi ne reconnaît pas l'obligation de protéger les terres pour que les Autochtones puissent continuer à s'adonner à leurs activités traditionnelles de chasse et de pêche. Si on regarde les chiffres, ce sont là les activités les plus importantes pour les Premières nations de notre région.
>
> Si le rejet autorisé de substances nuit à l'environnement au point où la chasse et la pêche deviennent impossibles, alors il y a à première vue atteinte à la

facie infringement of the Constitution.

Other environmental problems encountered by aboriginal women in particular were pointed out by Ms. Sheila Watt-Cloutier, President, Inuit Circumpolar Conference of Canada. She referred specifically to the high levels of PCBs in the blood of Inuit women being as much as five times the normal level.

All of the environmental issues which affect Canada's aboriginal people should be reviewed in depth to determine whether a legislation solution under Bill C-32 would be effective. Or should a completely different piece of legislation be brought forward dealing specifically with the myriad environmental issues confronting Canada's aboriginal peoples?

4) Support for voluntary approaches

Bill C-32 is virtually silent with regard to giving support to voluntary approaches which result in a cleaner environment. This was an issue raised by the Canadian Chemical Producers Association. They went on to detail one of their voluntary approaches to a cleaner environment which involves a rapid response by industry to any chemical spills.

In a discussion between the Chairman and Mr. Richard Paton, President and CEO of the Canadian Chemical Producers' Association, the idea was advanced by the Chairman of an amendment to the Preamble which would recognize that companies can be responsible and would encourage a voluntary approach to environmental problems by industry.

Constitution.

M^{me} Sheila Watt-Cloutier, présidente de la Conférence circumpolaire inuit, a signalé d'autres problèmes environnementaux auxquels se heurtent les femmes autochtones en particulier. Elle a fait plus précisément allusion aux taux élevés de BPC dans le sang des femmes inuit qui sont cinq fois supérieurs à la normale.

Il faudrait revoir en détail toutes les questions environnementales qui touchent les Autochtones du Canada pour déterminer si une solution législative dans le cadre du Projet de loi C-32 serait efficace. Ou faudrait-il proposer une mesure législative complètement différente qui traiterait spécifiquement de la myriade de questions environnementales auxquelles se heurtent les peuples autochtones du Canada?

4) Les approches volontaires

Le Projet de loi C-32 est pratiquement muet s'agissant d'appuyer des approches volontaires qui entraîneraient une meilleure protection de l'environnement. La question a été soulevée par l'Association canadienne des fabricants de produits chimiques. Ses représentants ont expliqué en détail une de leurs approches volontaires d'une meilleure protection de l'environnement qui comporte une réaction rapide de la part de l'industrie à tout déversement de produits chimiques.

Au cours d'une discussion à ce sujet avec M. Richard Paton, président-directeur général de l'Association canadienne des fabricants de produits chimiques, le président du Comité a proposé d'apporter au préambule un amendement qui reconnaîtrait que les entreprises peuvent être tenues responsables et qui encouragerait une approche volontaire des

problèmes environnementaux de la part de l'industrie.

5) Children's health and the environment

Progressive Conservative senators were particularly impressed by the presentation made to the Committee by the Canadian Institute of Child Health on Bill C-32. This group drew the attention of the Committee to what it believed were omissions from the Bill in the area of protection of children's health. They explained that at various stages of a child's development a child is particularly susceptible to or vulnerable to toxins which may cause irreversible damage to growing nervous systems. It also brought to our attention certain international commitments dealing with children's health to which Canada is a signatory which require Canada to make children's environmental health a high priority.

5) La santé des enfants et l'environnement

Les sénateurs progressistes-conservateurs ont été particulièrement impressionnés par le témoignage présenté au Comité par l'Institut canadien de la santé infantile au sujet du Projet de loi C-32. Ce groupe a attiré l'attention du Comité sur ce qu'il croit être des omissions dans le projet de loi à propos de la protection de la santé des enfants. Il a expliqué qu'à différentes étapes de son développement, un enfant est particulièrement réceptif ou vulnérable à des toxines qui peuvent causer des dommages irréversibles à un système nerveux en pleine croissance. Il a également attiré notre attention sur certains accords internationaux touchant la santé des enfants dont le Canada est signataire et qui l'obligent à considérer comme hautement prioritaire la salubrité de l'environnement des enfants.

Progressive Conservative Senators believe that the Committee, if given more time, would have had the opportunity to explore the concerns raised by the Canadian Institute of Child Health with government officials and other knowledgeable witnesses.

Les sénateurs progressistes-conservateurs estiment que, s'il avait disposé de plus de temps, le Comité aurait pu examiner les préoccupations soulevées par l'Institut canadien de la santé infantile avec des représentants du gouvernement et d'autres témoins bien informés.

Progressive Conservative Senators believe that certain amendments to Bill C-32 should be accepted by the government in order to highlight concerns with children's environmental health. For example, the Preamble could be strengthened by including a clause recognizing the special susceptibility of children to environmental contaminants. As well, Parts 3 and 5 of the Bill should be amended to include the unique physiology and special susceptibility of children to environmental hazards.

Les sénateurs progressistes-conservateurs croient que le gouvernement devrait accepter certains amendements au Projet de loi C-32 de manière à mettre en lumière les préoccupations au sujet de la salubrité de l'environnement des enfants. Par exemple, il y aurait moyen de renforcer le préambule en incluant une clause reconnaissant la réceptivité particulière des enfants aux polluants provenant de l'environnement. En outre, les Parties 3 et 5 du projet de loi devraient être modifiées pour inclure la physiologie unique des enfants et leur

vulnérabilité particulière aux risques environnementaux.

Finally, Progressive Conservative Senators were particularly impressed with the recommendation that the government establish an Office of Children's Environmental Health Protection. Such an office could be mandated to promote research and policy development in the area of children's environmental health, develop separate assessments of risks to children and adults and develop guidelines to reduce and eliminate exposure of children to environmental pollutants in areas accessible to children.

Enfin, les sénateurs progressistes-conservateurs ont été particulièrement impressionnés par la recommandation que le gouvernement crée un Office de la protection de la salubrité de l'environnement pour les enfants. Un tel office pourrait avoir pour mandat de promouvoir la recherche et l'élaboration de politiques dans le domaine de la salubrité de l'environnement des enfants, d'effectuer des évaluations distinctes des risques pour les enfants et les adultes et d'établir des lignes directrices pour réduire et éliminer l'exposition des enfants aux polluants provenant de l'environnement là où ils vivent.

6) Biotechnology

6) La biotechnologie

Progressive Conservative Senators are gravely concerned about amendments brought to Bill C-32 at Report Stage by the government which render this Bill completely ineffective when dealing with biotechnology. In Committee in the House of Commons, amendments were made so that the Ministers of Health and the Environment would determine whether what other departments were doing was adequate to protect human health and the environment. The preamble and administrative duty clauses of the Bill were also amended to explicitly recognize biotechnology as a potential threat to biological diversity. The government reversed the amendments at Report Stage.

Les sénateurs progressistes-conservateurs sont gravement préoccupés par les amendements que le gouvernement a apportés au Projet de loi C-32 à l'étape du rapport, lesquels le rendent complètement inefficace en ce qui concerne la biotechnologie. Des amendements ont été apportés en comité à la Chambre des communes de manière à ce que les ministres de la Santé et de l'Environnement déterminent si les mesures prises par d'autres ministères étaient suffisantes pour protéger la santé humaine et l'environnement. Le préambule et les articles du projet de loi se rapportant à l'application administrative ont aussi été modifiés pour reconnaître explicitement que la biotechnologie peut présenter une menace pour la diversité biologique. Le gouvernement a rejeté les amendements à l'étape du rapport.

Many witnesses expressed concern over these Report Stage amendments on biotechnology which virtually leave Canadians unprotected. Mr. Mark Winfield, Director of

De nombreux témoins ont exprimé leurs craintes au sujet des amendements relatifs à la biotechnologie apportés à l'étape du rapport qui laissent pratiquement les Canadiens sans

Research, Canadian Institute for Environmental Law and Policy addressed this issue at length in his presentation. He stated that the Bill as passed by the House of Commons removes any objective test as to the assessment of biotechnology products.

protection. M. Mark Winfield, directeur des recherches à l'Institut canadien du droit et de la politique de l'environnement, a longuement traité de cette question dans son exposé. Il a indiqué que le projet de loi, tel qu'il a été adopté par la Chambre des communes, élimine tout test objectif quant à l'évaluation des substances biotechnologiques.

He recommended that:

> …consistent with Canada's obligations under the United Nations Convention on Biological Diversity, Bill C-32 should be amended to recognize products of modern biotechnology as potential threats to the conservation and sustainable use of biological diversity.

Il a recommandé que :

> conformément aux obligations du Canada en vertu de la Convention des Nations Unies sur la diversité biologique, le projet de loi C-32 soit amendé de manière à reconnaître que les substances biotechnologiques modernes peuvent présenter une menace pour la conservation et l'utilisation durable de la diversité biologique

The Canadian Health Coalition brief said:

> Bill C-32 feeds into a legislative and regulatory agenda that totally abdicates the duty to prevent, protect and anticipate hazards. If you pass C-32 in its current form, the effect will be to expose your grandchildren to an uncontrolled experiment over a lifetime with biotechnology products that have no therapeutic value and whose safety is unknown. Surely this is not the kind of legacy you want to leave the children of Canada.

Le mémoire de la coalition canadienne de la santé a indique ce qui suit :

> Le projet de loi C-32 vient alimenter un programme législatif et réglementaire qui renonce tout à fait au devoir de prévention, de protection et d'anticipation des dangers pour la santé. Si vous adoptez le projet de loi C-32 dans sa forme actuelle, ses effets seront d'exposer vos petits-enfants à une expérience incontrôlée pendant toute leur vie avec des produits biotechnologiques qui n'ont aucune valeur thérapeutique et dont on ignore s'ils sont sûrs. Il est certain que ce n'est pas ce que vous souhaitez léguer aux enfants du Canada.

Senator Spivak, during clause-by-clause consideration of Bill C-32, put forward an amendment to the preamble to include "products

Au cours de l'étude article par article du Projet de loi C-32, la sénatrice Spivak a proposé un amendement au préambule pour inclure les

of biotechnology" along with toxic substances and other wastes so that the preamble would read as it was approved in Committee in the House of Commons. As she stated in the discussion of her amendment:

> One does not wish to have the product of biotechnology linked with any threats to biological diversity in the wording of Bill C-32 ... I am not suggesting for a moment that we should eliminate all biotechnology products. What I am trying to achieve is to get back to the House of Commons wording.

Unfortunately, this amendment like others advanced by Progressive Conservative Senators was defeated by the Liberal majority.

7) Reduction in the Authority of the Minister of the Environment

In a number of instances in Bill C-32, what should be a decision made by the Minister of the Environment has become a decision to be made by the entire cabinet. For example, the determination of the adequacy of the regulation of biotechnology products by government departments has become a decision for the whole cabinet, not just the Minister of the Environment.

Progressive Conservative Senators find this situation to be unacceptable. Leaving important environmental decisions to be made by the whole cabinet increases the opportunity for lobbying and takes the focus off protection of the environment. What should be a decision made totally for environmental reasons may become a totally different decision when the Ministers of

« substances biotechnologiques » parmi les substances toxiques et autres déchets pour que le libellé du préambule soit celui qui avait été approuvé en comité à la Chambre des communes. Comme elle l'a indiqué au cours de la discussion au sujet de son amendement :

> Ce n'est pas que les substances biotechnologiques devraient être considérées comme une menace pour la diversité biologique dans le libellé du projet de loi C-32… Loin de moi l'idée d'éliminer toutes les substances biotechnologiques. J'essayais simplement de revenir au libellé de la Chambre des communes.

Malheureusement, cet amendement, tout comme d'autres proposés par les sénateurs progressistes-conservateurs, a été rejeté par la majorité libérale.

7) Réduction du pouvoir du ministre de l'Environnement

Dans un certain nombre de cas, une décision qui devrait revenir au ministre de l'Environnement doit, en vertu du Projet de loi C-32, être prise par tout le Cabinet. Par exemple, c'est au Cabinet tout entier, et non seulement au ministre de l'Environnement, qu'il reviendrait de déterminer si la réglementation des substances biotechnologiques par les ministères du gouvernement est adéquate.

Les sénateurs progressistes-conservateurs trouvent cette situation inacceptable. Le fait de confier au Cabinet la prise de décisions importantes en matière d'environnement augmente les possibilités de lobbying et risque de faire passer la protection de l'environnement au second plan. Ce qui devrait être une décision prise uniquement pour des raisons

Industry and International Trade have their input into the decision making process.

We believe that the protection of our environment is too important to be left to the vagaries of negotiation around the Cabinet table. Environmental decisions should be made by the Minister of the Environment.

CONCLUSION

In spite of the concerns raised by Progressive Conservative Senators and amendments which we attempted to advance to strengthen Bill C-32, the government majority on the Standing Senate Committee on Energy, the Environment and Natural Resources kept to its artificial timetable rather than protecting the health of Canadians by producing meaningful, clearly enunciated and workable environmental protection legislation.

We deplore the position taken by the government on what we considered to be the most important bill to be considered by this Committee in many years.

We trust that through these observations, Canadians will see that this government is only concerned with meeting the demands of its own self-imposed timetable, rather than meeting the needs of Canadians in relation to the protection of the environment.

environnementales peut devenir une décision tout à fait différente lorsque les ministres de l'Industrie et du Commerce international ont voix au chapitre.

Nous croyons que la protection de notre environnement est trop importante pour être laissée aux caprices de la négociation au Cabinet. Les décisions concernant l'environnement devraient être prises par le ministre de l'Environnement.

CONCLUSION

Malgré les préoccupations exposées par les sénateurs progressistes-conservateurs et les amendements proposés pour renforcer le Projet de loi C-32, la majorité ministérielle au Comité sénatorial permanent de l'énergie, de l'environnement et des ressources naturelles s'en est tenue à son calendrier artificiel au lieu de protéger la santé des Canadiens en adoptant une loi sur la protection de l'environnement significative, sans équivoque et efficace.

Nous déplorons la position adoptée par le gouvernement à l'égard de ce que nous considérons comme le projet de loi le plus important examiné par le Comité depuis de nombreuses années.

Nous espérons que ces observations sauront convaincre les Canadiens que le gouvernement actuel tient plus à respecter le calendrier qu'il s'est fixé qu'à répondre aux besoins des Canadiens pour ce qui est de la protection de l'environnement.

APPENDIX

to the Seventh Report of the Standing Senate Committee on Energy, the Environment and Natural Resources

MAJORITY OBSERVATIONS

In the course of its deliberations on Bill C-32, An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development, the Standing Senate Committee on Energy, the Environment and Natural Resources heard 26 groups of witness, in addition to receiving many more written briefs expressing views concerning the objectives of the Bill that were sometimes encouraging, sometimes hesitant and sometimes stated that it "did not go far enough."

This polarization probably contributes to the two sets of observations incorporated in this one report, the majority observations which find Bill C-32 a careful and sometimes slow step forward to an improved environment for Canada, and the minority observations penned by the Chairman that want amendments that will make the Bill more aggressive.

A concern frequently expressed before the Committee was that the legislation was not strong enough, but most agreed that the Bill was a step in the right direction.

The Bill improves on the 1988 CEPA by

ANNEXE

au septième rapport du Comité sénatorial permanent de l'énergie, de l'environnement et des ressources naturelles

OBSERVATIONS MAJORITAIRES

Au cours de ses délibérations sur le Projet de loi C-32, Loi visant la prévention de la pollution et la protection de l'environnement et de la santé humaine en vue de contribuer au développement durable, le Comité sénatorial permanent de l'énergie, de l'environnement et des ressources naturelles a entendu 26 groupes de témoins et a reçu un nombre plus grand encore de mémoires exprimant au sujet des objectifs du Projet de loi des vues qui étaient parfois encourageantes, parfois indécises ou selon lesquelles il n'allait « pas assez loin ».

Cette polarisation a probablement contribué à la présence de deux séries d'observations dans le présent rapport, soit les observations majoritaires, selon lesquelles le Projet de loi C-32 est un pas prudent et parfois lent vers l'amélioration de l'environnement pour le Canada et les observations minoritaires, rédigées par le président du Comité, qui voudraient que des amendements soient apportés au Projet de loi pour qu'il soit plus énergique.

De nombreux témoins se sont dits préoccupés par le fait que la législation à l'étude n'était pas assez rigoureuse, mais la plupart ont convenu que le Projet de loi était un pas dans la bonne direction.

Le Projet de loi représente une amélioration

providing effective new legal tools for environmental protection, by setting out a process for aboriginal participation and oral evidence, by introducing biotechnical precautions (the Committee is, however, concerned that there could be loopholes resulting from possible uncertainty as to which Ministry controls what in this field), by the concept of virtual elimination and by providing whistle-blower protection.

par rapport à la LCPE de 1988 en fournissant de nouveaux outils juridiques efficaces pour la protection de l'environnement, en établissant un processus pour la participation des Autochtones et les témoignages oraux et en introduisant des précautions biotechniques (mais il faut noter que le Comité craint qu'il puisse y avoir des échappatoires si on ne sait pas au juste quel ministère contrôle quoi dans ce domaine), le concept de la quasi-élimination et la protection des dénonciateurs.

The Bill provides a solid platform upon which to build, by regulations and knowledge gained from future experience, one of the world’s best environmental regimes.

Le Projet de loi constitue une solide plate-forme sur laquelle bâtir, à l'aide de règlements et des connaissances tirées de l'expérience future, l'un des meilleurs régimes environnementaux au monde.

Bill C-32 will continue to improve our ability to meet Canada’s environmental challenges and, although many doubts and possible scenarios were presented, none were of the magnitude that your Committee majority felt that an amendment was required.

Le Projet de loi C-32 nous permettra de continuer à améliorer notre capacité de relever les défis environnementaux du Canada et, même si de nombreux doutes ont été émis et différents scénarios proposés, aucun n'était de nature à convaincre la majorité du Comité qu'un amendement s'imposait.

Representatives of municipal and provincial governments, public interest groups, industry, labour, aboriginal people, and academics were all consulted during the other place’s review of the 1988 CEPA legislation.

Des représentants des municipalités, des gouvernements provinciaux, des groupes de défense de l'intérêt public, de l'industrie, des syndicats, des Autochtones et des universitaires ont été consultés lors de l'examen de la LCPE de 1988 à l'autre endroit.

While the Committee majority is pleased with the provision that continues to call for a review every five years, it recommends the government begin the next review immediately after the passage of Bill C-32.

La majorité du Comité est heureuse que la loi continue à prévoir un examen tous les cinq ans, mais il recommande que le gouvernement entreprenne le prochain examen immédiatement après l'adoption du Projet de loi C-32.

This will ensure that Canadians from across the country will have the opportunity to express their views and to monitor the progress the

Ainsi, les Canadiens de toutes les régions du pays auront l'occasion d'exprimer leurs vues et de suivre les progrès réalisés par le ministre à

Minister makes in carrying forward and further defining concepts such as “cost effective,” “virtual elimination,” “intergovernmental environmental agreements,” and “precautionary principle.”

l'égard de l'application et de la définition de concepts comme les « mesures effectives », la « quasi-élimination », les « accords environnementaux intergouvernementaux » et le « principe de la prudence ».

The Committee majority supports the virtual elimination provision because it will reduce risk to our environment and is a step forward over the existing legislation. However, the Committee majority recommends the government continue to monitor this approach step-by-step, in order to ensure that risks to health are avoided, while maintaining the ultimate objective. Your Committee majority also believes that the federal government needs to respond to concerns about the impact of “cost effective” when determining environmental clean-ups, particularly in the North. The cost of living in the North is high, which in turn would suggest that the cost of an environmental clean-up there would be even higher than in southern Canada. This being the case, it is feared this higher cost may be a factor in determining whether it is “cost effective” to clean up in the Arctic. “Cost effective” is also a term about which the Committee heard conflicting testimony as to the correct French-English translation. This issue should therefore be addressed by the Minister in the future.

La majorité du Comité appuie la disposition relative à la quasi-élimination parce qu'elle réduira les risques pour notre environnement et constitue un pas en avant par rapport à la loi actuelle, mais elle recommande que le gouvernement continue à surveiller de très près cette approche pour s'assurer que les risques pour la santé seraient évités alors même que serait maintenu l'objectif final. La majorité du Comité croit aussi que le gouvernement fédéral doit donner suite aux préoccupations touchant les « mesures effectives » lorsqu'il est question de dépollution, surtout dans le Nord. Le coût de la vie est élevé dans le Nord, ce qui donne à entendre que le coût d'une opération de nettoyage y serait encore plus élevé qu'au sud du Canada. Cela étant, on craint que ce coût plus élevé ne soit un facteur qui intervienne le moment venu de décider s'il est « efficace » de procéder au nettoyage dans l'Arctique. « Mesures effectives » est d'ailleurs un terme au sujet duquel le Comité a entendu des témoignages contradictoires quant à la traduction exacte de l'anglais au français et qui devrait donc retenir l'attention du ministre.

The Committee was pleased to hear from Aboriginal leaders and elders whose oral traditions highlighted serious concerns about the environmental challenges facing our North and its people.

Le Comité a été satisfait d'entendre le témoignage de dirigeants et d'aînés autochtones dont les traditions orales ont fait ressortir de graves préoccupations à propos des défis environnementaux auxquels le Nord et ses habitants sont confrontés.

Long range trans-boundary air and water pollution are having an effect on the health of Northerners and the environment on which they depend for food.

La pollution transfrontalière de l'atmosphère et des eaux à longue distance a une incidence sur la santé des habitants du Nord, de même sur l'environnement dont ils dépendent pour survivre.

The Committee also heard testimony concerning Inuit women found to be carrying high levels of PCB's in their breast milk. Given these health concerns in the Arctic, the Committee majority recommends that the Minister of the Environment undertake to work with the Minister of Health to develop a system of continuous and widespread testing of "country food" to ensure safe human consumption.

Le Comité s'est également laissé dire que des niveaux élevés de BPC avaient été détectés dans le lait maternel des femmes inuit. Étant donné les inquiétudes au sujet de la santé dans l'Arctique, la majorité du Comité recommande que le ministre de l'Environnement s'engage à travailler avec le ministre de la Santé à l'établissement d'un système de vérification continue et à grande échelle des « aliments locaux » pour s'assurer qu'ils peuvent être consommés sans danger pour les êtres humains.

Although Bill C-32 includes for the first time the participation of Aboriginal governments and Aboriginal lands that fall under the *Indian Act*, the Committee majority observed that the definition of Aboriginal governments and lands is a "moving target" as land settlements, treaties and "self government" are constantly being re-defined and negotiated. The Committee majority recommends that in the years ahead, in the review of the CEPA legislation, the government keep current with the status of the Métis, who are not specifically mentioned in the Bill, the Inuit, and First Nations that fall under Section 35 of the *Constitution Act, 1982*. This will ensure that all our Aboriginal nations will continue to participate and be consulted and that there will be no erosion of their constitutional rights.

Bien que le Projet de loi C-32 vise pour la première fois les gouvernements autochtones et les terres autochtones qui relèvent de la *Loi sur les Indiens*, la majorité du Comité a fait observer que la définition des gouvernements et terres autochtones est une « cible mobile » puisque le règlement des revendications territoriales, les traités et « l'autonomie gouvernementale » font l'objet d'une redéfinition et de négociations constantes. La majorité du Comité recommande que dans les années à venir, dans le cadre de l'examen de la LCPE, le gouvernement se tienne au courant du statut des Métis, qui n'ont pas été expressément nommés dans le Projet de loi, des Inuit et des Premières Nations assujettis à l'application de l'article 35 de la *Loi constitutionnelle (1982)*. Nous serons ainsi assurés que toutes nos nations autochtones continueront à participer et seront consultées et que leurs droits constitutionnels ne seront pas minés.

The Committee recognizes that the greatest legacy we can leave our children is a clean and healthy environment. Protecting our children from environmental threats is an objective we all share. In general the Committee majority was pleased with the aggressive stand the legislation takes with environmental contaminants, but the federal government should undertake to work to continue addressing the special needs of children

Le Comité reconnaît que le plus grand héritage que nous pouvons laisser à nos enfants est un environnement sain. Nous avons tous à coeur de mettre nos enfants à l'abri de tout danger écologique. D'une manière générale, la majorité du Comité était satisfaite de l'approche énergique adoptée dans le Projet de loi à l'égard des contaminants de l'environnement, mais le gouvernement fédéral devrait s'engager à

in the context of environmental protection in its next review of CEPA.

continuer d'essayer de répondre aux besoins spéciaux des enfants dans le contexte de la protection de l'environnement au cours de son prochain examen de la LCPE.

Even though the Committee majority has expressed some concerns with certain provisions in Bill C-32, it recognizes the advancements made in this legislation to better protect our environment. We look forward to the next CEPA review, when we can continue to work to protect our environment for generations to come.

Même si la majorité du Comité a exprimé quelques inquiétudes à propos de certaines dispositions du Projet de loi C-32, elle reconnaît les progrès réalisés dans cette mesure législative pour mieux protéger notre environnement. Nous attendons avec impatience le prochain examen de la LCPE, car nous pourrons alors continuer à travailler à la protection de notre environnement pour les générations à venir.

The Committee majority also recommends that the Minister of the Environment meet each autumn with the Standing Senate Committee on Energy, the Environment and Natural Resources to exchange information, views, and discuss progress on the legislation.

La majorité du Comité recommande en outre que le ministre de l'Environnement rencontre le Comité sénatorial permanent de l'énergie, de l'environnement et des ressources naturelles chaque automne pour échanger des informations et des points de vue et pour faire le point sur les progrès réalisés en ce qui concerne la loi.

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Appendix 7: Total Health Expenditure, Canada, 1975 to 2003

Total Health Expenditure, Canada, 1975 to 2003—Summary Canadian Institute for Health 2004-04-05					
	Total Health Expenditure in current dollars /Dépenses totales de santé en dollars courants		Total Health Expenditure in constant 1997 dollars /Dépenses totales de santé en dollars constants de 1997		Total Health Expenditure as a % of GDP /Dépenses de santé en % du PIB
	Total / Total	Per Capita / Par habitant	Total / Total	Per Capita / Par habitant	
Year / Année	($' 000,000 / '000 000 $)	($)	($' 000,000 / '000 000 $)	($)	(%)
1975	12,199.4	527.13	39,691.4	1,715.04	7.0
1976	14,049.8	599.14	40,773.8	1,738.77	7.0
1977	15,450.0	651.19	41,617.0	1,754.07	7.0
1978	17,106.8	713.87	42,948.7	1,792.27	7.0
1979	19,169.7	792.08	44,214.7	1,826.92	6.8
1980	22,298.4	909.54	46,682.1	1,904.14	7.1
1981	26,276.7	1,058.67	48,791.9	1,965.80	7.3
1982	30,759.1	1,224.61	51,101.7	2,034.51	8.1
1983	34,038.6	1,341.85	53,092.6	2,092.98	8.3
1984	36,743.1	1,434.85	55,050.2	2,149.76	8.2
1985	39,841.7	1,541.70	57,472.9	2,223.95	8.2
1986	43,337.3	1,660.36	60,277.0	2,309.36	8.5
1987	46,788.2	1,769.01	61,937.8	2,341.80	8.4
1988	50,958.2	1,901.75	64,636.1	2,412.21	8.3
1989	56,095.5	2,056.15	67,577.8	2,477.03	8.5
1990	61,022.6	2,203.18	69,789.6	2,519.70	9.0
1991	66,289.1	2,364.82	72,607.7	2,590.23	9.7
1992	69,805.7	2,460.83	74,161.7	2,614.39	10.0
1993	71,557.2	2,494.88	74,768.8	2,606.85	9.8
1994	73,082.1	2,520.16	75,234.3	2,594.37	9.5
1995	74,065.8	2,527.66	75,511.9	2,577.01	9.1
1996	74,685.1	2,522.23	75,726.1	2,557.38	8.9
1997	78,452.2	2,623.19	78,452.2	2,623.19	8.9
1998	83,764.4	2,777.60	82,554.5	2,737.48	9.2
1999	90,066.6	2,962.34	87,335.2	2,872.50	9.2
2000	97,696.7	3,183.44	92,007.1	2,998.04	9.1
2001	105,953.6	3,415.52	98,323.9	3,169.56	9.6
2002 f / p	113,396.0	3,615.76	102,705.9	3,274.89	9.8
2003 f / p	121,430.8	3,839.14	107,389.7	3,395.22	10.0

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Appendix 8A: Nutrients Affect Genetic Expression

Editorial: Human genome remains full of surprises

19 November 2005
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BACK in June 2000, when Bill Clinton triumphantly announced the working draft of the human genome, it was tempting to believe that we would soon be masters of our own genetic make-up. Tempting but entirely wrong. Five years on, most of the profound possibilities stemming from the human genome project appear as far away as ever.

Take pharmacogenomics, the idea of tailoring medicines to an individual's genetic make-up. It was always going to take time to develop: identifying which genes act to alter a drug's impact on metabolism is a painstaking process, made still more complex and time-consuming by the fact that often several genes are implicated. As we head towards these horizons, much of what we discover threatens to push back still further the time when we can expect to understand what we are really dealing with. For the same reasons, and despite recent hype, diets tailored to genomes - or nutrigenomics - will not arrive any time soon.

But there are some fascinating hints of what may be in store. Last week, researchers reported finding a gene that codes for two hormones which act against each other: one suppresses appetite, the other stimulates it (see "The gene that can make you feast or starve"). Control over which of the two proteins is produced rests not in the genome, nor in the ribosome where they are made, but with enzymes that subsequently tweak the proteins according to some as yet undiscovered regulatory process. The driving force in this case appears to be the proteome, the massed ranks of interacting proteins within the body. The proteome was always known to be larger than the genome, and as estimates of the number of human genes has fallen - it now stands at about 25,000 - so the proteome has grown in importance.

However, the proteome is not the end of the story either. A Canadian group announced this week that a gene can be silenced in rats simply by giving them an amino acid, methionine (see "How the food you eat could change your genes for life"). Genes can be deactivated by adding methyl groups to their DNA, and in this case it seems likely that the methionine is donating methyl groups that makes this happen.

While this is not the first food found to exert such "epigenetic" control, it is especially interesting because it radically alters the behaviour of the rats. The hopeful implication of this work is that, with the right food supplements, we will be able to switch genes on and off at will to treat both physical and mental illness.

These studies show up the exquisite complexity of the human body and hint at the control we may eventually exert. But most of all, they highlight how far we still have to travel before we really understand what makes us what we are.

The food you eat may change your genes for life

17 November 2005
NewScientist.com news service
Alison Motluk

IT SOUNDS like science fiction: simply swallowing a pill, or eating a specific food supplement, could permanently change your behaviour for the better, or reverse diseases such as schizophrenia, Huntington's or cancer.

Yet such treatments are looking increasingly plausible. In the latest development, normal rats have been made to behave differently just by injecting them with a specific amino acid. The change to their behaviour was permanent. The amino acid altered the way the rat's genes were expressed, raising the idea that drugs or dietary supplements might permanently halt the genetic effects that predispose people to mental or physical illness.

It is not yet clear whether such interventions could work in humans. But there is good reason to believe they could, as evidence mounts that a range of simple nutrients might have such effects. Two years ago, researchers led by Randy Jirtle of Duke University Medical Center in Durham, North Carolina, showed that the activity of a mouse's genes can be influenced by food supplements eaten by its mother just prior to, or during, very early pregnancy (*New Scientist*, 9 August 2003, p 14). Then last year, Moshe Szyf, Michael Meaney and colleagues at McGill University in Montreal, Canada, showed that mothers could influence the way a rat's genes are expressed after it has been born. If a rat is not licked, groomed and nursed enough by its mother, chemical tags known as methyl groups are added to the DNA of a particular gene.

The affected gene codes for the glucocorticoid receptor gene, expressed in the hippocampus of the brain. The gene helps mediate the animal's response to stress, and in poorly raised rats, the methylation damped down the gene's activity. Such pups produced higher levels of stress hormones and were less confident exploring new environments. The effect lasted for life (*Nature Neuroscience*, vol 7, p 847).

Now the team has shown that a food supplement can have the same effect on well-reared rats at 90 days old - well into adulthood. The researchers injected L-methionine, a common amino acid and food supplement, into the brains of well-reared rats. The amino acid methylated the glucocorticoid gene, and the animals' behaviour changed. "They were almost exactly like the poorly raised group," says Szyf, who announced his findings at a small meeting on environmental epigenomics earlier this month in Durham, North Carolina.

Though the experiment impaired well-adjusted animals, the opposite should be possible, and Szyf has already shown that a chemical called TSA that is designed to strip away methyl groups can turn a badly raised rat into a more normal one.

No one is envisaging injecting supplements into people's brains, but Szyf says his study shows how important subtle nutrients and supplements can be. "Food has a dramatic effect," he says. "But it can go both ways," he cautions. Methionine, for instance, the supplement he used to make healthy rats stressed, is widely available in capsule form online or in health-food stores - and the molecules are small enough to get into the brain via the bloodstream.

Rob Waterland from Baylor College of Medicine in Houston, Texas, who attended the meeting, says Szyf's ideas are creating a buzz, as they suggest that methylation can influence our DNA well into adulthood. A huge number of diseases are caused by changes to how our DNA is expressed, and this opens up new ways of thinking about how to prevent and treat them, he says.

But Waterland points out there is still much work to be done. Substances like methionine and TSA are, he says, a "sledgehammer approach", in that they are likely to demethylate lots of genes, and we don't even know which they will affect. But he speculates that techniques such as "RNA-directed DNA methylation", so far tested only in plants but theoretically possible in mammals, may allow us to target such methylation much more precisely.

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Appendix 8B: Overview of Factors Affecting Genetic Expression

The following is a very concise glossary of basic terms used to describe common genetic functions and compounds. While they are not explored in depth in this paper, the ability to refer to these definitions may enable the reader to more fully comprehend other parts of the paper, as well as subject matter found in the media. The terms have been organized to flow in a specific order.

The hyperlinks below link to the online dictionary. Also, while it's not required to read this paper, for an excellent overview of how genetic systems normally work, please see the article written Joan Polancic of the American Society for Clinical Laboratory Science at the link below:
http://www.accessexcellence.org/RC/AB/BA/dnaintro/index.html

Eukaryote: A cell, or organism with cells, that possess a nucleus and other membrane-bound vesicles, including all members of the protist, fungi, plant and animal kingdoms; and excluding viruses, bacteria, and blue-green algae.

Prokaryotes: Biological kingdom composed of bacteria and cyanobacteria, one-celled (sometimes colonial) organisms whose cells lack a nuclear envelope, mitochondria, or plastids. They reproduce asexually through fission (splitting in two) and mainly gain their nutrition by absorbing it from their environment (though some species are chemoautotrophs or photosynthetic).

Chromatin: is a complex of nucleic acid and basic proteins (also known as histones – any of various simple water-soluble proteins rich in the basic amino acids lysine and arginine) in eukaryotic cells. Chromatin is usually dispersed in the interphase nucleus and condensed into chromosomes during mitosis and meiosis.

Mitosis: a process that takes place in the nucleus of a dividing cell, involves typically a series of steps consisting of prophase, metaphase, anaphase, and telophase, and results in the formation of two new nuclei each having the same number of chromosomes as the parent nucleus.

Chromosome: A structure in a cell nucleus that consists of genes. In humans, 23 pairs of chromosomes, each pair containing one chromosome from each parent, carry the entire genetic code.

A chromosome is a single DNA molecule, a tightly coiled strand of DNA, condensed into a compact structure in vivo by complexing with accessory histones or histone-like proteins. Chromosomes exist in pairs in higher eukaryotes.

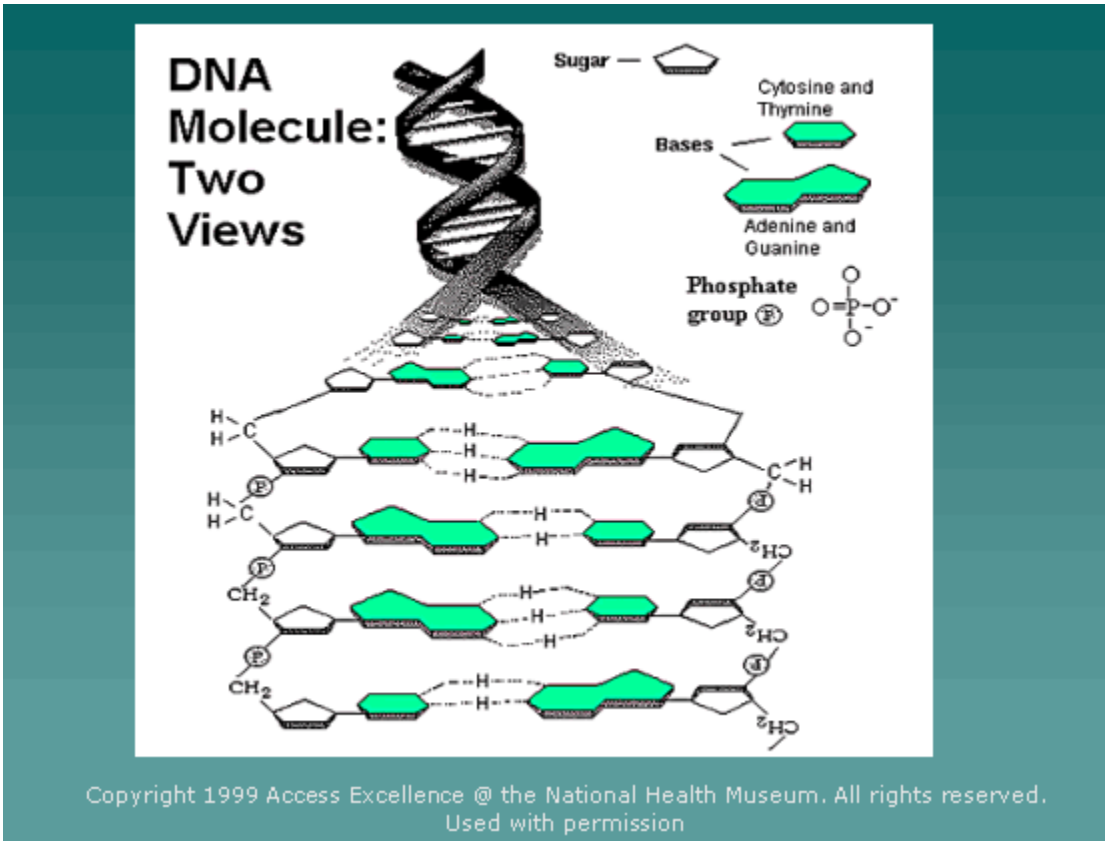
Chromosomes are the self-replicating genetic structure of cells containing the cellular DNA that bears in its nucleotide sequence the linear array of genes. In prokaryotes, chromosomal DNA is circular, and the entire genome is carried on one chromosome. Eukaryotic genomes

consist of a number of chromosomes whose DNA is associated with different kinds of proteins.

Gene: The fundamental physical and functional unit of heredity. A gene is an ordered sequence of nucleotides located in a particular position on a particular chromosome that encodes a specific functional product (i.e., a protein or RNA molecule). See gene expression.

Nucleic Acids: The two nucleic acids, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), are made up of long chains of molecules called nucleotides.

DNA: The four nucleotides in DNA contain the bases: adenine (A), guanine (G), cytosine (C), and thymine (T). Localized especially in cell nuclei, DNA is the genetic material of most organisms and usually exists as a double-stranded molecule in which two antiparallel strands are held together by hydrogen bonds between base pairs of nucleotides, adenine-thymine and cytosine-guanine. These purine and pyrimidine base pairs project inward from the double-stranded chains. The spine or back-bone holding these double-stranded helical chains together are alternate links of the pentose sugar, deoxyribose, and phosphate. In nature, base pairs form only between A and T and between G and C; thus the base sequence of each single strand can be deduced from that of its partner. This allows DNA to repair itself.



Base: Any basic (alkaline) compound containing nitrogen, but generally referring to one of four complex molecules (nucleotides) that form the building blocks of the nucleic acids, DNA and RNA. A subunit of a nucleotide that makes up the DNA and RNA molecules; either a purine or a pyrimidine.

Nucleotide: a phosphoric (substance containing phosphorus) ester of a nucleoside; the basic structural unit of nucleic acids (DNA or RNA).

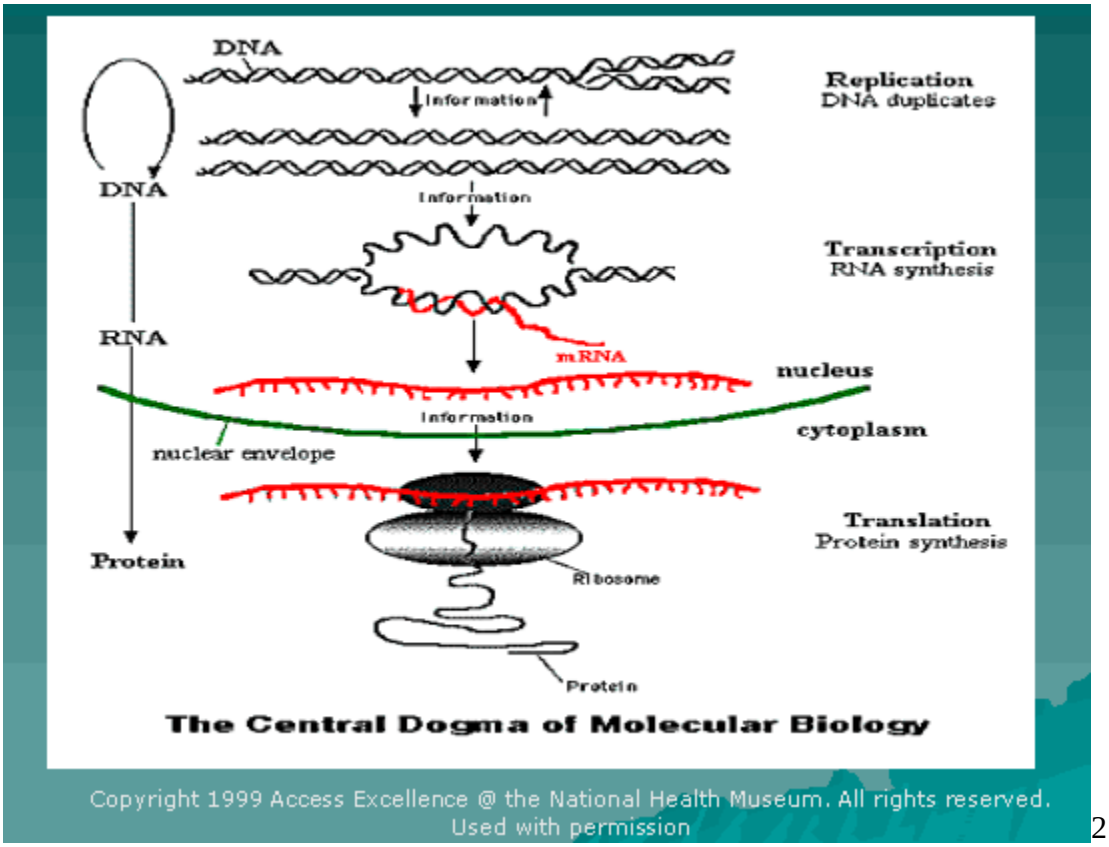
Ester: formed by reaction between an acid and an alcohol with elimination of water.

Purine: A nitrogen-containing, double-ring, basic compound that occurs in nucleic acids. The purines in DNA and RNA are adenine and guanine.

Pyrimidine: A nitrogen-containing, single-ring, basic compound that occurs in nucleic acids. The pyrimidines in DNA are cytosine and thymine; in RNA, cytosine and uracil.

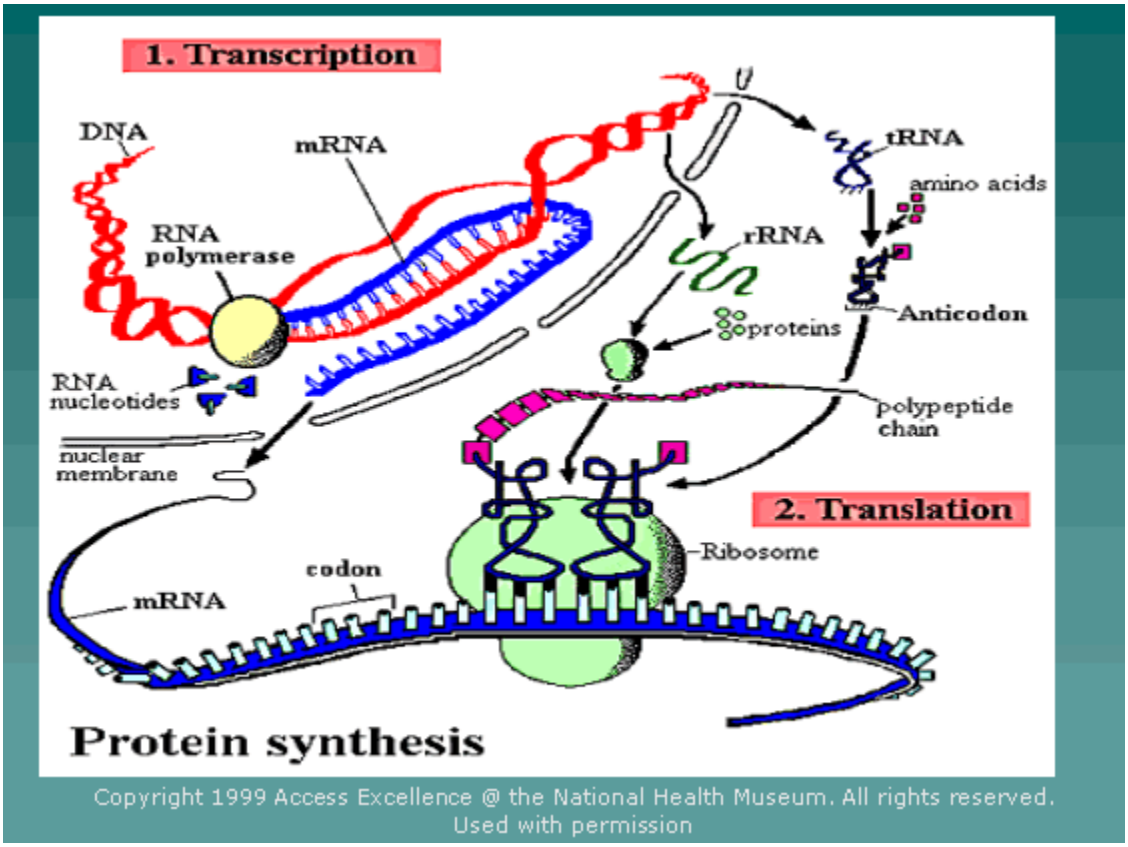
Recombinant DNA: genetically engineered DNA prepared in vitro by cutting up DNA molecules and splicing together specific DNA fragments usually from more than one species of organism.

Gene Expression: The process by which a gene's coded information is converted into the structures present and operating in the cell. Expressed genes include those that are transcribed into mRNA and then translated into protein, and those that are transcribed into RNA but not translated into protein (e.g., transfer and ribosomal RNAs).



Genetic Transcription: The organic process whereby the DNA sequence in a gene is copied into mRNA; the process whereby a base sequence of messenger RNA is synthesized on a template of complementary DNA.

Genetic Translation: The process whereby genetic information coded in messenger RNA directs the formation of a specific protein at a ribosome in the cytoplasm.



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Appendix 9A: Dr. Lam MD: Heart Disease Prevention - A Complete Nutritional Approach

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7. **Triglyceride**
8. **Total cholesterol / HDL Cholesterol ratio**
9. **LDL cholesterol**
10. **Total cholesterol**

Summary

Introduction

14 million Americans have heart disease and more than 2,600 die daily from heart attacks in the United States alone. 15% of adults in their late 30s to 40s are afflicted by cardiovascular disease, about 50% of 55 to 64 year-olds, and 65% of those will be afflicted in the next decade.

After 20 years of aggressive drug therapy and promotion of low-fat diet, the tide on cardiovascular disease has not reversed. Obviously, this elusive condition is far more complicated that we had ever imagined. It is clear that there are other factors that have not being addressed

Cause of Cardiovascular Disease

For decades, the public at large has been taught that the key culprit to heart disease is high cholesterol in our blood that comes from a diet that is high in cholesterol. This notion must be downgraded.

Consider the following:

· Polar bears, for example, maintain total blood cholesterol of over 400 mg/dl and they seldom develop heart attacks.

· Eskimos are relatively free of heart disease. They eat animal fats from fish and marine animals liberally.

· The Okinawans are the longest living population group in the world. The average life span for Okinawan women is 84 years. Their diet? An intake of fish 2-3 times a week and high intake of vegetables. Their cholesterol intake on the whole is more than most.

· People in North India consume 17 times more animal fat but have 7 times fewer incidences of heart disease compared to people in southern India.

In the Framingham study for example, men and women consumed an average cholesterol intake of 700 mg and 500 mg per day respectively (one egg provides 200 mg). The average serum concentration of cholesterol for men and women with higher than average cholesterol intake was

found to be 237 and 245 mg/dl respectively. Subjects with lower than average intakes has an average serum concentration of 237mg/dl for men and 241 mg/dl for women. The difference is statistically insignificant. Statistically, studies have shown that **people who consume 4 eggs per week actually have average serum cholesterol (193 mg/dl) same as those who reported consuming only 1 egg per week (197 mg/dl). Clearly dietary cholesterol in and of itself is not the critical link to heart disease risks as we once thought.**

Today, few experts deny that the **low-fat message of the past three decades is radically oversimplified.** If nothing else, it effectively ignores the fact that mono-unsaturated fats like olive oil is full of omega-3 fatty acid, which is good for health and must be consumed in large amounts. Bad fats such as overcooked saturated fats from meat or trans-fat from processed food should be avoided.

While a diet high in unhealthy fat can promote heart disease, it is only one of many factors that increase cardiovascular risk. Science is telling us that in fact, it is only a minor reason. Other than the familiar hypercholesteremia, **the main reason for high blood cholesterol is excessive metabolism of oxygen and sugar in our blood stream** due to the polluted environment, and a diet high in refined carbohydrate, trans-fat, and stressful lifestyle. This leads to free radical generation that in turn damages the endothelial wall of the blood vessel. The body has an intrinsic repair mechanism to overcome the damage, but it needs the proper nutrients to get the job done. Some nutrients are made internally, while others need to be supplied externally. In the case of blood vessel repair, the key is ascorbic acid. It cannot be made endogenously and has to be taken in externally from food sources.

Sad to say, but the food we take in today is far different from that our grandparents ate. They simply cannot provide all the nutrients needed by the body to repair the damaged endothelium. Our soils are depleted of nutrients, the amount of chemicals and preservatives are at an unprecedented high level, and the way we cook our food with high heat is nothing short of extreme. The wholesome meal that our grandparents ate is now replaced by frozen and processed food when we are not able to go to a fast food restaurant. Even the 65 mg of Vitamin C in one orange gets only fractionally delivered to our body by the time it makes the journey from the orchard to our kitchen. Our body was never designed to take in large quantity of glucose from breakdown of pasta, bread, French fries, cookies, and soda over years. It simply does not have the ability process them properly without residual damaging effect.

Lacking the specific nutrients in order to carry out the repair process properly, the body puts its emergency repair team into action. It instructs the liver to produce cholesterol (a sticky and waxy substance) as a surrogate in its attempt to repair damaged artery by covering the damaged areas. Cholesterol so produced travels from the liver to the damaged areas as LDL cholesterol. It is further converted into oxidized LDL cholesterol and sets off a cascading inflammatory reaction. This eventually leads to a thrombus formation, reduction of nitric oxide synthesis, high blood pressure, and ultimately blockage of blood vessels resulting in heart attacks or strokes.

A high cholesterol blood level can therefore be viewed as a sign of underlying vascular wall dysfunction at the endothelium and defect in our insulin's activity against glucose. Unfortunately, this has gone unrecognized. Instead, the cholesterol myth has lead researchers to focus on stopping the production of cholesterol from the liver by the use of drugs.

Advanced Markers of Cardiovascular Disease

The all out assault on lowering cholesterol has failed to reduce the incidence of heart disease because the root cause of heart disease does not lie in cholesterol alone. To use total cholesterol and LDL as a surrogate end point in measurement of cardiovascular disease risk is rudimentary at best given the amount of scientific research available.

Are there any alternative markers that help us formulate a more complete picture of heart health from multiple angles? Indeed there are, they have been known for years. However, most of these markers have been ignored because there are no drugs available to "normalize" them. No doubt as drugs are developed, these markers will take on significant commercial value, and that is when their importance will be publicized. At the mean time, as most medical students were taught: Never order a test when you know ahead of time you're not going to know what to do with the results.

It is far better to incorporate the following sensitive and easily obtainable indicators when assessing cardiovascular risk. They are listed in decreasing order of importance (the most important and sensitive listed first), as follows:

1. **Lipoprotein (a)** – indicator of endothelial wall integrity
2. **Homocysteine** – indicator of free radical activity
3. **Fibrinogen** – indicator of thrombus formation and blood viscosity
4. **Arterial Stiffness** –indicator of wall flexibility and blood pressure health
5. **Cellular Energy Generation** – indicator of mitochondrial function
6. **C Reactive Protein** – indicator of inflammatory response
7. **Triglyceride** – leading cause of metabolic syndrome
8. **Total cholesterol / HDL cholesterol ratio** –key indicator in lipid metabolism
9. **LDL cholesterol** – indicator of the level of "bad" cholesterol
10. **Total Cholesterol** – overall indicator of total cholesterol in blood.

As we can see, cholesterol is near the bottom in terms of sensitivity and predictability of cardiac accidents when compared to others.

This paper will examine each of these markers in more detail and suggest conventional and nutritional therapeutics that can normalize each of these indicators.

While none of these key indicators are in and of themselves and an absolute prognosticator of impending heart attack or stroke, there is little doubt that taken as a group, the overall predictive value of these indicators are overwhelming significant and have strong predictive value. They offer the best that science can offer today, short of scans and invasive procedures.

1. Lp(a)

Autopsy studies of heart attack victims have shown that many have clean vessels and normal cholesterol levels. It is obvious that there are other causes for heart disease. Indeed, researchers with the Framingham Heart Study (the decades-long study that brought us the term "risk factor") identified a relative of LDL-cholesterol called **lipoprotein (a) [Lp(a)], which is now recognized as major independent risk factor for heart disease.** While LDL cholesterol maybe known as the "bad" cholesterol, Lp (a) is even worse. Lp(a) is a plasma lipoprotein that structurally resembles LDL, but with additional adhesive properties. Some of the natural cholesterol produced by the liver in response to free radical damage is converted into LDL cholesterol and its relative Lp (a). Lp(a) fosters cholesterol deposition by enhancing oxidation of LDL-cholesterol. It is the oxidized form of cholesterol that penetrates the endothelium, leading to the build up of plaque and vascular disease.

It should be noted that artery blockage (plaque) is composed mainly of Lp(a) and not of ordinary cholesterol.

Oxidized cholesterol is a free radical generator. Research has shown that rabbits that consumed a small amount of oxidized cholesterol for merely 12 weeks had atherosclerosis plaques that were two times as big as the control population. Studies reveal that heart attack risk falls 2% for every 1% drop in LDL cholesterol level.

Studies have also shown that Lp(a) holds fast to damaged blood vessel, attracting other Lp(a) molecules, and finally constituting the atherosclerotic plaques. In fact, a high Lp (a) level (more than 30 mg/dl) has been revealed to carry a 10 times greater risks for heart disease than LDL cholesterol level.

Linus Pauling, two-time Nobel Laureate, postulated that Lp(a) may be the surrogate for ascorbate in the human. Low dietary intake of ascorbate leads to weaken blood vessels because ascorbate is required for the synthesis of collagen and elastin, which strengthen the blood vessel wall. In the absence of ascorbate, Lp(a) is mobilized to repair these structural defects in arterial walls by being deposited to strengthen the tissue. However, if the plasma concentration of Lp(a) is too high, the process goes too far. Too much Lp(a) gets deposited in the arterial wall, and plaque formation is initiated.

Chronic depletion of these essential nutrients such as vitamin C, lysine, and proline in the endothelial and vascular smooth muscle cells impairs their ability to function properly. Guinea pigs fed a diet low in ascorbate rapidly developed atherosclerotic plaques, similar to those found in humans. When large amounts of supplementary ascorbate were given to these guinea pigs, there was a regression in plaque formation.

Because humans, other primates, and guinea pigs do not produce ascorbate endogenously, they have to be supplemented from external source. Dr. Pauling concluded that the optimum intake of Vitamin C is perhaps 100 times more than the RDA (RDA is 85 mg). During the last 25 years of his life (he died at age 93 from cancer), Dr Pauling increased his own intake of Vitamin C many times, taking 3,000 mg to 18,000 mg per day. This amount is consistent with the amount of ascorbate in animals that are capable of producing their own on a daily basis. Dr. Pauling believed that cardiovascular disease is the general result of ascorbate deficiency.

Lp(a) is a simple blood laboratory test to perform. The optimum laboratory level should be under 20 mg/dl and preferably under 14 mg/dl. Currently, there is no medicine or drugs that effectively lowers Lp(a) to this level.

A high Lp(a) is genetically linked. (Sam Bock's Note: However, new research shows genetic expression is regulated by nutrient ingestion affecting the proteome.) The most effective and natural way to normalize it is a nutritional cocktail consisting of high dose Vitamin C (4-6 grams), L-lysine (2-4 grams), and L-proline (1-2 grams). Other synergistic amino acids such as glutamine, ornithine, and pine bark extract should also be included. Because high dose vitamin C can lead to diarrhea, it is very important to incorporate the fat-soluble form called ascobyl palmitate. Being fat soluble, this form of vitamin C stays in the body much longer than regular vitamin C and in effect extends the efficacy of vitamin C in the body while at the same time reduces the amount of vitamin C needed.

This mega vitamin cocktail therapy will increase blood concentrations of important substances and focuses on:

· Strengthening and healing damaged blood vessels
· Lowering LP(a) blood levels
· Inhibiting the binding of LP(a) molecules on the walls of blood vessels

This concept of endothelial repair advanced by Dr Pauling to lower Lp(a) is simple and logical. **Once the endothelium is healed, the body will not send a signal to the liver to produce cholesterol and its related products such as LDL and Lp(a). The key is to focus on the endothelium and not focus on the liver.**

Many conventionally trained physician uses niacin or statin drugs to reduce Lp(a). This works to a limited extent. Statin drugs have some Lp(a) lowering effects by suppressing its production in the liver, but this is a band-aid approach and comes with side effects. Niacin also reduces the production of Lp(a) in the liver, and helps to reduce its blood level . However, this approach has its limitations because until the endothelial wall is optimized and cleared, the Lp(a) level will not be reduced significantly. T**he effects of niacin or statin drug therapy usually hit a plateau after 9-12 months of therapy.** The Lp(a) level seldom goes below 30mg/dl because until the endothelium is healed, the body will always instruct the liver to make cholesterol.

On the other hand, with the proper nutritional cocktail focusing on endothelial repair, drastic improvements on Lp(a) level can usually be seen within the same time frame for the majority of the people. The higher the starting value, the more significant is the reduction.

It is not unusual for the Lp(a) level to be slightly elevated from its baseline level in the early months of therapy (as it is cleared from the arterial wall into the lumen) before normalizing. This is normal and is not a cause for alarm. A follow up Lp(a) test should be done 9-12 months after starting the nutritional program. While the majority responds favorably, some people are particularly resistant, and may take up to 1 year to effect a minor change. In a very small group or people, no change at all can be expected after an extended period. The good news is that there are no negative side effects. All people with high Lp(a) should be started on a nutritional cocktail program. Even if repeated blood tests do not show any improvement, vascular integrity is enhanced. There is nothing to loose and everything to gain.

2. Homocysteine

Homocysteine is an amino acid by-product of food metabolism. It contributes to atherosclerosis, reduces the flexibility of blood vessels, and increases clotting by making platelets stickier and slows blood flow. Studies show a direct positive correlation between high serum homocysteine levels and the risk of heart attack and stroke.

A high homocysteine level is also associated with Alzheimer's disease, as well as depression, multiple sclerosis, menopausal symptoms, and rheumatoid arthritis.

Homocysteine is formed naturally when protein is broken down. **Too much of it causes oxidative damage to the endothelium.** Oxidative damage is caused by free radicals--byproducts of the body's normal processes that can damage body tissues. In fact, the risk for heart disease triples when the homocysteine blood level exceeds 15.8 umol/L - a reading still considered by many to be within the "normal" range (The optimum target should be under 8 umol/L). Worse yet, the odds of heart disease are directly proportional to the homocysteine concentration. The higher the blood homocysteine level, the higher the risk of cardiac disease.

This direct correlation has been well researched, including a study conducted at the University of Bergen of 2127 men and 2639 women aged 65 to 67 years between 1992 and 1993. By February 1997, 162 men and 97 women had died; 121 from cardiovascular causes (including stroke), 103 from cancer, and 33 from other causes. Using a baseline homocysteine level of 9.0 umol/L the researchers found that for every 5.0 umol/L increment increase in homocysteine levels, all-cause mortality increased by 49%, cardiovascular mortality by 50%, cancer mortality by 26%, and deaths from other causes (respiratory, gastrointestinal and central nervous system diseases) by 104%.

Looking at it another way, **dropping the homocysteine level by 5 points can reduce heart**

disease risk by 50%. These percentages refer to values obtained after adjusting for a variety of lifestyle factors including cholesterol level, blood pressure, smoking, body mass index, physical activity, age, sex, and baseline cardiovascular disease risk. About 78% of this study group had homocysteine levels at or above 9.0 umol/L and 12% had levels exceeding 15 umol/L. It is interesting to note that Smoking and drinking coffee were associated with higher homocysteine levels while taking vitamins and exercising were associated with lower levels. The result is clear – for optimum heart health, lower the homocysteine level.

In another study published in the Journal of the American College of Cardiology (June 1, 2001;37:1858-1863), researchers found that heart disease patients who took 5 milligrams (mg) of folic acid daily (not microgram or mcg) for 12 weeks had slightly better functioning of their arterial inner lining, or endothelium, and a greater ability to widen their arteries appropriately, than those who took an inactive placebo.

Sad to say, but only 11 percent of all Americans get enough folic acid from its main sources - liver, kidney, broccoli, beef, kale, turnip greens, and beats. Cooking destroys as much as 90 percent of a food's folic acid content. The average American over 50 years old only takes in 130 mcg of folic acid per day. The RDA is 400 mcg a day. Its level is also depleted by chronic alcohol consumption and medications such as anticonvulsant. In fact, studies have shown that eating 400 mcg of folic acid from food alone does not raise the serum folic acid concentration anywhere close to that obtained by simple folic acid supplementation. You need more than what food can provide.

Drugs easily deplete folic acid as well. The NSAID anti-inflammatory drugs, including aspirin and ibuprofen, deplete folic acid. The popular class of anti-ulcer drugs known as the H-2 receptor antagonists [Zantac, Tagamet, Pepcid, etc.] also depletes folic acid.

Instead of encouraging simple folic acid supplementation, the US Food and Drug Administration implemented a policy of mandating that certain food be "enriched" with folic acid in 1998. Since that time, folic acid has been added to certain grain products including cereals, breads, pasta and flour. This has resulted in higher folic acid levels in adult Americans. Unfortunately, the amount of enrichment, while enough to protect the pregnant women and the fetus from neural tube defect, is hardly enough for optimum health. Only 636 mcg is present per pound of such "enriched food". While some of these foods are good, the majorities fall in to the category of "junk food" because of its high grain and refined sugar content. Clearly, eating such “junk food” as a method to supplement folic acid is not the best way to optimize health.

(Sam Bock’s Note: Methyl groups, B6 and B12 are also required for the conversion of homocysteine. Tri***methyl***glycine is betaine, not to be confused with betaine hydrochloride. Organic quality, pharmaceutical grade TMG is an excellent methylating agent and assists homocysteine in being metabolized into methionine, resulting in the production of DMG (dimethylglycine). Further metabolism of TMG produces the enzyme methyltetrahydrofolate reductase (the active form of folic acid). **)**

There are no medications or drugs that can effectively reduce homocysteine level.

How much folic acid do you need?

RDA: 400 mcg a day
For heart heath**: 400 mcg 800 mcg a day**
To lower serum homocysteine level: 3-20 mg a day

3. Fibrinogen
Fibrinogen is a key indicator in heart disease risk. In one study of 116 men, it was found that people who have high LDL (bad) cholesterol but low fibrinogen level had only 1/6 the heart attack risk of men with high LDL level and high fibrinogen levels. High fibrinogen levels promote the spontaneous

formation of fibrin clots and increase the risk of heart disease. Reducing the level of fibrinogen is therefore an important part of a heart disease prevention program.

A clot is also known as a thrombus. It is formed when platelets and red blood cells come together. It is formed at the sight of the clot from soluble circulating protein called fibrinogen. This protein binds the clots together, and is naturally formed in the blood after injury or trauma. The injury could be severe, as when a blood vessel breaks. The injury could also be very minor from shear forces and stress of the blood flowing in the blood vessel to free radical attack on the endothelial wall caused by pollutants and sugar. During the aging process, when the collagen structure of the blood vessel wall is weakened, clots may also form. Fibrin also increases the blood viscosity, blood pressure, and impairs blood flow. Complete blockage results in heart attack or strokes.

Laboratory testing of fibrinogen is simple and easy. However, its use has not gained widespread acceptance though, because there are no direct drug based treatments for elevated levels available. Normal range = Males 180-340 mg/dl, Females 190-420 mg/dl.

Plasmin

While there are over 3000 enzymes in the body and there are more than 20 enzymes involved in the coagulation cascade that creates blood clots, there is only one enzyme that Mother Nature has provided to the human body that can dissolve the fibrin and break up blood clots. This enzyme is called plasmin. Unfortunately, the body's production of this decline with age. In addition to its decreased production with age, fibrinogen levels also rises 25mg/dl per decade in healthy people. In other words, as we age, our plasmin level reduces while our fibrinogen level rises. The resulting risk of cardiac accidents goes up.

Plasmin is called a thrombolytic (clot-dissolving) enzyme and is made from plasminogens through the action of the enzyme called Tissue Plasminogen Activator (TPA). Acting on the same principal, a class of drug has been developed that mimic this activity. For example, Urokinase is a drug that belongs to a class of medication called Tissue Plasminogen Activities. It is administered within a few hours after admission in to a hospital after an acute onset of thrombus formation and is delivered intravenously. It is also very expensive.

Are there natural compounds that have similar thrombolytic activities? Yes. Let us take a closer look.

Natto

In 1980, after studying physiological chemistry at the University of Chicago Medical School, Japanese researcher Dr. Hiroyuki Humi discovered that a traditional Japanese food called **natto derived from fermented soy** had the ability to dissolve clots. Specifically, he was able to identify and purify the specific enzyme in the fermented soy cheese that he called nattokinase. **Natto has been widely consumed in Japan as a condiment for over 1000 years.**

Extensive studies have been conducted worldwide on this compound. In one study, 12 volunteers, 6 men and 6 women, were fed 200g (7oz.) of natto and had their thrombinolytic activities measured. Researchers found that the time needed to completely dissolve a clot was cut in half in those taking natto as compared to those who did not take it. In 1995, researchers did a study wherein the corona arteries of rats were injured to induce thrombus formation. The arteries were then completely blocked and blood flow to the brain was stopped. Three enzymes-elastase, plasmin, nattokinase, were then tested on different rats and the researchers found that **nattokinase was successful in restoring circulation by 62%,** while plasmin was able to restored it by 16% and elastase produced no reopening. Since natto is a natural compound, its potency has to be standardized in order to have relevancy to the studies. In Dr. Sumi's original nattokinase research paper, it was reported that natto has an average of 40 fibrinolytic units (FU).

In human research, 50-200 gram is the typical daily food dose used to supply nattokinase. This is equivalent to 2,000-8,000FUs. The nattokinase currently available in dietary supplementation supplies about 20,000 FU/g. This can be compared with serrpeptase, an enzyme from the silk worm that has fribrinolytic properties with an equivalent of 60,000 FU/g.

Natto is a fermented cheese like food and it use as a folk remedy for heart and cardio vascular disease has been well established. It is produced using a fermentation process by adding a beneficial bacterium known as bacillus-natto to boiled soybeans. The resulting nattokinase enzyme is then produced when the bacillus natto acts on the soybean.

While soy food does contain a variety of enzymes, it is only in the natto preparation that contains the specific nattokinase enzyme. Unfermented soy products such as tofu or soymilk do not contain nattokinase.

Nattokinase produces a prolonged action in two ways: it prevents the coagulation of blood and dissolves existing thrombus. Both the efficacy and the prolonged action of nattokinase can be determined by measuring the levels of EFA (euglobulin fibrinolytic activity) and FDP(fibrin degradation product) which will become elevated as fibrin is dissolved. It has been shown that by measuring EFA and FDP levels, that nattokinase activity can last from 8-12 hours.

Nattokinase has been subjected to 17 studies including 2 small human trials. Nattokinase has also been used to lower blood pressure in Japan. In 1995, researchers from Miyazaki Medical College and Kurashiki University of Science and Arts in Japan studied the effects of nattokinase on blood pressure in both human and animal subjects. With a single administration of 400-450g of nattokinase infused into the peritoneal, there was a 12.7% drop in systolic blood pressure within 2 hours of administration. When the same natto extract was tested on human volunteers, it was shown that when 30g of lyophilized extract, equivalent to 200g of natto food, were given, 4 out of 5 volunteers had their systolic blood pressure reduced by 10.9% and their diastolic blood pressure also reduced by 7%.

To guard against thrombus formation and to dissolve existing clots, **take 25 mg to 100 mg of nattokinase in the form of nutritional supplements if you do not like to consume natto bean. Make sure the FU value is more than 20,000 Fu/g .**

4. Arterial Stiffness

One of the hallmarks of aging is the loss of collagen supporting structure throughout the body. Collagen reduction is visible and presents itself in the form of wrinkles on our face and skin surfaces during the aging process. Our blood vessel is also structurally supported by collagen. **As this collagen structure deteriorates, stiffening of the arteries occurs.** Indeed, the fact that arteries stiffen with age, and that such changes are associated with an increased incidence of major cardiovascular events and increase in blood pressure, is now established beyond doubt.

Measuring the stiffness of arteries would logically provide a better insight into blood vessel health, in addition to the traditional blood pressure measurement. Scientists have machines, with a reproducible parameter termed 'stiffness index' by measuring the time delay between direct and reflected waves in the digital volume pulse. There are several apparatus commercially available to physicians. Unfortunately, its use is not widespread because there is no drug based treatment program to reduce the stiffness once discovered

As collagen is lost and elasticity reduced, stiffening of the arterial wall lead to increase in systolic and diastolic pressure. In particular, the systolic pressure will be disproportionately higher, registering a reading of 140-160 mmHg or higher. There is often a wide systolic to diastolic gap (normal is 40 mmHg), often up to 60-70 mg Hg, with a typical blood pressure reading of 160/100 mmHg without medication, and 140/90 at best with medication.

Postural hypotension is also common. With reduced elasticity to normalize blood pressure, it can drop quickly as a one goes from a sitting to a standing position. Anyone over age 45 can practically assume that arterial stiffening is already in a progressive state. Unless active steps are taken, the stiffening will continue. Those who have elevated blood pressure should be specially concerned as it may indicate arterial stiffening. Unfortunately, there are no medications that can reduce the arterial stiffness at this time.

Nitric Oxide (NO)

In 1998, a trio of scientist's was awarded the Nobel Prize for discovering the enormous role that Nitric Oxide (NO) plays in our body. NO is the first gas discovered to have signaling properties. It is produced by one cell and is able to penetrate through the membrane and regulate the function of another cell. The discovery of this pathway opens up an entirely new principle of signaling and communications in the biological system.

Mention nitric oxide and most think of it as the toxic gas produced and given off by a car engine. It is a poison that up until now is thought to exist outside the body and does nothing more than cause trouble. NO was not expected to be important in higher animals such as humans. This is now proven wrong. NO in fact is produced inside most if not all tissues by the body and plays a very important role in the cardio vascular, immune, and nervous systems.

Nitrous oxide is known as the laughing gas, the anesthetic that is used commonly by dentists. This should not to be confused with Nitric Oxide.

NO and the Cardiovascular System

NO is produced by the inner most layer of the arteries called the endothelium. Once produced, it rapidly spreads through the cell membrane to the underlying muscle cells, causing them to relax from its default-constricted state. This results in the dilation and widening of the artery lumen. Blood pressure drops as a result. Because NO is short lived, a constant supply of it is generated by the endothelial cells in response to the sheer stress of the blood flow on the artery walls. In arthrosclerosis, the endothelium has been damaged by free radical attacks as well as plaque formation and inflammatory response. **The capacity to produce NO is reduced, and the vascular musculature constricts and blood pressure can be elevated.**

It is now known that normal cardio vascular contraction state is biased in one direction, which is towards vessel constriction. This is the body's way of maintaining the blood pressure at a slightly constricted state in order to channel adequate blood supply and oxygen delivery to the brain continuously. With the constant NO production by the endothelium, vessel dilation is sustained, and blood pressure is maintained at a normal systolic rate of around 120 mm Hg and a diastolic rate of around 80 mm Hg. **Too much NO can lead to excessive vasodilatation and a fall in the blood pressure, while too little NO can lead to rise in blood pressure.**

The vasodilatation effect of NO applies to all blood vessels. It can initiate erection of the penis by dilating the blood vessels to the erectile bodies. This knowledge has already led to the development of new drugs to treat impotency such as Viagra.

Any interruption the production of NO interferes with the tone of the arterial muscles and the blood vessels will return to its constricted state. From this point of view, a rise in blood pressure may due to the constriction caused by other factors such as the hormone epinephrine produced by the adrenal glands.

In the case of heart disease, the tension is focused on NO deficiency. Healthy blood vessels are pliable and elastic by nature. They can alter their diameter instantly in response to a greater or lesser out flow of blood from the heart. This continuous change happens during exercise as well as

when we are excited. This spontaneous regulation of blood pressure goes on uninterrupted 24 hours a day. As we age, the elasticity of our blood vessels declines due to collagen loss, free radical damage, as well as plaque accumulation. Poor diet, lack of exercise, cigarette smoking, and genetic predisposition all contribute to a breakdown of collagen fibers that support the blood vessels. This results in the lack of elasticity. Blood vessels then become passive and stiff pipe-like structures which raises blood pressure, forcing the heart to work harder.

In addition to helping the blood vessels relax, NO also helps to prevent the clogging of arteries in several ways. First, it prevents the white blood cells from sticking to the arterial wall. It also helps to prevent damage to the arterial wall by reducing the production of free radicals. In other words, it acts like an antioxidant. NO also helps to prevent the thickening of the middle (muscular) wall of the artery that can narrow the opening where the blood flows.

Other Function of NO

NO gas, when inhaled by patients with pulmonary hypertension has been shown to relieve lung congestion. In a treatment for newborn babies, breathing problems can be helped by inhaling NO that relaxes constricted blood vessels and dilates the lung's blood vessels. NO is also produced in the brain in neuronal form that acts as a chemical messenger at the synapses. This has opened up a new approach to the studies of Alzheimer's disease, Parkinson's disease, and other neurological disorders. NO also inhibits the loss of bone, and the release of growth hormone may augment bone density.

Exercise and NO

Exercise alone has also been shown to increase the production of NO in the body. This may explain why exercises can reduce blood pressure.

The effect of adding the amino acid arginine and vitamin C and E to an exercise program have been shown to synergistically increased NO production. In a study conducted at UCLA, researcher Louis Ignarro studied 6 groups of 8-week-old receptor deficient male mice with high cholesterol over 18 weeks. The mice were randomly divided into 3 dietary groups called fat with high cholesterol diet alone, fat with high cholesterol diet with antioxidant vitamin E and C, and a fat with high cholesterol with the antioxidants arginine. It was shown that the mice from all 3 groups were able to lose weight and had lower cholesterol when they exercised. The atherosclerotic legions were significantly reduced in the mice group that had arginine.

The explanation is that exercise will increase the amount of endothelial nitric oxide synthetase (NOS) and enzymes that will then convert the arginine into NO, which in turn lowers abnormally elevated blood pressure, prevent unwanted blood clots, and early inflammation associated with coronary artery disease. Nitric oxide production is stabilized when vitamins C and E are added as these remove destructive oxidants from the blood stream.

Even without exercise, these supplements will work on their own to increase NO. Studies have shown that mice that were sedentary and fed supplements alone showed a 40% reduction in atherosclerotic legions compared to mice that were on a regular, high cholesterol diet but did not exercise or take supplements.

Exercise alone without supplementation also shows a 35% reduction in legions. It can be concluded therefore that amino acid supplementation has an atherosclerotic reduction effect similar to exercise. Doing both exercise and supplementing with antioxidants concurrently will produce the best results.

Formation of NO

No is formed in varies places in the body. In the endothelium, NO is formed by the enzymatic action of nitric oxide synthetase (NOS) on the amino acid arginine and citrulline . This process is enhanced when antioxidants are present, especially vitamin C. NO also forms in nerve cells, where it spreads rapidly in all directions and affects all cells in the vicinity. NO is also produced in the white blood cells such as macrophages and NO is toxic to invading bacteria and parasites.

There are 3 forms of NOS enzymes. One is in the endothelium, one in the immune system, and one in the brain. Genes responsible for encoding the NOS are located in chromosomes 12, 7, and 17 respectively. The discovery of NOS opens up another new class of drugs based on n-monomethyl-arginine (l-nmma), an inhibitor of the NOS enzyme. Drugs are being used to explore the possibility of blocking NO production in order to raise the blood pressure. Experiments have been performed where volunteers were injected with l-nmma. Blood flow was then compared from one arm to the other arm. As l-nmma was infused, blood flow is observed to gradually decrease to half as compared to that in the control arm. This has important ramifications, and drugs are being developed to raise blood pressure. Clinical application of this pathway is be particularly useful for those who have acute low blood pressure as frequently experienced when in shock or trauma.

L-Arginine and NO

L-arginine is an essential amino acid that is present in many foods and it is also a precursor of NO production.

Studies have shown that arginine, when taken in proper amounts, can stimulate NO production. In a 1999 study, 30 impotent men were given 1500 mg of arginine each per day. It was shown that is worked no better than the placebo in terms of vasodilatation and sexual performance. However, when 21 men with mild to moderate impotence were given 3,000mg a day of arginine, significant improvement in erection as well as sexual satisfaction was reported. This study was published in the December 1998 issue of Hawaii Medical Journal. It is obvious that the use of arginine as a nitric oxide precursor is dose dependant, and a low dose regiment will not be effective.

L-arginine supplementation has also been shown to significantly reduce systolic and diastolic blood pressure. Reductions were evident in subjects when they were rested as well as when they were not stressed. The reduction in blood pressure was associated with increased cardiac output. These findings were reported in the in the American Heart Association meeting in November 2003 where 16 hypercholestrolemic men with normal blood pressure were given 12 grams of oral arginine a day over a period of 3 weeks.

L-arginine has long been used in the enhancement of sports performance and cardiac function. A double blind placebo control study of 22 subjects with stable angina and supplementation with l-arginine at 1 gram twice a day has been shown to significantly improve their exercise capacity. Arginine supplementation has also been reported to result in 70% reduction in angina attacks in another study.

L-arginine works by stimulating the production and release of NO. However, L-arginine may have separate anti-atherogenic independent in of its role in the enzymatic formation of NO. For example, l-arginine itself may have antioxidant activity. It has been shown to inhibit the oxidation of unoxidized low density lipoprotein (LDL) to oxidized LDL (oxl LDL). The oxidation of LDL to oxl-LDL is believed to be a critical early step in the formation of arthrosclerosis.

L-arginine may also independently have a scavenger effect in sweeping up super oxide anions and hydrogen peroxide as well as reducing the peroxidation of lipid. Furthermore, it has been shown to have immunomodulatory activities. Supplementation of this amino acid in breast cancer has been shown to increase the quantity and cytotoxicity of natural killer (NK) and Lymphokine-activated-killer

(LAK) cells. The exact mechanism is not clear and but it has been shown however that l-arginine is a precursor in the synthesis of tetrapeptide tuftsiin, which itself appears to have immunomodulatory activities.

Arginine is an excellent helper when it comes to wound repair. This may be due to its precursor role in the formation of l-ornithine, and ultimately l-proline. L-proline in conjunction with l-lysine and vitamin C are the key elements in collagen biosynthesis. Collagen is the main ingredient in tissue healing and scar tissue formation. Arginine participates in the maintenance of muscle and lean tissue in the body.

Arginine, in high dose, promotes an increase in the body's production of insulin like growth factor (a measure of human growth hormone). Its use, together with lysine, ornithine and glutamine, is one way to stimulate the body's release of growth hormone.

Interestingly, l-arginine has also been shown to increase sperm counts. In one early study, 178 men with oligospermia were given 4g of l-arginine daily. Severe oligospermia was diagnosed in 93 of these subjects and 100% increased in sperm count was found in 42 cases, resulting in 15 pregnancies. Studies have also shown that l-arginine is beneficial for people with kidney diseases as well as interstitial cystitis. It improves kidney function in diabetic animal models and it helps promote renal vasodilatation.

In summary, arginine is a very versatile amino acid. Many of its functions have just started to be explored. **NO produced in the body from the intake of arginine can play a major role in anti-atherogenic activity.** NO inhibits mononuclear cell adhesion, platelet aggregation, proliferation of vascular smooth muscle, and production of some reactive oxygen species, such as super oxide anions. It is a promoter of endothelium dependant dilation and is able to normalize high blood pressure. In other words, it relaxes the blood vessel and reduces the arterial stiffness. It increases sperm count, boost immune function, and enhances male sexual disorders, restores protein balance and speeds wound healing.

Arginine Dosage

Arginine is a non-toxic compound. Dosage of up to 15 grams a day has been well tolerated. The most common adverse reaction to high doses (15-30 grams a day) are nausea, abdominal cramps, and diarrhea, and scaling back the dosage will eliminate the problem. Because high dose and long term use of arginine can lead to an increase in growth hormones, pregnant and nursing mothers should refrain from high doses of arginine supplementation. The use of arginine in the cardio vascular and erectile dysfunction setting has been very promising. While no supplementation can work 100% of the time, most people do experience some improvement when dosed properly. **For cardio vascular health doses, 2-15 grams a day should be used in divided doses.** To help sperm count, doses of 10-20 grams a day have been used. For erectile dysfunction, daily doses of 5 grams a day have been used. For interstitial cystitis, 1 to 4 grams a day is commonly used.

To avoid arginine's risk of promoting free radical oxidation, supplementation should always be accompanied by antioxidants including vitamin C, ascobyl palmitate, lysine, proline, small amount of co-enzyme Q10, and lipoic acid and other antioxidants. This is especially important for those with inflammatory problems such as arthritis as excess NO can stimulate an inflammatory response. If the immune enhancing properties of arginine are desired, always add proline and lysine. Because some infectious pathogen may actually use arginine as a fuel, lysine should be added to help neutralize any virus attack. Children under 18 should not take arginine for any extended period of time.

Anyone concern with cardiovascular health, and especially with normalization of blood pressure, should consider nutritional supplementation of arginine in conjunction with other synergistic and pre-cautionary co-factors mentioned above. Arginine dosage ranges from 2-5 grams a day. **Those who have a history of low blood pressure should be careful as NO may further lowers the**

pressure.

5. Cellular Energy Metabolism

Mitochondria are the energy factories of the cell. The energy currency they produce is ATP. Generation of ATP is therefore vital to cellular process. Coenzyme Q10, or ubiquinone, is a vital component in the ATP-generating process. It acts as an electron acceptor/proton donor; hence its presence in the body is fundamental to the support of cellular life. It is omnipresent in body tissues.

With advance technology, the cellular metabolism rate can now be measured. Unfortunately, its commercial use is not wide spread because laboratory test are very expensive. Fortunately, there is already enough scientific research that commands us to do all we can to enhance cellular energy generation regardless. When more energy can be generated by the heart with the same fuel, the heart does not have to work as hard. In laymen's term, you don't need to get a fancy tune up for your car to know that regular use of better grade gasoline can help to have a cleaner and more efficient engine.

The following are proven nutrients that promote cellular metabolism and should be taken by everyone concerned with heart health.

Coenzyme Q10 (Ubiquinone)

The body's production of CoQ10 begins to decline after age 20 to just 50% of levels by age 70. Because the function of the heart is so dependent on the energy produced with the help of CoQ10, CoQ10 is extremely important for heart health. It is also important as a powerful antioxidant and a membrane stabilizer. **The range of heart conditions for which research has found CoQ10 beneficial include (1) congestive heart failure, (2) cardiomyopathies, (3) arrhythmias, (4) angina, when there is a lack of oxygen, and (5) muscular dystrophy.**

Individuals with cardiac disorders have been identified as having abnormally low levels of CoQ10. Numerous long-term studies have been conducted to ascertain the efficacy of CoQ10. These studies indicate that there is a statistically significant improvement in the condition of those patients with myocardial dysfunctions such as ischemic cardio-myopathy or congestive heart failure when they take CoQ10. In an 8-year study of 424 patients with cardiac dysfunction, 58% improved by one functional class, 28% by two classes, and 1.2% by three classes. Further, overall medication requirements dropped, with 43% of the patients discontinuing between one and three drugs. Only 6% were required to add one drug. In another study on 40 patients undergoing elective coronary artery bypass surgery, pretreatment with CoQ10 at 150mg/day for seven days served as a protection against oxidative compounds.

CoQ10 also plays a vital role as an antioxidant in cellular membranes and plasma lipoproteins. It is present in all plasma membranes and in LDL-cholesterols. Studies illustrate CoQ10's protective action against the oxidative modification that makes LDL-cholesterol atherogenic. In its reduced form, ubiquinol, CoQ10 also functions as a chain-breaking antioxidant and is believed to regenerate Vitamin E.

You can get CoQ10 from your diet, although the amount of food intake is insubstantial. For example, one pound of sardines or 2.5 pounds of peanuts provide 30 mg of CoQ10.

Working synergistically with CoQ10 are two endogenous antioxidants that enhance mitochondrial function and reduce free radical damage - L-Carnitine and Lipoic Acid.

L-Carnitine and Lipoic Acid

The ability of the cell to utilize fatty acids as a source of fuel is essential for optimizing the

production of ATP by mitochondria in cardiac cells to keep the heart properly functioning. L-carnitine assists in this transportation process by bringing fatty acids from the extra-cellular space into the mitochondria. In one double blind trial, 500 mg per day of a modified form of carnitine called propionyl-L-carnitine lead to a 26% increase in exercise capacity after six months.

Lipoic Acid is both a water- and fat-soluble antioxidant. It neutralizes free radicals in both the fatty and watery regions of cells, in contrast to Vitamin C, which is water soluble, and Vitamin E, which is fat soluble. Lipoic acid is therefore called the "universal antioxidant". It has the ability to recycle both Vitamin C and E in our body. It helps break down sugars so that energy can be produced from them through cellular respiration. In addition to serving as the bulb of the body's antioxidant network, lipoic acid is the only antioxidant that can boost the level of intracellular glutathione, a cellular antioxidant of tremendous importance. Glutathione is a water-soluble antioxidant and is essential for the optimum functioning of the immune system.

Nutritional Supplement Consideration:
Coenzyme Q10: 30 - 300 mg (less is needed if synergistic agents are added such as peperine extract that can enhance CoQ10 activities by up to 25%)
L-Carnitine: 300 - 2,000 mg
Lipoic Acid: 75 - 300 mg

6. CRP

C-reactive protein (CRP) is a protein released into the bloodstream any time there is active inflammation in the body, such as infections and arthritis. CRP is conventionally regarded as the first-line of defence of the immune system against invading pathogens by eliminating them through the inflammatory response.

Recent studies have shown, however, that CRP is much more than that. In a study published in the New England Journal of Medicine, researchers analyzed over 20,000 blood samples taken from women enrolled in the Women's Health Study, a long-term study that enrolled and followed apparently healthy women for a number of years. It was found that an elevated blood level of CRP is strongly predictive of future cardiovascular events such as heart attack and stroke. In other words, CRP is an independent marker of cardiovascular risk, and may be a partial explanation for why some patients develop significant coronary artery disease despite normal cholesterol levels. In this study, women with low CRP and low cholesterol have the lowest risk, while those with high CRP and high cholesterol had very high risk. Women with either high CRP or high cholesterol also had elevated risk. Interestingly, those with high CRP but normal cholesterol apparently had a higher risk than those with normal CRP and high LDL cholesterol. CRP is a predictor of future atherosclerotic event.

CRP binds to LDL in the artery wall, creating an "oxidized LDL" that is thought to be the cause of inflammation. The inflammation process attracts macrophages. These macrophages then become "foam cells," initiating a cascade of events leading to the generation of atherosclerotic plaques.

CRP therefore is tied into cardiovascular risk by at least two distinctive pathways. The importance of CRP as an advance-screening tool of cardiovascular risk cannot be ignored. In fact, it may be just as important as elevated LDL cholesterol levels. Without measuring CRP level, many high-risk patients would be "missed".

Fortunately, **CRP is an easy and inexpensive blood test to perform. The normal value is under 1 mg/dl. There are no drugs or medication that can definitively reduce CRP levels.** There is suggestive evidence that both aspirin and statin drugs can reduce CRP levels to a certain degree. However, there are side effects accompanying the use of these drugs. Certain lifestyle changes can also lead to a reduction in CRP levels, such as smoking, metabolic syndrome (syndrome X), and

periodontal disease (gum disease).

Fortunately, taking nutrients with anti-inflammatory properties such as molecularly distilled fish oil high in omega 3 will help, together with compounds such as bromelain, curcumin, cat's claw, olive leaf, and fibrin dissolving nutrients such as natto.

A. Omega-3 Fatty Acid

Omega-3 fatty acids provide a range of benefits and protection for the heart and our body. In addition to reducing the risk of heart disease, they also help prevent blood clotting, heart attacks and irregular heartbeats that could lead to sudden cardiac death. They are anti-inflammatory, and inflammation is a key initiator of the atherosclerotic cascade leading to plaque formation and sudden death. Omega-3 also has anti-cancer functions, as we shall see.

Omega-3 fatty acids can be divided into 3 main categories -- Eicosapentaenoic Acids (EPA), Docosahexaenoic Acids (DHA) and Alpha-Linolenic Acids; out of which EPA and DHA have the most beneficial effects. EPA and DHA are found mainly in fish oils while Alpha-Linolenic Acids are usually derived from plant sources such as soybeans, canola, walnut and flaxseed.

Of all the fatty acids in the blood including saturated, monounsaturated, and polyunsaturated, only the percentage of long chain omega-3 predicted fewer sudden death. In a study of 11,323 recent survivors of heart attack, 1 gram of omega-3 or 300 mg of Vitamin E or both was given. The usual pharmacological regiment and lifestyle recommendations were made. It was shown that omega-3 and not Vitamin E improved survival. After 3 months of remaining on regiment of omega-3, patterns showed a 41% decrease in mortality, a 53% reduction in sudden death after 4 months, and a 30% decrease in cardiovascular mortality after 12 months. There was also a 5% decrease in triglyceride but not total cholesterol, HDL, or LDL cholesterol.

Increasing the intake of EPA and DHA will lead to an increase of omega-3 fatty acids in tissue or cellular lipids and circulatory lipids. At the same time, it will reduce the omega-6 fatty acids such as LA and Arachidonic Acid (AA), which is not beneficial to our bodies.

The fatty acid shifts are particularly pronounced in the cell membrane-bound phospholipid components. Cell membranes and their functioning, for example, improved with reduced inflammatory response. There is also reduced platelet aggregation and enhanced blood flow. The vasodilatory effect will increase lumen size of vascular system. Studies have shown that fish oil concentrates that provide EPA and DHA at intakes of up to 2-4grams a day, taken over a few weeks, can lower various risk factors for heart disease. These effects include an anti-thrombotic effect, lipid (triglyceride) lowering, reduced blood and plasma viscosity, and improvements in endothelial dysfunction.

Omega-3 fatty acids accumulate to a considerable extent in various sites including circulating blood platelets, the heart and serum phospholipid. The accumulation of EPA and DHA in platelets leads to a decrease in platelet adhesiveness, aggregation and an overall reduction in thrombogenicity. Antiatherogenic effects of omega-3 fatty acids have also been shown in animal studies with similar results. Eicosanoid formations are also influenced positively. The eicosanoids formed via oxygenase enzymes acting on AA and EPA includes prostaglandins, leukotrienes and thromboxanes. Both eicosanoid-dependent and eicosanoid-independent processes mediate the benefits of omega-3 fatty acids on cardiovascular disease. For example, the reduced blood platelet reactivity (antithrombotic effect) with increased EPA and DHA intakes involve the reduced formation of the proaggregatory eicosanoid known as thromboxane A2 (TxA2).

B. Curcumin

Curcumin comes from turmeric root and is an ancient spice within the ginger family that is widely used in cooking. Its use dates back to the time of Egyptian pharaohs more than 6,000 years ago. A tall, stemless, perennial plant cultivated throughout the tropics, turmeric is what gives curry its unique color and flavor.

In addition to its kitchen uses, curcumin has been used by traditional medicine for wide variety of ailments including liver disease indigestion, urinary tract diseases, inflamed joints, insect bites, and dermatological disorders Although the chemical structure of curcumin was discovered in 1910, it was only during the mid 1970s and that the potential uses of curcuminoids in medicine began to be extensively studied. It has been shown that curcumin has both strong anti-oxidant and anti-inflammatory properties. It's anti-inflammatory property help to bring curcumin into the forefront of heart disease prevention supplements.

Inflammation results from a complex cascade of chemical reactions in a series of actions triggered by the body's response to tissue damage. This damage may be caused by physical traumas including various diseases and surgery. It can also come from chronic minute free radical damage to endothelial wall over time. Curcuminoids prevent the synthesis of several inflammatory prostaglandins and leukotrienes. Curcuminoids inhibit several enzymes that participate in the production of inflammatory metabolites in the body. **The natural anti-inflammatory activity of curcuminoids is comparable in strength to steroidal drugs as well as nonsteroidal anti-inflammatory drugs as indomethacin and phenylbutazone, which have dangerous side effects.**

In a double blind, controlled study, three groups of patients received curcumin (400 mg), the anti-inflammatory prescription drug phenylbutazone (100 mg), or a placebo three times daily for five consecutive days after surgery for either a hernia condition or an accumulation of fluid in the scrotum. The results show that curcumin was just as effective as phenylbutazone in reducing post-operative inflammation.

Inflammation is known to be associated with increased levels of lipid peroxides and free radicals, which are generated by the liver as well as by inflamed tissues in the body. Animals fed curcumin showed decreased levels of lipid peroxides and subsequent reduction in the processes of inflammation. In one study, curcumin was shown to be eight times more powerful that vitamin E in preventing lipid peroxidation. With decreasing oxidation of the endothelium, more nitric oxide is produced and the arterial stiffness is lessened.

Curcumin has a similar anti-inflammatory action to aspirin. However, unlike aspirin curcumin inhibits the production of inflammatory prostaglandins. It does not affect the synthesis of prostacyclin, an important factor in preventing vascular thrombosis. Compared to drugs, curcumin may therefore be preferable for patients who are prone to vascular thrombosis and require anti-inflammatory and/or anti-arthritic therapy.

Dosage: 50-200 mg. Since curcumin also lowers cholesterol levels by increasing the flow of bile out of the liver, those with biliary tract obstruction should not use curcumin. **Always take curcumin with food.**

C. Bromelain

Discovered in 1957, bromelain is the name of a group of protein-digesting, or proteolytic enzymes that are found in the pineapple plant. It is usually distinguished either as the fruit bromelain or stem bromelain, depending on the source. All commercially available bromelain comes from the stem. Bromelain is a natural blood thinner and an anti-inflammatory agent. It works by breaking down

fibrin, a blood clotting protein that can prevent healthy circulation and tissues from draining properly. Bromelain also blocks the production of compounds that cause pain and swelling.

Bromelain, when taken orally, is absorbed through the gastro-intestinal tract, with up to 40% absorption. Because it comes from a natural source, a variety of destinations have been used to indicate the potency and activity of this compound. Research studies vary in destinations utilized. The most common unit includes RORER units (RU), gelatin dissolving units (GDU), and milk clotting units (MCU). One gram of bromelain standardized to 2000MCU is the equivalent of 1g of 200GDU of activity or 8g of 100,000RU of activity. Bromelain's cardio benefit properties were first discovered in 1972. It was found that it has the ability to prevent aggregation of blood platelets. In a study, bromelain was administered to 20 volunteers with a history of heart attack or stroke and have a high platelet aggregation values. Bromelain was shown to decrease blood aggregation in 17 of the subjects and normalize values in 8 of the 9 subjects who previously had high aggregation values.

Bromelain is an effective fibrinolytic agent. In high doses, there is a correspondent reduction in the serum fibrinogen level shown in rats, with both prothrombin time (PT) and activated partial thromboplastin time (APTT) markedly prolonged. With the presence of bromelain, the conversion of plasminogens to plasma is enhanced. The spread of the coagulation process is limited due to fibrin degradation. In addition to the platelet pathway, bromelain also has direct as well as indirect action involving other enzyme systems and exerts its anti-inflammatory effects. Experimental studies using bromelain has shown its ability suppress inflammation is similar to that of prednisone. This is due to its ability to selectively modulate the biosynthesis of thromboxanes and prostacyclin. These 2 groups of prostaglandins with opposing actions ultimately influence the activation of cyclic-3,5-adenosine (cAMP), an important cell growth modulating compound.

Dosage: 1,000 to 6,000 mg with potency of 3,000 GDU/gram.

7. Triglyceride

Of the four commonly measured lipid markers (total cholesterol, HDL cholesterol, LDL cholesterol, and triglyceride)**, triglyceride is the most under-appreciated and perhaps the most important.** Reason – we don't know enough about triglyceride metabolism within the body.

Triglycerides are etherified fatty oils that form the core of chylomicrons and VLDL cholesterol. Triglycerides and cholesterol both measure the total amount of lipoproteins in the serum. The associated cardiovascular disease risk prediction offered by triglycerides and cholesterol by themselves is 44%, but when coupled with low Vitamin A and E, looking at the ratio of (cholesterol + triglycerides)/ (Vitamin A & E), the risk predictive power goes to 85% accuracy.

A diet high in saturated fats, such as red meat and a diet high in simple carbohydrates and starchy food (such as sugar, rice, and wheat respectively) raise serum triglyceride drastically. Only 20% of the ingested sugar load can be burned or stored as glycogen at any one meal. The remainder 80% will be converted to triglyceride that can contribute to the build-up of acidity, or stored as fat deposits. **(Sam Bock's Note: This rule can not be applied to everyone. Certain people who use very high amounts of energy, like athletes, require higher levels of carbohydrate.)**

Elevated blood levels of triglycerides, but not cholesterol, have been associated with an impaired fibrinolytic system, leading to atherothrombotic stroke and transient ischemic attacks. It is a powerful predictor of myocardial infarction.

The role of triglyceride has is now only being studied in depth. It is clear that triglyceride is in fact the key link that connects carbohydrates to obesity, and not dietary fats or dietary cholesterol. The dominant cause of high triglyceride is high carbohydrates and not fats. In other words**, a high triglyceride level is almost synonymous to a high carbohydrate diet and not a high fatty diet.**

Since triglyceride elevation is almost universally related to dietary intake of sugar (including grains), high triglycerides is one of the most easy and straightforward problems to correct with proper diet alone. The decline is dramatic and in a matter of weeks if the proper low glycemic, low grain anti-aging diet is followed.

While a normal triglyceride level can be up to 160mg/dl, the appropriate goal for anyone serious about optimum health should target the triglyceride to be no higher than 100 mg/dl. A triglyceride count of 100 or more increased the relative risk of a new cardiovascular event by 50% and reduced the chance of surviving a subsequent heart attack. **Medications are available to lower triglyceride level, but this is seldom necessary as long as a strict no grain diet is adhered to. (Sam Bock's Note: I would argue a low grain diet is adequate for certain people as well. Most people who are overweight are consuming too much carbohydrate and/or alcohol.)**

Start with eliminating all grain products from the evening meal. This includes wheat, rye, barley, potato, bread, and rice. It is usually difficult in the beginning and carbohydrate cravings may be experienced. This is quite common because the body is already addicted after years of taking in grains. If this happens, cut back by only 30 %for 60 days and allow your body to have a transition. If you feel hungry 1-2 hours after a meal, eat a handful of raw nuts such as almonds or walnut that has been pre-soaked for at least 6 hours in room temperature water. **(Sam Bock's Note: People with highly active mental or physical activity need some complex carbohydrate the night before to adequately replenish glycogen stores in the liver and muscles.)**

As the body slowly gets used to the reduced grains intake at dinner, also reduce grains intake at lunch. Substitute with more above the ground vegetables, eggs (raw is best, and try not to cook the yolk too well), and unroasted nuts. Oils are acceptable as long they have not been exposed to high heat. Use virgin olive oil for salads and light stir fry, butter for high heat frying, and coconut oil for deep-frying (which should be kept to a minimum). As usual, no desserts after dinner, and reduce snacks before bedtime. All refined carbohydrates such as cookies, ice cream, and chips should be avoided. Follow the above, and the triglycerides level will come down drastically in a matter of weeks. **As the triglycerides normalize, the total cholesterol will reduce automatically, and the total cholesterol to HDL cholesterol ratio will automatically improve.**

For those unable to follow no grain diet, taking a natural compound called panthethine at 600-1200 mg a day will effectively lower triglyceride as well without any side effects. Other nutritional supplementation that can help lowering triglyceride includes L-carnitine (500-3,000mg), chromium polynicotinate (400 to 1,200 mcg), venadyl sulfate (15-30mg), EPA/DHA (500 –5,000 mg)

8. Total cholesterol / HDL Cholesterol ratio.

Cholesterol is a key macronutrient the body cannot do without. It is a precursor to all the steroid hormones in our body, including pregnenolone, DHEA, estrogen, progesterone, testosterone, and cortisol. Too low a total cholesterol level (under 150mg/dl) have been associated with cancer and brain function impairment. The ideal total cholesterol level should be around 200 mg/dl.

HDL is the "good" cholesterol. It is a carrier of "bad" LDL and oxidized-LDL cholesterol from the blood stream back to the liver. The higher the HDL level, the better. It is best to have HDL level over 45 mg/dl. Anything under 30 mg/dl is considered a risk factor by itself. Taking nutrients such as fish oil can increase HDL. Exercise has shown to increase HDL as well. It is not unusual for

those in good health with HDL level of close to 100 mg/dl.
Total cholesterol in and of itself alone as rudimentary tool in cardiovascular health predictive value, and HDL in and of itself is a reasonable marker. **Taken together as a ratio, their predictive value increases significantly.** In fact, total cholesterol of over 200 mg/dl, as long as it is accompanied with high HDL cholesterol with resulting low total cholesterol to HDL cholesterol ratio of less than 3.5, requires no therapeutic intervention at all.

The ideal Total cholesterol / HDL cholesterol ratio should be 3.5 or less, and preferably under 2.5.

9.LDL cholesterol

Low-density lipoprotein (LDL) is the major cholesterol carrier in the blood. If too much LDL cholesterol circulates in the blood, it can get oxidized. It is the oxidized form of this that triggers a series of inflammatory reaction in the blood stream, providing a trigger for heart attack and stroke. It is therefore also called the “bad” cholesterol for a good reason. Oxidized LDL slowly builds up in the walls of the arteries feeding the heart and brain. Together with other substances it can form plaque.

A high level of LDL cholesterol (160 mg/dl and above) reflects an increased risk of heart disease. If you have heart disease, your LDL cholesterol should be less than 100 mg/dl.

One would think that its measurement in the blood should be highly complex. In reality, LDL is not even measured in the traditional lipid panel blood test. Out of the five tradition markers reported in the lipid panel, **LDL is the only marker that is a calculated number and not a measured number.**

Here is the formula:

LDL cholesterol = total cholesterol – HDL cholesterol – (Triglyceride /5).

You can accurately decide the LDL cholesterol level as long as the total cholesterol, HDL cholesterol and triglyceride level is available. However, **if the triglyceride level exceeds 350 mg/dl, the total LDL level will not be accurate** based on the calculation and therefore cannot be relied upon. In this case, the actual measured LDL level should be obtained from the laboratory.

The single focus on LDL lowering has been a pharmaceutical industry darling for the past 20 years, and for good reasons. Worldwide sale of these drugs continues to climb at a record pace. **There is little doubt that drugs can reduce LDL cholesterol aggressively.** These drugs are the synthetically derived HMG-CoA reductase inhibitors such as lovastatin, pravastatin, and simvastatin. They are collectively called "statin" drugs. By inhibiting the production of HMG-CoA reductase, cholesterol production in the liver is reduced. **Based on the latest “scientific” recommendation to bring down the blood LDL cholesterol level to 70 mg/dl, 40 million Americans will qualify to enter this drug based cholesterol lowering program. In America alone, over 40 million prescriptions were written yearly for cholesterol lowering medications. It is estimated that in the coming years, 50% of American adults will be on this serious drug.**

While statin drugs are effective in lowering LDL cholesterol, they have serious side effects.
In August 2001, however, German Pharmaceutical giant Bayer AG withdrew the cholesterol-lowering statin drug Baycol from the market because it was linked to 31 deaths. Moreover, deaths occurred at the manufacturer's recommended initial dose (0.4 mg/day) as well as at the highest dose (0.8 mg/day). The majority of deaths occurred in elderly patients and more often in women. Statin drugs can cause severe muscle weakness and pain even at low doses. Using the proper dosage is clearly an important if not critical part any drug based lipid-lowering program.

Recent studies have also shown that high dose (80 mg) of a popular statin drug called Zocor does no better than low dose (40mg) in the prevention of heart attack in high risk patients.

There are other statin drugs on the market, such as Lipitor. Like Baycol, these drugs are linked to the same rare muscle weakness, known as myositis, which occurs in about 1 in 1,000 statin users. Myositis occasionally progresses to rhabdomyosis -- a complete breakdown of muscle cells that can lead to kidney failure and death. Statin drugs also cause cognitive impairment and memory loss. It has been well known that **these drugs routinely cause cancer in laboratory animals**. Some experts believe that pravastatin (Pravachol) and fluvastatin (Lescol) may have less potential for these deadly drug interactions. The data at this time is not sufficient to declare one statin drug safer or more dangerous than the others. It will be years before we know the full side effects of statin drugs.

Statin drugs also inhibits the intrinsic biosynthesis of Coenzyme Q10 (CoQ10), a central compound in the mitochondrial respiratory chain. CoQ10 is indispensable for optimum cardiac function. Reduction of CoQ10 constitutes new risk of cardiac disease, especially for those whose cardiac function is already compromised, such as those with congestive heart failure or cardiomyopathy.

While cholesterol-lowering drugs may lead to fewer heart attacks, the mechanism of action may not be related to a lowered blood cholesterol level only. **Statin drugs have been shown to reduce inflammatory response in the endothelium. It may well be that reduction accounts for the cardiac benefit effect**. The suppression of cholesterol manufacturing in the liver leading to cholesterol lowering levels may be a less important and a secondary benefit. There is also a desirable effect of raising nitric oxide levels. **It is interesting to note that there are natural compounds that have anti-inflammatory and raising nitric oxide level properties without side effects.**

The optimum level of LDL is under 100 mg/dl, and over 160 mg/dl is considered high. While LDL does have predictive value in terms of cardiovascular disease risk, it should, like others, be view as part of an overall picture and not a stand-alone key indicator. This has not been the case, sad to say.

It is important to note that as the endothelium heals, the LDL level will naturally normalized without the use of drugs. Because endothelium healing takes some time, **immediate drop in LDL level will not and should not be expected.** For those requiring immediate normalization without drugs, the following should be considered: : panthethine (300-900 mg), panthothenic acid (600-1,500 mg), chromium polynicotinate (300 to 600 mcg), ascorbic acid (1000 to 3000 mg), guccolipid (50-200 mg) and polycosinol (5-20 mg).

10.Total cholesterol

Thanks to mass-market commercialization, total cholesterol testing is now easily and widely available. A simple pinprick and a drop of blood on a test strip can offer almost instant results in a matter of minutes.

It is important to note that the total cholesterol is reported based on the following formula in the laboratory:

Total cholesterol = HDL cholesterol + LDL Cholesterol + (triglyceride / 5).

Looking at the formula, **one can easily see that if LDL, HDL or triglyceride is high, then the total cholesterol level has to be high.**

If the total cholesterol is high and is due to high HDL cholesterol, there is no cause for alarm. Any attempt to lower total cholesterol in such case is in fact unwarranted. **HDL cholesterol should be as high as possible.**

If the total cholesterol level is high primarily due to a high LDL or triglyceride level, then a cholesterol-lowering program should be considered. However, the therapeutic pathway to lowering LDL (with statin drugs or nutritional supplementation) is different from that of triglyceride lowering (by diet, drugs, and nutritional supplements). It is imperative that a critical distinction be made to determine if the root cause of the high cholesterol is due to high LDL or high triglyceride prior to initiation to therapeutic measures.

Specifically, if the high total cholesterol is due to a high triglyceride level, then a no grain dietary approach is best, and using drugs to normalize triglyceride without dietary change is a band-aid approach. A no grain diet will be able to universally lower triglyceride level unless it is a familial condition. Many well intentioned but misguided physicians embark on a program of cholesterol reduction only to find failure at the end of the tunnel. Patients are subjected to ever-higher doses of statin drugs unnecessarily when all it needs is simple dietary change if the main cause of high cholesterol is due to triglyceride overload.

Traditionally, a total cholesterol value of less than 200 mg/dl is considered desirable, while the value of over 240 mg/dl is considered high. By now it should be obvious that **simply looking at the total cholesterol alone without considering HDL, LDL, or triglyceride will not give a true picture and is obviously incomplete. In this respect, it can be seen that the total cholesterol number on its own is of little significant clinical value.**

Summary

Modern science has ushered in a series of advanced markers of cardiovascular health that only 20 years ago was not available. The traditional dependency on cholesterol as the key marker needs to be downgraded. **Far more sensitive markers including Lp(a), homocysteine, C reactive protein, arterial stiffness, and fibrinogen levels are easily obtained, and reference ranges have been well established. Currently, there are no effective drug base programs to normalize these markers, and the use of these markers is therefore not widespread.**

The use of natural nutritional supplementation to normalize these markers have been well studied and their effectiveness not in doubt. They should represent the first line defense for those who are at risk or have damaged cardiovascular system. Optimization with a complete nutritional program focused on the heart will not only reduce risk, but in fact in many cases, can reverse existing damage without the side effects often seen by medications.

For optimum heart disease prevention, the following basic comprehensive nutritional cocktail should be considered and taken on a daily basis. There is no one nutrient that is more important than others, because each has a part to play and is important is its own right. Do not simply pick and choose.

The advantage of having a blended nutritional cocktail is that a much lower dose of each nutrient is required due to their combined synergistic effect without sacrificing therapeutic efficacy. At the same time, all the key cardiovascular pathway markers are covered. Because endothelium healing takes time, patience is required. **While some people notice a significant improvement in heart health in as little as a few weeks, expect 3 to 6 months for cellular nutrition to do its work is best. The key is to take the entire cocktail blend in proper dosage for long enough time to allow the body to heal itself.** Because each person is different and the degree of existing damage varies, be prepared to allow up to 6 –12 months in selected cases. The key to apply the right dose, and consulting a health care professional experienced in this area is highly recommended.

(Sam Bock's Note: While I agree with Dr. Lam that the following nutrients are important for good cardiovascular health, many of the issues discussed in the paper above must be considered when considering any of the nutrients listed below.

Alpha Lipoic Acid –75 mg (Sam Bock's Note: ALA should be taken in the R-ALA form, the one produced and used by the body. Of the two isomers of lipoic acid present in conventional supplements, the enantiomer which is made by living things for their use – the natural form of lipoic acid – is the "R(+)-enantiomer," or " R(+)-lipoic acid." "S(-)-lipoic acid" is a purely artificial molecule: it does not exist in nature but is produced as a by-product in the normal method of producing commercial lipoic acid.[251]**)**
Coenzyme Q10 –10 mg (as long as enhancing agents such as peperine is included)
Curcumin – 20 mg
Folic Acid – 150 mcg
Fish Oil – 500 mg (Sam Bock's Note: Even pharmaceutical grade fish oils usually contain higher levels of mercury that will be further concentrated in your body due to biomagnification (as discussed above under "Fish Oil". I advise taking blends of organic flax, borage, pumpkin and safflower oils, that are almost mercury free, and that are converted into the super-polyunsaturated fatty acids in your body. If metabolic testing after 3-6 months usage shows you to be low in the super-polyunsaturated fatty acids, consider taking a pharmaceutical grade supplement, such as that developed By Dr. Michael Murray, N.D. and manufactured by Natural Factors.)
Bromelain - 1000 mg (3,000 GDU /gram)
Citrus Bioflavonoids - 30 –100 mg
Nattokinase – 25 mg (20,000 FU/gram)
Magnesium - 90 mg (Sam Bock's Note: needs to be in bio-available form such as asporotate or malate. Also requires Vitamin B6 for proper metabolism. Lack of B6 can cause disturbed internal magnesium/calcium balance.)
L-arginine - 600 mg
L- carnitine - 100 mg
L-lysine - 300 mg
L- proline -15 mg
Vitamin B5 (calcium pantothenate) - 70 mg
Vitamin C including ascobyl palmitate- 500 mg
Vitamin E - 75 I.U.
(Sam Bock's Note: Vitamin B3, as Niacin, along with Vitamin C is very important for lowering LDL, although Niacin causes flushing in many people in doses over 15-25mgs and must be taken several times a day to avoid that temporary sensation. Another common form of B3, called niacinamide will not lower cholesterol.)

Other nutrients that can be helpful include hawthorne, n-acetyl cysteine, pine bark extract, ornithine, glutamine, malic acid, citrus bioflavonoids, peperine extract.

If there are significant cardiac health challenges such as high blood pressure, calcium plaques, or arrhythmias are present, the dosage should be increased substantially by up to 5 to 20 times of each nutrient, depending on the situation.

About The Author

Michael Lam, M.D., M.P.H., A.B.A.A.M. is a specialist in Preventive and Anti-Aging Medicine. He is currently the Director of Medical Education at the Academy of Anti-Aging Research, U.S.A. He received his Bachelor of Science degree from Oregon State University, and his Doctor of Medicine degree from Loma Linda University School of Medicine, California. He also holds a Masters of Public Health degree and is Board Certification in Anti-aging Medicine by the American Board of Anti-Aging Medicine. Dr. Lam pioneered the formulation of the three clinical phases of aging as well as the concept of diagnosis and treatment of sub-clinical age related degenerative diseases to deter the aging process. Dr. Lam has been published extensively in this field. He is the author of

The Five Proven Secrets to Longevity (available on-line). He also serves as editor of the *Journal of Anti-Aging Research*.

For More Information

For the latest anti-aging related health issues, visit Dr. Lam at **www.LamMD.com**. Feel free to email Dr. Lam at dr@LamMD.com if you have any questions.

Reprint Information

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For Section On ***Understanding Arrhythmias,*** scroll down ½ page.

Appendix 9B: Understanding Arrhythmias: How They Can Be Treated with Diet & Exercise

The Magnesium Report
Clinical, Research, and Laboratory News for Cardiologists, December 1999,
http://www.mgwater.com/arr.shtml

Oral Magnesium for Cardiac Arrhythmias: Current Clinical Perspective

EZRA A. AMSTERDAM, MD

The relationship between magnesium and the heart—specifically, the influence of low levels of magnesium on cardiac rhythm—has been studied for more than 60 years. Magnesium has an essential role in normal cardiac electrophysiology, and inadequate concentrations of this cation contribute to a variety of cardiac arrhythmias. Most important among these are ventricular tachycardia (VT), ventricular fibrillation (VF), long QT and torsades de pointes, and atrial and ventricular premature beats (Table 1), all factors in sudden cardiac death. Magnesium deficit in the setting of congestive heart failure (CHF), which affects some 4 million Americans, and in the setting of hypertension, which affects more than 30 million, is particularly important and worrisome.

Table 1. Consequences of Magnesium Deficiency

Cardiac	Central Nervous System	Metabolic	Neuromuscular
Arrhythmias, especially	Agitation	Hypocalcemia	Chvostek's sign
• Ventricular tachycardia	Depression	Hypokalemia	Dysphagia
• Ventricular fibrillation	Nystagmus		Fatigue
• Long QT and torsades de pointes	Psychosis		Muscle fasciculation
• Atrial premature beats	Seizure		Tremors
• Ventricular premature beats			Trousseau's sign
Electrocardiographic changes			Weakness

Adapted with permission from Seelig M. Cardiovascular consequences of magnesium deficiency and loss: pathogenesis, prevalence and manifestations—magnesium and chloride loss in refractory potassium repletion. *Am J Cardiol.* 1989;63:4G-21G. Copyright 1989, with permission from Excerpta Medica Inc.

Clinical magnesium deficiencies and subclinical magnesium deficits have a number of causes (Table 2) and appear to promote cardiac electrical instability by affecting ion transport across cell membranes.

Table 2. Causes of Magnesium Deficiency
• Aldosteronism
• Diabetes mellitus (poorly controlled)
• Excess alcohol intake
• Gastrointestinal magnesium loss
• Heart failure
• Hepatic failure
• Hyperthyroidism
• Low dietary magnesium
• Renal magnesium-wasting drugs (eg, diuretics, aminoglycosides, antineoplastic agents)
• Respiratory failure
• Toxemic pregnancy

Magnesium and CHF

Between 400 000 and 700 000 patients are newly diagnosed with CHF (congestive heart failure) every year. Patients with CHF have a very high propensity for ventricular arrhythmias, which are an important cause of death in this group. In fact, a majority of patients referred for the treatment of CHF have ambient ventricular arrhythmias, which are frequently linked to hypomagnesemia.

In patients with CHF, magnesium deficiencies may develop as a result of increased urinary excretion, which is a consequence of diuretic and digoxin therapy, and of elevated circulating levels of catecholamines, aldosterone, and vasopressin. Treatment with diuretics, except for those that spare potassium and magnesium, increases urinary magnesium excretion by 25% to 400%.

This increased magnesium loss in patients with CHF impairs their response to digitalis therapy, necessitating as much as twice the amount of digitalis as patients with normal serum magnesium levels to control the ventricular rate in atrial fibrillation. Magnesium administration can reduce the amount of digitalis required in these patients and, thus, decrease the risk of its toxicity.

Clinical Hypomagnesemia

Hypomagnesemia is among the most common electrolyte disorders. Low serum magnesium has been reported in 7% to 11% of hospitalized patients, in approximately 40% of patients with hypokalemia, and in over one third of patients with CHF who use diuretics. Elderly hypertensive men treated with diuretics have a higher frequency of coronary artery disease and arrhythmias than those not treated or receiving nondiuretic therapy for hypertension.

Despite the prevalence and potential seriousness of magnesium deficit, however, the frequent absence of serum magnesium analysis from routine electrolyte panels means the diagnosis is too often delayed— or missed entirely. To complicate matters, even though magnesium status is most commonly determined by measuring serum levels directly, less than 1% of the total body magnesium is in the serum. This is because magnesium is primarily an intracellular ion, and intracellular levels do not correlate with serum levels. Moreover, intracellular levels are difficult and expensive to measure, so it is necessary to suspect magnesium deficit based on clinical settings (eg, diuretic use, poor nutrition, or both).

Role of Magnesium Replacement
Arrhythmias associated with magnesium depletion can often be minimized or eliminated with magnesium replacement. Studies that have examined the effects of pharmacologic doses of intravenous (IV) magnesium on heart rate and rhythm suggest that sudden death from arrhythmias might be reduced by maintaining adequate magnesium levels. Thus, in patients with low magnesium levels, administration of magnesium (parenterally or orally) should be considered.

Parenteral use of magnesium boasts a long history in the treatment of arrhythmias. Candidates for IV magnesium therapy include patients with ventricular tachyarrhythmias that have been incompletely responsive or refractory to conventional antiarrhythmic treatment. These patients may have CHF, idiopathic dilated cardiomyopathy, acute myocardial infarction, or have undergone cardiac surgery. Infusions of magnesium have also been suggested as a preferred therapy for patients with torsades de pointes.

Parenteral Magnesium: The Data. In 1994, Sueta and colleagues reported on 30 arrhythmic patients with symptomatic CHF who were treated acutely with IV magnesium (0.3 mEq/kg as a bolus over 10 minutes followed by a maintenance infusion of 0.08 mEq/kg/h for 24 hours). This therapy doubled serum magnesium concentrations after 24 hours. The treatment also significantly decreased total ventricular ectopy, couplets, and episodes of VT as well as the rate of the most rapid episode of VT.

A prospective evaluation of the electrophysiologic and antiarrhythmic effects of parenteral magnesium was conducted in patients with reentrant paroxysmal supraventricular tachycardia. In this 1990 study, Sager and associates administered IV elemental magnesium and found that tachycardia cycle length increased from 319 ± 39 msec to 348 ± 43 msec, reflecting a decrease in ventricular tachycardia rate.

As far back as the 1930s, arrhythmias precipitated by digitalis were found to be reversed by injections of magnesium. Patients with digitalis-related paroxysmal tachycardia and bidirectional VT had long lasting responses to IV magnesium in a study by Szekely and colleagues in 1951. In a 1984 report of a potentially fatal case of massive digitalis intoxication and recurrent VF, French and associates reported suppression of VF in response to IV magnesium after lidocaine or phenytoin were ineffective.

A diagnosis of hypomagnesemia is not required before parenteral magnesium therapy is given. Magnesium administration can—and often should—be considered for patients with symptomatic or life-threatening arrhythmias even when serum magnesium levels are normal. In patients with apparently normal serum digoxin and magnesium levels but low lymphocyte levels of magnesium and potassium, VT responded to parenteral magnesium therapy, as reported by Cohen and associates in 1993.

Oral Magnesium: Clinical Studies. **Investigations have shown that the use of oral magnesium may decrease the risk of arrhythmias associated with cardiac disease and medication use. For example:**

• In 1978, Davis and coworkers administered oral magnesium tablets to patients with long QT (LQT). Subjects experienced statistically significant declines in QTc and QUc intervals, as well as normalization of ST-segment and T-wave abnormalities.

• In 1993, Bashir and colleagues studied patients with stable CHF secondary to coronary artery disease who were taking long-term loop diuretics. Oral magnesium markedly decreased the

incidence of asymptomatic ventricular arrhythmias. The frequency of ventricular couplets declined by 52%, and nonsustained VT episodes declined by 24%.

• In 1981, in a controlled study by Krasner and associates, patients scheduled for mitral valve replacement received either oral magnesium or placebo before surgery. Effects on QTc intervals became significant after 4 days of oral magnesium supplementation, and only patients receiving placebo developed LQT and arrhythmias postoperatively.

Magnesium Plus Potassium. Because both magnesium and potassium play roles in preserving electrical stability of the heart, researchers have studied the effect of increasing the oral intake of both electrolytes.

• A 1989 Finnish study by Kohvakka and colleagues examined the effects of magnesium and potassium on hydrochlorothiazide treated patients with chronic compensated CHF. Patients received either an oral potassium supplement or an oral magnesium-potassium combination in a double-blind, crossover protocol. Potassium chloride alone did not correct hypokalemia. Treatment with the combination of magnesium and potassium increased serum concentrations of both ions significantly; this trend continued (although to a lesser degree) during 4 weeks of observation.

• A 1997 study by Zehender and associates evaluated oral magnesium and potassium supplements in patients with stable, frequent ventricular arrhythmias to determine the potential antiarrhythmic effects of increasing the daily recommended minimal dietary intake of magnesium and potassium by 50%. Compared to placebo pretreatment, 3 weeks of supplementation with oral magnesium (6 mmol/d) and potassium (12 mmol/d) produced a median 17.4% decline in premature beats. The suppression rate was 2.4 times greater in the treatment phase compared to placebo.

The investigators concluded that the simplicity, cost-effectiveness, and safety of increasing the daily intake of magnesium and potassium salts suggest that such supplementation is a first-line option for treating patients with frequent but not life-threatening ventricular tachyarrhythmias.

Oral Magnesium Recommendations

Magnesium can be consumed in a number of common foods. Legumes and whole grains are excellent sources of magnesium, as are green vegetables, nuts, shellfish, and dried fruit (Table 3).

Table 3. Magnesium-Rich Foods

Food	Magnesium Content (mg%)
Whole grains and grain products	60-420
Shellfish	34-414
Nuts	132-411
Cocoa and chocolate (bitter and sweet)	107-292
Legumes	113-255
Dried fruit	59-92
Dark, leafy green vegetables	53-59

Adapted with permission from Seelig M. Cardiovascular consequences of magnesium deficiency and loss: pathogenesis, prevalence and manifestations—magnesium and chloride loss in refractory potassium repletion. *Am J Cardiol*. 1989;63:4G-21G. Copyright 1989, with permission from Excerpta Medica Inc.

Foods particularly rich in magnesium, however, are not major components in the diets of many people. In fact, surveys indicate that American diets tend to be deficient in magnesium. As a result, patients at risk for arrhythmias may have magnesium needs in excess of their dietary intake. These patients are candidates for oral magnesium supplementation.

The recommended dosage of oral magnesium may vary, depending on the severity of magnesium deficiency and the urgency of the clinical circumstances. When an individual increases his or her calcium consumption, magnesium intake also should be increased. These adjustments are based on the need to maintain a balance between the two cations.

Diarrhea, which has been encountered in about one third of patients started on full supplemental doses of magnesium, usually can be eliminated or mitigated by starting with lower doses and gradually increasing to the level of intestinal intolerance. There is a low incidence of serious adverse effects associated with the use of oral magnesium supplements.

Suggested Reading

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Q&A: Using Oral Mg for Cardiac Arrhythmias

Q: *Do you recommend oral magnesium?*
DR. AMSTERDAM: Yes, usually when a patient is taking a diuretic or if there is high digitalis requirement or digitalis toxicity.

Q: *Which patients at risk for arrhythmias are most likely to benefit?*
DR. AMSTERDAM: In addition to those taking diuretics, patients with documented magnesium deficiency, digitalis-induced arrhythmias, torsades de pointes associated with long QT, and premature ventricular complexes may benefit.

Q: *Is the mechanism known?*
DR. AMSTERDAM: No, but a number of different mechanisms contribute. Magnesium at physiologic concentrations has a rhythm-stabilizing effect on the heart and is important in calcium homeostasis. Hypomagnesemia increases the electrical instability of the heart and results in intracellular hypokalemia. Magnesium prolongs the PR and QRS intervals and shortens the QT interval, which is important in opposing arrhythmias related to long QT syndrome (such as torsades de pointes).

Q: *Do you ever recommend that a patient boost dietary magnesium intake?*
DR. AMSTERDAM: Yes. Good dietary sources are legumes—peas and beans such as pinto, soy, garbanzo, kidney, lima, and lentil. Spinach, kale, collard greens, and mustard greens are high in magnesium. Oatmeal, brown rice, wheat germ, and whole wheat are also helpful. Many patients still need oral magnesium supplements, though.

Contents

Function Of The Heart During Atrial Fibrillation

Much of the material that follows below was souced from Medinet.com

During atrial fibrillation (AF), electrical discharges are not generated solely by the SA node. Instead, electrical discharges come from other parts of the atria. These abnormal discharges are rapid and irregular and may exceed 350 discharges per minute. The rapid and irregular discharges cause ineffective contractions of the atria. In fact, the atria quiver rather than beat as a unit. This reduces the ability of the atria to pump blood into the ventricles.

The rapid and irregular electrical discharges from the atria then pass through the AV node and into the ventricles, causing the ventricles to contract irregularly and (usually) rapidly. The contractions of the ventricles may average 150/minute, much slower than the rate in the atria. (The ventricles are unable to contract at 350/minute.) Even at an average rate of 150/minute, the ventricles may not have enough time to fill maximally with blood before the next contraction, particularly without the normal contraction of the atria. Thus, AF decreases the amount of blood pumped by the ventricles because of their rapid rate of contraction and the absence of normal atrial contractions.

Heart Rate During Atrial Fibrillation

In a heart that is beating normally, the rate of ventricular contraction is the same as the rate of atrial contraction. In AF, however, the rate of ventricular contraction is less than the rate of atrial contraction. The rate of ventricular contraction in AF is determined by the speed of transmission of the atrial electrical discharges through the AV node. In people with a normal AV node, the rate of ventricular contraction in untreated AF usually ranges from 80 to 180 beats/minute; the higher the transmission, the higher the heart rate.

Some older people have slow transmission through the AV node due to disease within the AV node. When these people develop AF, their heart rates remain normal or slower than normal. As disease in the AV node advances, these people can even develop an excessively slow heart rate and require a permanent pacemaker to increase the rate of ventricular contractions.

The progression of atrial fibrillation varies among individuals. Initial episodes of atrial fibrillation are generally symptomatic, intermittent paroxysmal episodes. Some people experience recurring episodes of atrial fibrillation that progress to a chronic state of continuous fibrillation.

Although not immediately life threatening, atrial fibrillation may cause up to a 30% reduction in cardiac output resulting in shortness of breath, fatigue and reduced exercise capacity and a reduction in cerebral blood flow during the fibrillation episode, resulting in fainting and fatigue[252].

Ventricular rates can also rise dangerously high when the chaotic signals of the atria are conducted to these lower chambers of the heart. More seriously, since the atria provide minimal pumping function during atrial fibrillation, blood pools in the chambers, which can lead to the formation of blood clots. Blood clots in the left atrium can dislodge and travel to the brain resulting in stroke.

Other Atrial Arrhythmias

Examples of atrial tachycardias include atrial fibrillation (discussed above), atrial flutter, and paroxysmal atrial tachycardia (PAT). These arrhythmias occur because of electrical disturbances in the atria and/or the AV node, leading to fast heartbeats.

Atrial flutter is a more regular version of atrial fibrillation. Conditions that cause atrial fibrillation can also cause atrial flutter. Treatment of atrial flutter and atrial fibrillation are also similar.

Paroxysmal atrial tachycardia (PAT) represent bouts of rapid, regular heart beating originating in the atrium. Patients with PAT are believed to have abnormalities in the AV node "relay station" that lead to rapid firing of the electrical impulses from the atrium which bypass the AV node under certain conditions. These conditions include alcohol excess, stress, caffeine, overactive thyroid or excessive thyroid hormone intake, and certain drugs. PAT is an example of an arrhythmia where the abnormality is in the electrical system of the heart, while the heart muscle and valves may be normal.

Ventricular Arrhythmias

Ventricular arrhythmias are rapid arrhythmias that originate in the lower chambers of the heart (the ventricles). Ventricular arrhythmias include ventricular tachycardia and ventricular fibrillation. Ventricular tachycardia is a rapid regular arrhythmia which originates from an area of the ventricle. Ventricular fibrillation is an irregular arrhythmia which is a result of multiple rapid and chaotic electrical signals firing from many different areas in the ventricles.

Ventricular tachycardias and fibrillation are life threatening arrhythmias most commonly associated with heart attacks or scarring of the heart muscle from previous heart attack. Less common causes of ventricular arrhythmias include severe heart muscle failure (cardiomyopathy), medication toxicity (such as digoxin toxicity), medication side effects, and blood electrolyte disturbances (such as low potassium level). Again, I would argue that many of these problem are probably a result of intracellular electrolyte imbalance that is being missed by traditional blood work. Ironically, some medications used in treating heart arrhythmias can cause ventricular tachycardias.

Bradycardias

Diseases of the SA node, the AV node, and the conduction system in the ventricles can lead to slow arrhythmias (bradycardias). Calcium channel blockers, such as verapamil

(CALAN), beta-blockers, such as propanolol (INDERAL), and digoxin (LANOXIN) can also cause bradycardias.

These medications can also seriously aggravate bradycardias in patients with existing diseases of the SA node, AV node and other parts of the conduction system. For further information, please visit web sites discussing LANOXIN, INDERAL, and CALAN. Even though some patients experience no ill effects from bradycardias, serious bradycardias can lead to low blood pressure (shock), and passing out (syncope).

Premature Contractions

Early heartbeats that don't originate from the SA node pacemaker are called premature contractions. Premature atrial contractions (PACs) and premature ventricular contractions (PVCs) can be caused by stress, caffeine, cigarette smoking, and excessive alcohol intake. Generally, PACs and PVCs are not associated with significant heart disease.

Sinus Tachycardia

Tachycardia occurring because of rapid firing by the SA node is called sinus tachycardia. Sinus tachycardia is usually a rapid contraction of a normal heart responding to a condition or disease state.

Sinus tachycardias can cause palpitations. Causes of sinus tachycardia include pain, fever, excessive thyroid hormone, exertion, excitement, low blood oxygen level (hypoxia), caffeine, and drugs such as cocaine and amphetamines. Under these circumstances, sinus tachycardia represent "appropriate" responses of the heart to stress and stimulation, and do not reflect underlying diseases of the heart muscle, heart valves and electrical conduction system.

In a more serious case I saw (which would result in atrial fibrillation as discussed above), this was due to a lack of oxygen transport capacity in the blood and tissues (due to an essential fatty acid deficiency), poor physical conditioning, and possibly a lack of magnesium for proper electrical function.

When exercising the individual would push himself too far, overly depleting his venous blood of oxygen, thereby causing the SA node to signal the heart to pump rapidly beyond its capacity. As this person's heart reached beyond it's capacity (about 160 bpm) the heart would suddenly and dramatically loose its ability to pump blood due to the ineffective atrial quivering caused by chaotic conduction of electrical signals through the upper chambers of the heart, as described above.

This would further reduce the flow of oxygen-depleted blood past the SA node, causing the SA node to signal the heart to pump even faster. During this period of ineffective pumping his heart rate would very rapidly sore to 205-215 bpm and stay there for a minute or two. After resting, his heart would finally subside from this dangerous, inefficient state as his returning venous blood gradually recovered enough oxygen to allow the SA node to signal the heart to beat more slowly, allowing his heart's atrial mechanics to return to normal.

This regular and very scary condition was relieved with short-term therapeutic levels of Omega 3 rich flax oil and magnesium supplementation along with gradual increases in exercise over a 6-week period.

In some other patients, however, sinus tachycardia may be a symptom of heart failure or significant heart valve disease.

What Are Symptoms Of Arrhythmia?

Arrhythmias are pattern and/or speed changes from the normal heart rhythm. Some patients are totally unaware of their arrhythmias. Others may report symptoms, such as palpitations, skipping or fluttering sensations, dizziness, fainting, shortness of breath, or chest pain. The latter underlined symptoms are more dangerous, and are evidence of compromised pumping movements, reduced blood flow, and ultimately reduced oxygen transport.

In both tachycardias and bradycardias, lack of blood flow to the brain, the coronary arteries, or the rest of the body can occur. Lack of blood flow to the brain can cause dizziness or loss of consciousness (syncope). Lack of blood supply to the coronary arteries can cause chest pain or pressure (angina). Inadequate blood supply to the rest of the body can cause weakness and shortness of breath.

What Are The Causes Of Arrhythmias?

In some patients, arrhythmias are caused by diseases of the heart muscle, valves or coronary arteries. In others, arrhythmias can reflect disease of the electrical system of the heart only, while the rest of the heart is healthy. Again, I feel much of such "disease" isn't disease at all, but intracellular mineral imbalance. Other causes of arrhythmias include medications, alcohol excess (which causes a depleting in magnesium when alcohol is metabolized), excessive levels of thyroid hormone, low blood oxygen levels (caused by many various nutritional factors, and/or lack of exercise), stress (again magnesium depleting), and cigarette smoking.

How Are Palpitations Evaluated?

The first step in the evaluation of patients with palpitations is to determine whether their symptoms are due to arrhythmias. Because the treatment of varying types of arrhythmias can differ, it is also important to determine the type of arrhythmias involved. Since arrhythmias can be related to underlying disease of the heart valves, heart muscle, and coronary arteries, tests are often performed to exclude heart abnormalities. Blood tests are also obtained to measure blood sodium, potassium, calcium, magnesium, thyroid hormone levels, and medication levels (such as digoxin levels). As indicated above, blood tests for potassium and magnesium, two of the most important factors affecting all cardio-vascular function, are not of use without corresponding intracellular analysis of tissues, such as HTMA (hair tissue mineral analysis).

Tests for arrhythmias include resting electrocardiogram (EKG), 24-hour rhythm monitoring (Holter), and a treadmill exercise test.

A resting EKG is a short recording of the heart's electrical activity, usually performed in the doctor's office. An EKG is useful only if the arrhythmia causing the palpitations is occurring when the EKG is being recorded. Oftentimes, the resting EKG cannot catch the arrhythmias, and a 24-hour Holter monitor is required. The 24-hour Holter is a cassette tape worn by the patient continuously while carrying out his/her usually activities. The patient simultaneously keeps a diary of palpitations or other symptoms during the recording period. Symptoms of palpitations can later be correlated with the presence or absence of arrhythmias on the Holter tape. If suspected arrhythmias causing palpitations still cannot be captured by the 24-hour Holter, a small patient-activated event monitor is worn by the patient for 1 to 2 weeks. When the patient experiences palpitation, he/she presses a button to record the heart rhythm prior to, during, and after the episode. The recordings can be analyzed by a doctor at a later date.

In some patients, exercise treadmill is used to detect arrhythmias that occur only with exertion. Exercise treadmill is a continuous EKG recording of the heart as the patient performs increasing levels of exercise. In addition to detecting arrhythmias, exercise treadmill is a useful screening test for the presence of narrowed coronary arteries that can limit supply of oxygenated blood to the heart muscle during exercise. For further information, please visit the ANGINA site of MedicineNet.

Echocardiography uses ultrasound waves to obtain images of the heart chambers, valves and surrounding structures. Echocardiography is useful in detecting diseases of the heart valves, such as mitral valve prolapse, mitral stenosis, and aortic stenosis (examples of valve diseases that can cause arrhythmias and palpitations). For further information, please visit the MITRAL VALVE PROLAPSE, and AORTIC STENOSIS sites of MedicineNet.

In patients with arrhythmias associated with significant heart muscle or valve disease, correction of the underlying heart disease is important. Patients with severe aortic stenosis can develop heart failure as well as serious ventricular arrhythmias. Treatment of the aortic stenosis by valve repair surgery (valvuloplasty), and/or by surgical valve replacement can alleviate these problems. For further information, please visit the AORTIC STENOSIS site of MedicineNet.

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Appendix 10: Determining Iron Status

A recent study examined the effects of a six week high-intensity interval training programme, followed by two weeks' recovery, on iron status in trained cyclists.[253] Dietary intake was monitored to ensure that iron intake remained consistent throughout the study, but by the end of week three, haemoglobin, haematocrit and red blood cell count (three different markers of iron status) were all depressed.

Meanwhile, serum ferritin (a blood protein involved with iron storage) decreased significantly by week five and remained depressed even in the recovery phase. Total iron binding capacity (TIBC – a measure of a blood protein that transports iron from the gut to the cells that use it) was significantly increased after three weeks, suggesting low iron stores. The researchers suggested that this reduction could be sufficient over time to have an adverse effect on aerobic cycling performance.

Iron loss as a result of endurance exercise has been confirmed in other studies. For example, a large and comprehensive study examined the effects of different types of exercise on the iron status of 747 athletes divided into three groups (power, mixed and endurance sports) compared with untrained controls.[254] The researchers found that the endurance athletes had reduced levels of haemoglobin and haematocrit which was mainly attributable to exercise-induced plasma volume expansion: in other words, the same amount of iron carrying compounds were present, but diluted in a larger volume of plasma. However, they also found that physical activity of increasing volume and duration led to decreased ferritin (an iron storage protein) levels, which were particularly pronounced in runners. This was probably a result of haemolysis – the breakdown and destruction of red blood cells. Paragon's research indicates that this can be caused by acidosis and mechanical wear and tear, leading to the release and loss of iron.

This effect of endurance training on iron status has been demonstrated even in very young athletes. An eight-month study examined elite swimmers in the 10-12 age bracket and compared them with non-active controls.[255] Although swimming is regarded as a 'non-traumatic' activity, during the competition phase the elite swimmers suffered significant decreases in serum ferritin and iron stores by comparison with the controls.

A True Measure Of Iron Deficiency

At the same time, the swimmers showed significantly higher levels of a new and highly sensitive indicator of tissue iron status known as 'serum transferrin receptor concentration' (STFR). When cells require more iron, they signal this need by increasing the number of transferrin receptors on their surface; a small proportion of these receptors actually come off the cell surface and are carried into the blood stream, where they can be measured. A high serum transferrin receptor concentration is, therefore, related to iron deficiency at a truly fundamental level – within the cells or tissues.

Given that iron availability in foods is frequently poor, that iron is difficult to absorb and that training (especially endurance training) can deplete iron stores, it is hardly surprising

that iron status in athletes has come under scrutiny. In the past, the age-old haemoglobin test was thought to be sufficient to determine an athlete's iron status, the 'normal' range being 12-16 g/dl (grams per decilitre), with anything under 12g/dl signifying iron anaemia. However, more recent research has indicated that you can be quite iron deficient without being diagnosed as anaemic. This is because reduced blood haemoglobin is one of the very final stages in iron deficiency, and a lot of iron-dependent systems can suffer before this final stage is detectable.

For example, a Canadian study found that although 39% of Ontario women had depleted iron when assessed by the more sensitive serum ferritin test, less than one tenth of these were identified as anaemic by the conventional haemoglobin test.[256] Moreover, research increasingly shows that a low iron status without a corresponding low blood haemoglobin level impairs physical performance.

Another study found that women athletes who were not conventionally anaemic but had a mild iron depletion as demonstrated by the serum ferritin test had significantly lower VO2max values than those with no iron depletion.[257] The researchers concluded that this reduction in VO2max was due to lower stored iron rather than reduced blood haemoglobin. They also demonstrated that when these women were given iron supplements, their serum ferritin values and performances improved without any apparent changes in blood haemoglobin.

Another study examined 40 young elite athletes with normal haemoglobin levels but below-average serum ferritin.[258] The athletes were spilt into two groups and randomly assigned to a 12- week treatment with either iron supplements or placebo. Before and after the treatment, aerobic and anaerobic capacity was measured in both groups by means of treadmill tests. At the end of the study period, the iron-supplemented athletes recorded significant increases in VO2max and oxygen consumption by comparison with those on placebo, despite the fact that there were no significant changes in haematological measures.

Such findings are not restricted to endurance activities. A very recent six-week study examined the effects of tissue iron depletion on dynamic knee extensions in young women.[259] The participants, who all had low serum ferritin but normal haemoglobin levels, were treated with either iron or placebo. In the iron-supplemented group, the number of maximal voluntary contractions performed in a subsequent test was significantly higher than in the placebo group. These improvements did not seem to be related to measured changes in iron-status indexes or tissue iron stores. Interestingly, though, serum transferrin receptor concentrations increased significantly in the placebo group, suggesting that they were suffering further iron depletion.

It has long been recognised that iron deficiency serious enough to lead to reduced blood haemoglobin also impairs aerobic performance and reduces VO2max; the function of haemoglobin is, after all, to transport oxygen to the working muscles. But how do more marginal iron deficiencies that are not accompanied by anaemia affect performance?

Although this type of iron deficiency is known to be commonplace in Western societies,[260] there has until recently been a poor understanding of how it impacts on physical performance.

Animal studies have indicated that endurance capacity and the effects of endurance training are diminished when a mild iron deficiency without anaemia exists, and that this probably occurs as a result of diminished concentrations of iron-dependent muscle enzymes and respiratory proteins involved in the biochemical pathways of aerobic metabolism.[261] [262]

However, although many previous human studies have found suggestive relationships between mild iron deficiency without anaemia and reduced aerobic performance, many of these findings have failed to reach statistical significance – ie the results were not sufficiently clear cut to draw reliable conclusions and were probably clouded by the inclusion of subjects with both normal and deficient tissue-iron status.

The problem has been that until recently there has been no definitive test for a real 'tissue iron deficiency'. While measures like serum ferritin, total iron binding capacity (TIBC) and transferrin saturation do give a much clearer picture of an athlete's iron status than a simple blood haemoglobin test, they still don't tell the whole story – only whether an athlete is within certain 'normal' ranges.

They say that every cloud has a silver lining, and it seems that a really definitive test has emerged from the battle to detect erythropoietin (EPO) abuse in athletes. The use of EPO to artificially enhance the red blood cell count (and therefore the blood's oxygen-carrying capacity) in endurance athletes is believed to have become widespread during the mid-to-late 80s; and in the search to come up with a reliable test for possible EPO abuse, a new marker of iron status was identified – serum transferrin receptor concentration (STFR). As we've already seen, STFR is an excellent indicator of tissue iron status because it actually shows how 'hungry' the cells are for iron.

STFR: A Marker Of Iron Status

The use of STFR as a marker of iron status is at the centre of some very new US research, which suggests that tissue iron deficiency without anaemia can not only impair aerobic performance but also blunt the adaptations that occur following aerobic training. In the first study, 41 untrained iron-depleted but non-anaemic women were randomly assigned to receive either a twice daily iron supplement or placebo for six weeks.[263] From week three of the study, all the subjects trained on cycle ergometers five days a week.

As expected, iron supplementation significantly improved several markers of iron status, including serum ferritin, transferrin saturation and serum transferrin receptor (STFR) concentrations, yet this occurred without affecting blood haemoglobin concentrations or haematocrit. And, while the average VO2max and maximal respiratory exchange ratio (a measure of how efficiently oxygen is used in aerobic metabolism) improved in both groups after training, the iron group experienced significantly greater improvements in VO2max.

When the researchers analysed the results for relationships between the iron status markers and the measured improvements, it became apparent that it was the STFR concentrations that held the key. In the women whose STFR levels had been greater than 8mg per litre, taking extra iron produced a significant increase in VO2max above and beyond that produced by training alone; (remember, higher STFR levels indicate that the cells are signalling they need to take up more iron). Conversely, in women with STFR levels below 8mg per litre there were no significant benefits to iron supplementation.

The same researchers followed up with another study designed to investigate the role of tissue iron status in the impairment of endurance adaptation, using STFR as the main marker of tissue iron deficiency.[264] Using a very similar testing protocol, 51 iron-depleted but nonanaemic women were selected and randomly assigned to supplementation with either iron or placebo, undergoing five days a week of training on the cycle ergometer (between 75 and 85% of max heart rate) from week three of the six-week supplementation period. At the end of the study, all of the women completed three consecutive 5k time trials with only a short rest between trials. STFR measurements were taken at the beginning, middle and end of the study.

The researchers were particularly interested to see what differences emerged between women with raised levels of STFR and those without, and also how the former were affected by iron supplementation. The results showed that it was the raised STFR group who benefited from iron supplementation, working at a significantly lower percentage of their maximum work capacity during the first and second 5k bouts (indicating improved aerobic efficiency) and showing the largest overall improvement as a result of the training regime, especially by comparison with raised STFR subjects on placebo.

This placebo group reduced their time trial times by an average of only 36 seconds, compared with 3mins 24secs for the raised STFR/iron supplemented group. Moreover, the raised STFR/placebo group had to work at a higher percentage of their VO2max than the iron group for their relatively negligible improvement. Given that all the women in this study were assessed as iron depleted but non-anaemic, the researchers came to two main conclusions:

Iron depletion as measured by serum ferritin was not a reliable indicator of how the women adapted to training. All the women in the placebo group had depleted serum ferritin, but only those with raised STFR suffered an impaired training response. Moreover, in the iron group extra iron only helped those with raised STFR levels. While iron raised serum ferritin levels, it did not produce any significant performance increase in women whose STFR was already below the 8mg per litre baseline. It appears, therefore, that STFR is a far more reliable measure of a truly 'functional' tissue iron deficiency; iron tissue deficiency not only reduces VO2max but also impairs the body's ability to adapt to an aerobic training load (probably due to a decrease in the iron-containing proteins involved in aerobic energy production), with serious implications for athletes.

In the light of the latest research, maintaining an optimum iron status could be far more important for athletes than has previously been realised, especially given that even a mild

shortfall appears to not only reduce maximum oxygen uptake capacity and aerobic efficiency but also to reduce the body's response to aerobic training. The fact that iron is more difficult to absorb than most other nutrients and that vigorous aerobic training appears to readily deplete tissue iron only serves to underline the extent of the potential problem, especially for young female athletes.

Testing for iron status is also far from straightforward. A low blood haemoglobin (Hb) measurement only appears in the very advanced stages of iron deficiency. It's perfectly possible to have a normal blood Hb level while suffering severe effects from a tissue deficiency. Some athletes and coaches seeking a more reliable method of monitoring iron status have been using a combination of tests on iron storage/transport compounds in the body (see table 1).

Table 1: Current tests for iron status

METHOD	VALUES		
	Normal	Depleted	Anaemic
Haemoglobin	12-16 g/dl		<12g/dl
Serum ferritin	40-160 mcg/l	20 mcg/l	<12 mcg/l
Total iron binding capacity (TIBC)	300-360 mcg/dl	360 mcg/dl	410 mcg/dl
Transferrin saturation	30-50%	<30%	<10%
Haemocrit	37-47%		<37%
Serum transferrin receptor (STFR)*	<8mgs/l	>8mgs/l	

*A new test, which will require further research to determine the ideal values for athletes. Provisional ranges used in scientific studies are shown

However, the latest research suggests that, although better then Hb alone, even these tests are insufficient to assess the real need for iron at the cellular level. For example, a reduced serum ferritin concentration generally indicates depletion of the iron stores; but, as the studies mentioned above showed, a reduced serum ferritin does not necessarily mean that performance will suffer because tissue iron stores may not actually be depleted. Serum ferritin is also what's known as an 'acute phase protein', which means that concentrations are raised during inflammatory conditions. Thus, serum ferritin may be normal (or even raised) in an athlete with such a condition even if he or she is genuinely iron deficient. To determine the real need for iron, a serum transferrin receptor test is the best on offer, although it is relatively new and may not be readily available from your GP.

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Appendix 11: Ninety Percent Reduction in Cancer Mortality after Chelation Therapy With EDTA

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Walter Blumer, M.D. and Elmer Cranton, M.D.

ABSTRACT: Mortality from cancer was reduced 90% during an 18-year follow-up of 59 patients treated with Calcium-EDTA. Only one of 59 treated patients (1.7%) died of cancer while 30 of 172 non treated control subjects (17.6%) died of cancer (P=0.002). Death from artherosclerosis was also reduced. Treated patients had no evidence of cancer at the time of entry into this study. Observations relate only to long-term prevention of death from malignant disease, if chelation therapy is begun before clinical evidence of cancer occurs. Control and treated patients lived in the same neighborhood, adjacent to a heavyily traveled highway in a small Swiss city. Both groups were exposed to the same amount of lead from automobile exhaust, industrial pollution and other carcinogens. Exposure to carcinogens was no greater for the studied population than exists in most other metropolitan areas throughout the world. Statistical analysis showed EDTA chelation therapy to be the only significant difference between controls and treated patients to explain the marked reduction in cancer mortality.

Edta is well recognized as a therapy for lead toxicity. EDTA also removes other toxic heavy metals and nutritional elements such as iron which promote cancer by catalyzing free radical pathology.

Lead from automobile exhausts, petrochemicals form wear of automobile tires, cadmium, and other carcinogens are present in higher concentrations adjacent to heavily traveled automobile highways. These substances cause cancer and potentate other carcinogens.

It was reported in an earlier paper that cancer mortality among 231 adults living along a heavily traveled highway was higher than among persons living in a traffic-free section of the same city[1] Nervous disorders, headaches, fatigue, gastrointestinal disorders, depression, and substance abuse was also observed with higher frequency.[2] It was postulated that lead exposure from automobile exhausts might be one cause of this difference.

Beginning in 1961, a group of 59 patients with such symptoms was treated with parenteral doses of Calcium EDTA. Symptoms improved and urinary delta-amino levulinic acid diminished.[3]

Subsequent to the EDTA chelation therapy, a decrease in cancer mortality was observed. When compared with a control group of untreated patients who did not receive EDTA, many fewer cancer deaths were recorded,[4,5]. The control group was similar to the treated group in all ways except to the EDTA chelation therapy.

The purpose of this present study is to determine more precisely and to statistically analyze the long-term change in cancer mortality after treatment with EDTA.

Statistical Data

A group of 231 adults was studied beginning in late 1958. All resided along the main highway in a small Swiss city with a total population of approximately 3,000. Of these 231 people (105 men and 126 women), 31 persons, (17 men and 14 women) died of malignant tumors during the 18-year observation period (1959-1976). Causes of death included 4 cases of bronchogenic carcinoma, 5 of colon carcinoma, 5 of gastric carcinoma, 2 of beast cancer, 3 of ovarian carcinoma, 1 of pancreatic carcinoma, 2 of pleural endothelioma, and 9 cases of other types of cancer. In all but one case, histopathological diagnosis was confirmed by a hospital pathologist. Twenty-eight of the deceased individuals had lived for 10 or more years directly adjacent to the highway and most were normally present in their homes for 24 hours of every day.

Fifty-nine adult study patient received ten or more injections of 1.9 gm calcium EDTA plus vitamins C and B_1 From 1959 through 1976, only one (1.7%) of patients treated with EDTA died from cancer. In comparison, of 172 untreated control subjects who had not received calcium EDTA, 30 (17.4%) died from cancer. This represents a ten-fold greater incidence of cancer mortality in untreated persons (P=0.002). The two groups were similar in all other respects.

The treated group consisted of 35 women and 24 men. It was initially thought that this higher percentage of women may have included fewer smokers which might partially explain the reduced mortality. Analysis showed that none of the 35 treated women died of cancer. Of 91 untreated women, 14 died of cancer, an incidence of 15%, and all female cancer deaths occurred in nonsmokers.

The treated group did not include a greater proportion of persons who were less exposed to carcinogens in their occupations or who spent more time away from the heavily congested highway during the day. Analysis of occupational data and location during the day showed no differences between the two groups. Housewives, the majority of whom remained at home each day, were represented equally in both groups.

No significant differences existed in age distribution between treated patients and controls. There were no significant socio-economic differences between the treated and the untreated persons. Cancer mortality was independent of monetary income.

Laboratory Analysis

Increased urinary lead excretion after injection of EDTA is a recognized test for lead accumulation in the body.[6] Urinary lead excretion was measured before and after EDTA infusion in 5 patients with atomic absorption spectroscopy,[7] using the method of Roosels.[8] In every case, a substantial increase in lead excretion was measured. Simultaneously, urinary delta-amino levulinic acid (DALA) decreased. DALA was measured in the Central

Laboratories of the University Hospital of Zurich, according to the methods of Doss and Schmidt.[9]

It is emphasized that the population studied and reported on in this paper was not exposed to any more lead or other environmental carcinogens than residents of most metropolitan areas throughout the world.

Traffic flow past residences of the study subjects was 4000 vehicles per day in 1956, increasing to 8000 vehicles per day in 1968. Of those, 7000 were passenger cars and 400 were diesel trucks.

Environmental measurements of pollutants and carcinogens were made in the immediate and surrounding area of this study. Tests were done at the Woods Hole Laboratories, Massachusetts, USA, using ultraviolet spectrophotography, mass-spectrography and chromatography.[10] Soil tests adjacent to the highway where the study population lived showed the presence of polycyclic aromatic hydrocarbons, which are known carcinogens. In more remote sections of the same city, levels of these pollutants were found to be approximately three times lower, inversely correlated with the distance from automobile traffic. Further analyses showed the majority of measured carcinogens to be from automobile pollution. Pollution immediately adjacent to the highway where the study population resided was at or only slightly above permissible levels allowed under public health and environmental regulations in the USA.

Discussion

Following preliminary communication of these data, the committee responsible for the surveillance of air quality in Switzerland scrutinized the results using a different statistical method.[11] They found a higher incidence of death from cancer in the untreated group than in the population of Switzerland as a whole.

The fact that an identical group treated with EDTA experienced a 90% reduction in cancer mortality, as well as a reduction in death from all causes was also confirmed. The fact that the general mortality as well as cancer mortality was lower in treated than untreated individuals was also confirmed by Knutti and Schlatter.[11] Their proposed explanation was that treated patients might possibly have been more health conscious or under better medical care, but this does not seem an adequate explanation of the recorded facts. Residents of less polluted areas experience a lower cancer mortality, despite the same level of medical care.

Evidence presented in this paper indicated that (1) EDTA removes cancer causing or promoting substances, from the body, and (2) those substances are correlated with environmental pollution from vehicular traffic.

The overall reduction of death from all causes and increased longevity I the EDTA treated group shows that chelation therapy also reduces other common causes of mortality such as

artherosclerosis and cardiovascular disease. Except for cancer mortality, exact data are not available for statistical analysis.

As early as 1961, it was reported from animal experiments that intravenous injections of EDTA could slow the growth of experimental carcinoma [12]. A cancer-inhibiting effect has also been demonstrated for other chelating agents, including BAL, cystine, penicillamine and citric acid [13-16]. Many tumor inhibiting medications, including 5-flouracil, possess metal-binding properties. [17]

Lead potentiates the carcinogenicity of aromatic hydrocarbons such as benzopyrene by five fold. 18 areas adjacent to heavily traveled highways are polluted with many other carcinogens, including polycyclic aromatic hydrocarbons, nitrosamines, epoxides, cadmium and asbestos, in addition to inorganic and tetraethyl lead.

Since the data from this study were last reported,[5] new research has linked cancer to free radical pathology. [19-21]. EDTA removes transition elements, such as iron, which accelerate free radical pathology, including cancer. Iron is an essential nutritional element but it is also know to accumulate with age. Catalysis of lipid peroxidation by iron potentiates the cancer promoting substances. EDTA increases the urinary excretion of unbound and freely catalytic iron 10 times more then it does lead. There are many reasons why EDTA chelation therapy could act to prevent cancer.

A recent publication by McDonagh, et al, [22] confirms improvement in a wide variety of symptoms, as first reported in this study population.2 Neurasthenic and nonspecific multi-organ symptoms improve significantly following EDTA chelation therapy, resulting in a marked improvement in the overall quality of life.

Body stores of iron correlate with the risk of cancer[23-25] and artherosclerosis. [26] EDTA removes unbound and potentially toxic iron from the body much more effectively than lead, [21] which may account for the findings in this study.

Large scale, double blind, controlled studies should be undertaken to fully document the many benefits observed in clinical practice following treatment with EDTA. EDTA is an inexpensive and relatively safe substance to administer but the patent has expired and pharmaceutical companies have no incentive to fund such research.

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Appendix 12: The Knowledge Torrent Effect

The Knowledge Torrent Effect:

What it Means for the Development and Commercialization of Science and Technology in the Months and Years Ahead

By Sam Bock, February 2005

We are in the midst of a Knowledge Torrent Effect which, in relative terms, is fast approaching its zenith. Almost the entirety of our scientific knowledge has been accumulated in the last two millennia – most of it in the past 100 years[265].

Humankind's accumulation of knowledge & subsequent progress has always been a derivative of the rate at which one person can communicate with another. A reduced ability to communicate, diminishes any organism's potential to organize and exchange thoughts necessary to learn and improve its position in the world.

Humans first gained the ability to communicate through gestures and a look in the eyes, followed by speech, then writing, and then through the mass distribution of books in schools and libraries. More recently, with the development of electronic and wireless media, the exchange of knowledge and ideas has accelerated at a fantastic pace.

It took from year 1 AD to 1750 to double humankind's scientific knowledge. It doubled again between 1900 and 1950, and again between 1950 and 1960. It quadrupled in the 1970s, and again in the 1980s. It likely increased a staggering tenfold in the `90s. And it's probable that the rate of growth will continue to accelerate in the first ten years of the new millennium[266].

Lets consider what this means. After 3.1 billion years of no scientific knowledge since the origins of life on Earth, very slowly it began to accumulate over the past 2000 years, and then in the last 50 years scientific knowledge has multiplied more than 1600 times over.

However most current models for societies and business were adapted and developed ***in*** slower times, ***for*** slower times. Certain models that became standards for many generations of life, are now increasingly dated. Aspects of various government constitutions are examples that readily come to mind.

The vast majority of modern societies are comprised of successful socio-political and corporate systems that evolved as few as 30, 20 and even 10 years ago, but that are now increasingly dated as well. Recently generated scientific theories and ideas face the same reality check. As do many current theories and perceptions regarding health care.

"Spinning" perception is possible when some, but not all, information regarding a complex issue is released by a influential authority, be it an individual, institution, corporation or

government. Such well organized bodies use strategic advertising and public relations to promote selected data and evidence into accepted public perception.

However, more and more, those with electronic communication are now able to bypass the official spin of governments, corporations and others to get a more complete picture regarding almost any issue – from the treatment of an illness or the effects of a drug, environmental toxin, or emerging technology – to corporate track records and the private lives of politicians. A few strokes of the keyboard allows the modern researcher instant access to documents and information that just a few years ago would have taken years to locate using available research methods.

Government, academic, and corporate institutions once held tight control of most knowledge and its development. This has changed in less than a decade.

Behind this incredible acceleration of knowledge, access to it, and the rapid evolution of technology are many factors – like one known as the Bit Torrent Effect. In 2002, 26 year old Bram Cohen's ingenious programming reorganization allowed massive transfers of data at incredible rates of speed, with no increase in required bandwidth (see below).

There are many other such examples. For instance, entire patent data bases are now available on-line instantly. Just ten years ago reviewing any patent required a trip in person to a country's capital, say Washington D.C. or Ottawa. The multitudes of phenomena such as these are helping to intellectually connect everyone on the planet.

The Internet is allowing a rapidly growing number of users access to this growing common knowledge. More importantly, in effect it's created the world's largest parallel processing supercomputer, ***infinitely*** more powerful than any super-computer developed to date.

This planetary supercomputer consists of 3 primary parts:

1. the internet, (the planetary motherboard)
2. the billions of powerful individual computers connected to it, (a growing number of parallel processors built into that motherboard)
3. and the hundreds of millions of intelligent brains operating the individual machines (a second layer of rational intelligent processors operating in parallel as well.)

The cumulative processing and learning capability of this system is hard to imagine. And it is expanding like a continuously growing computer chip of greater and greater processing power & speed. Each new person that logs on expands the system's cognitive capability.

And powerful search engines allow increasingly rapid sourcing of its information.

The most adept at using the electronic media are young people, the current or future market for most corporations and governments. Older people can stay current with emerging technologies, but must maintain an open-minded youthful exuberance to do so.

Today, in 2005, a more traditional 45+ year old mentality might find this more difficult, as it was born at a time of slower change, and may have grown accustomed to a rate of change synonymous with its earlier formative years.

Those born after 1970, who were only 10 years old or less when computers became common place, are more accustomed to the current pace of development. Each emerging "generation" since then is more so, making the traditional definition of "generation gap" no longer relevant.

Instead, the period of time required for ***knowledge to multiply*** is becoming the critical factor to determining the length of a "knowledge-generation gap". Just 50 years ago that was two human generations, or fifty years – providing lots of time for one to adjust to the changing world. Today it is only months long. In a decade it may be measured in days.

Independent of the above is the individual human's capacity to learn and organize. With each new generation this is growing at a fantastic rate as well. Humans have gone from an organism barely capable of communication to that of modern man in only 150,000 years, or in less than 10,000 generations (assuming and average age of 15 years per generation).

We have advanced from Neanderthal intelligence to modern cognitive power in just 40,000 years, or about 2500 generations, and most of that has occurred within the last 5000 years. The development and accumulation of the vast majority of our modern scientific knowledge over the past 2000 years required just 117 generations, and as cited earlier, about 90% of all humankind's scientific knowledge has been accumulated in the last 10 years, or in about one half of one human generation!

Put in that perspective, it is clear that each new generation, as compared to the one before it, is developing intellectually at a very rapid rate. An understanding of concepts such as Einstein's special and general theories of relativity, only twenty-five years ago considered the privileged domain of just a few, are now widely understood and challenged by many.

Today's newest generations are capable of learning an incredible array of skills at very early ages. Bill Gates is considered one of the first "super-kids", but there are more and more like him everyday, made possible by relatively instant access to the answers to most questions any inquisitive mind might pose. This has dramatically accelerated the development of logical thought streams for any person with access to the system.

And all of this is having profound affects on the way we live and do business.

More than ever investors of capital will have to consider the age of the IP and technology being developed, and the number of years to recoup that investment.

Marketers will not be able to count on spinning less-than-outstanding product results into something more than they really are. And more transparent representation will be necessary to avoid potential litigation. More importantly, marketers will need to quickly master using the internet for marketing and distribution.

An excerpt from Wired.com, Feb 2005: "Bram Cohen is the creator of BitTorrent, one of the most successful peer-to-peer programs ever. BitTorrent lets users quickly upload and download enormous amounts of data, files that are hundreds or thousands of times bigger than a single MP3. Analysts at CacheLogic, an Internet-traffic analysis firm in Cambridge, England, report that *BitTorrent traffic accounts for more than one-third of all data sent across the Internet*.

Cohen showed his code to the world at a hacker conference in 2002, as a free, open source project aimed at geeks who need a cheap way to swap Linux software online. But the real audience turns out to be TV and movie fanatics. It takes hours to download a ripped episode of *Alias* or *Monk* off Kazaa, but BitTorrent can do it in minutes. As a result, more than 20 million people have downloaded the BitTorrent application. If any one of them misses their favorite TV show, no worries. Surely someone has posted it as a "torrent." As for movies, if you can find it at Blockbuster, you can probably find it online somewhere - and use BitTorrent to suck it down…

"All hell's about to break loose," says Brad Burnham, a venture capitalist with Union Square Ventures in Manhattan, which studies the impact of new technology on traditional media. BitTorrent does not require the wires or airwaves that the cable and network giants have spent billions constructing and buying. And it pounds the final nail into the coffin of must-see, appointment television. BitTorrent transforms the Internet into the world's largest TiVo.

During the last century, movie and TV companies had to be massive to afford distribution. Those economies of scale aren't needed anymore. Will the future of broadcasting need networks, or even channels?

"Blogs reduced the newspaper to the post. In TV, it'll go from the network to the show," says Jeff Jarvis, president of the Internet strategy company Advance.net and founder of *Entertainment Weekly*. Burnham goes one step further. He thinks TV-viewing habits are becoming even more atomized. People won't watch entire shows; they'll just watch the parts they care about.

Evidence that Burnham's prediction is coming true came a few weeks before the US presidential election in November, when Jon Stewart - host of Comedy Central's irreverent *The Daily Show* - made a now-famous appearance on CNN's *Crossfire*. Stewart attacked the hosts, Paul Begala and Tucker Carlson, calling them political puppets. "What you do is partisan hackery," he said, just before he called Carlson "a dick." Amusing enough, but what happened next was more remarkable. Delighted fans immediately ripped the segment and posted it online as a torrent. Word of Stewart's smackdown spread rapidly through the blogs, and within a day at least 4,000 servers were hosting the clip. One host reported having, at any given time, more than a hundred peers swapping and downloading the file. No one knows exactly how many people got the clip through BitTorrent, but this kind of traffic on the very first day suggests a number in the hundreds of thousands - and probably much higher. Another 2.3 million people streamed it from iFilm.com over the next few weeks. By contrast, CNN's audience for *Crossfire* was only 867,000. Three times as many people saw Stewart's appearance online as on CNN itself.

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