The Nature of Vitamin C

The Position of the Vitamin C Foundation on Natural Vitamin C and so-called Vitamin C-complex

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"The 'powers that be' did a good job of influencing me to ignore Linus Pauling, describing him as a failing old man with a 'mental' problem who had once been a great scientist. They said he was wrong about vitamin C. I believed them. - 'Richard' - Vitamin C Foundation On-Line Forum

There are a surprising number of well-intentioned people among the alternative medical community who now believe that ascorbic acid isn't the real vitamin C. The dietary substances which causes scurvy when missing and cures scurvy when present is by definition vitamin C. Linus Pauling was unequivocal in his belief that the ascorbate fraction of ascorbic acid (called the ascorbate ion) is vitamin C. Referring to scurvy in his landmark *Vitamin C and the Common Cold* (1970), Pauling stated, "*Ascorbic acid is an essential food for human beings. People who receive no ascorbic acid (vitamin C) become sick and die.*"

There is a growing school of thought among an unlikely foe of Pauling - the natural purists who proclaim that only vitamins gleaned from plants are the real vitamins. The views of these alternative healers, as summarized by authors Thomas S. Cowan, MD and Sally Fallon in their recent book *The Fourfold Path to Healing* (2004) is that the real vitamin C is "*actually a complex of nutrients that includes bio-flavonoids, rutin, tyrosine, copper and other substances known and unknown.*" (Cowan and others 2004 p. 21)

Ascorbic acid, which has been vitamin C since at least 1937, has only a supporting role, according to Cowan and Fallon, who write that ascorbic acid is only present in plants "*as a preservative for this complex, serving to keep it together in the plant tissue, preserving its integrity, freshness and color*." (Cowan and others 2004 p. 21)

Cowan and Fallon even go so far as to say in this book that *"ascorbic acid is not a food for us; that which it preserves is our food.*" (Cowan and others 2004 p. 21) Too much "synthetic" ascorbic acid is harmful, the naturalists assert, especially when not accompanied by the vitamin C-complex.

If the naturalists are right about the C-complex being the "real" vitamin C, then Linus Pauling was wrong in his reviews and analyses of more than 60 years of vitamin C science. There is massive scientific support for Linus Pauling's position that ascorbic acid is vitamin C. No scientific basis has been found for the existence of the C-complex or that such a complex can cure scurvy without ascorbic acid present. This assertion is proven every day in hospitals around the world. Comatose patients are kept alive using *ascorbic acid* only. There are no hospitals keeping patients on a feeding tube alive with a vitamin C-complex.

Those who are making the case for the C-complex and other so-called "natural" vitamins, are highly respected among the alternative community. Their stature prompted Berkley Bedell's National Foundation for Alternative Medicine (NFAM) to turn down funding of a study of the Linus Pauling's vitamin C and lysine therapy for cardiovascular disease. NFAM told the Vitamin C Foundation that they rejected the study because of the fear that ascorbic acid form of vitamin C might prove harmful to the study participants.

The following treatise represents the position of The Vitamin C Foundation on the true nature of vitamin C. The ascorbate ion, the fraction commonly found in ascorbic acid, or one of the salts, e.g., sodium ascorbate or calcium ascorbate, <u>is</u> vitamin C. This is the substance that when missing in the diet causes death by scurvy. There is no scientific debate about this fact. The scientific literature is so voluminous that few

would be capable of digesting it. Part of the problem is that today's dietitians and orthodox nutritionists are taught to ignore much of the early research and medical doctors are not well versed in vitamin C either. Apparently this knowledge vacuum has opened the door to the emotionally appealing idea of a "natural" vitamin C-complex.

The Perfect Food Theory versus The Orthomolecular Theory

The basis for Cowan's, Fallon's, and other naturalist's arguments is that plant-derived "natural" vitamins, and vitamin complexes which are obtained from foods, are more wholesome and generally better for us than individual synthetic vitamins. The naturalists argue that food complexes are preferable because groups of these substances usually appear together in healthful foods, and because individual vitamins do not work alone in the body to sustain health.

There are at least two theoretical reasons why plant food may provide perfect nutrition for humans and other animals: Either perfect foods evolved from a mutual dependency between the plants and the animals that eat them, or these perfect plant foods were created by divine intervention. Either way, plants and their contents are the model naturalists look to for the best guidance as to what constitutes proper human nutrition. This theory might be called the *Theory of Divine Food Creation in Plants* or the *Perfect Food Theory*.

The naturalists are not wrong that animals evolved to eat particular foods. It seems likely that animals and plants evolved together, and in such a way that any plants which the surviving animals generally ingest does provide some guidance as to the nutrition that the animal requires. To obtain information about the foods that are best for humans, this theory requires the study of our ancestor's diets -- what they ate, not necessarily why they ate it.

On the other side in the Pauling camp, orthomolecular nutritionists, or orthomolecularists, might argue that during the course of evolution, immovable plants had different survival issues from the evolving animals, which ate the plants.

Orthomolecularists' view foods, from the perspective of what they contain -- which molecules are required to sustain life, and which ones must be obtained in food.

Linus Pauling and other biochemists explain that there is no difference between a so-called "synthetic" and a "natural" vitamin molecule. Biologically identical, or bio-identical, molecules are indistinguishable from those synthesized by plants or animals. In the blood serum, the origin of bio-identical molecules is thought to be of little significance. Receptors on the surface of animal cells control the uptake of individual molecules regardless of how or why these molecules appear in the blood stream. Any complexes of molecules present in food generally disassociate during digestion.

The theory that animal biochemistry and DNA, perhaps more than plant biology, provides the better guide for optimal nutrition, might be called *The Molecular Theory of Vitamin Evolution in Animals*, or simply *The Orthomolecular Theory*.

The Myth of the Vitamin C-complex

> "*This was the first proof that ascorbic acid was identical with vitamin C, and that the substance's activity was not due to an impurity.*" – Albert Szent-Gyorgyi, Nobel Lecture, *Oxidation, Energy Transfer, and Vitamins*, December 11, 1937.

Mainly because of the words "natural" and "vitamin complex," adherents to the naturalist view have gained many followers, and their views are often repeated by respected nutritional authorities. It is understandable why naturalists distrust modern medical science with its orientation towards potentially dangerous prescription drugs, but this is no reason to ignore science altogether.

There is no scientific debate whether there is such a thing as a vitamin C-complex. Such a thing as a matter of human nutrition does not exist. The argument for ascorbic acid as vitamin C carries as much weight as any argument in any field of science. Its sugar-like molecular structure was first isolated by Albert Szent-Gyorgyi, and the chemical shorthand is C6H8O6. Dr. Szent-Gyorgyi received the Nobel prize for this discovery.

No one who is engaged in conventional medical research believes there is a C-complex, nor are there any peer-reviewed papers accessible in the *Medline* medical database that support the idea that there is a C-complex, much less that it is the real vitamin C.

It is known that animals generally do not require vitamin C in their diets. Almost all mammals, and virtually all animals, synthesize ascorbic acid in the liver or kidney. While most animals synthesize ascorbic acid, there is no scientific evidence that any animal synthesizes the ill-defined C-complex within its body.

The previously mentioned book entitled *Fourfold Path to Healing* (2004), by Thomas Cowan, MD, with Sally Fallon and Jaimen McMillan, is remarkable for the number of false or unsupported assertions these authors make concerning vitamin C. Every sentence in the vitamin C section on pages 20 and 21 is either unsupported, or contains misleading or false information which they present as fact. The message these authors are trying to convey is that the natural vitamin C-Complex not only exists, but it is required, lest consumers risk clogged arteries and DNA damage.

Cowan et. al. begin their Vitamin C section on page 20 with the intriguing sentence, "*Several recent studies have shown that taking synthetic vitamins can actually be harmful, thus challenging a practice suggested in virtually all other books written about health and nutrition over the past 40 years.*" (page 20) Unfortunately, one reason for their different advice is that they are wrong. The two studies cited made headlines, but both "studies" have been debunked scientifically by the Vitamin C Foundation. (See the Vitamin C Foundation on-line *forum* for our rebuttal to these two media reports, and for the complete description of the errors about vitamin C that have been published on pages 20 and 21 of *The FourFold Path to Healing*.)

The Real Vitamin C is the Ascorbate Ion (commonly Ascorbic Acid)

Any review of the scientific literature that spans 80 years and includes more than 100,000 published studies and reports, concludes that what is commonly called vitamin

C, the ascorbate ion, or simply ascorbic acid, is the real vitamin C. Humanity is fortunate that Linus Pauling became interested, for such a review of the literature requires reading the equivalent of 400 bound books just to hold the abstracts. The genius Linus Pauling was probably the only person who could possibly digest and assimilate and then disseminate this much scientific research over the course of his 30-year study. It was his practice to read the body of every study paper, not merely the abstract, draw conclusions and test whether his conclusions match the author of the study.

Linus Pauling made the vitamin C science understandable to the rest of us with his books for the lay public. His 1986 book *How To Live Longer and Feel Better* is an updated and expanded version of his earlier landmark *Vitamin C and the Common Cold (1970)* and is still one of the best references on the true nature of vitamin C.

In the early 1900s, the existence of a dietary factor that cured scurvy was named vitamin C before the substance had been isolated or its molecular structure had been identified.

According the late science writer Isaac Asimov in 1972:

> *"In 1913, two American biochemists, Elmer Vernon McCollum and Marguerite Davis, discovered another trace factor vital to health in butter and egg yolk. This one was soluble in fatty substances instead of water. McCollum called it "fat-soluble A," to contrast it with "water-soluble B," which was the name he applied to the antiberi-beri factor. In the absence of chemical information as to the nature of the factors, this seemed fair enough, and it started the custom of naming them by letters. In 1920, the British biochemist Jack Cecil Drummond changed the names to "vitamin A" and "vitamin B," dropping the final e of "vitamine" as a gesture toward taking "amine" out of the name. He also suggested that the antiscurvy factor was still a third such substance, which he named "vitamin C." (Asimov 1972)*

Isolating and identifying the nature of vitamin C turned out to be a more difficult task for biochemists than most of the other vitamins that were being identified at the beginning of the twentieth century. More from Asimov on isolating vitamin C:

> *"Vitamin C was a different sort of problem. Citrus fruits furnish a comparatively rich source of this material, but one difficulty was finding an experimental animal that did*

not make its own vitamin C. Most mammals, aside from man and the other primates, have retained the capacity to form this vitamin. Without a cheap and simple experimental animal that would develop scurvy, it was difficult to follow the location of vitamin C among the various fractions into which the fruit juice was broken down chemically.

In 1918 the American biochemists B. Cohen and Lafayette Benedict Mendel solved this problem by discovering that guinea pigs could not form the vitamin. In fact, guinea pigs developed scurvy much more easily than men did. But another difficulty remained. Vitamin C was found to be very unstable (it is the most unstable of the vitamins), so it was easily lost in chemical procedures to isolate it. A number of research workers ardently pursued the vitamin without success.

As it happened, Vitamin C was finally isolated by someone who was not particularly looking for it. In 1928, the Hungarian-born biochemist Albert Szent-Gyorgi, then working in London in Hopkins' laboratory and interested mainly in finding out how tissues made use of oxygen, isolated from cabbages a substance which helped transfer hydrogen atoms from one compound to another. Shortly afterward Charles Glen King and his co-workers at the University of Pittsburgh, who were looking for vitamin C, prepared some of the substance from cabbages and found that it was strongly protective against scurvy. Furthermore, they found it identical with crystals they had obtained from lemon juice. King determined its structure in 1933, and it turned out to be a sugar molecule of six carbons, belonging to the L-series instead of the D-series. It was named "ascorbic acid" (from Greek words meaning "no scurvy").” (Asimov 1972 p. 690-700)

Ascorbic acid was easily synthesized after this discovery and the deadly scurvy became rare. As little as ten milligrams per day of ascorbic acid, or one of its salts, is all that is required to cure frank scurvy. Scurvy-like symptoms can rarely be caused by a lack of other factors in the diet, such as a lack of vitamin B6 or copper, but vitamin C is by far the most important and the most likely essential substance to be missing in the diets of humans. (Williams 1971)

Vitamin C is now one of the most studied substances in the history of science. We know what vitamin C is, we know a great deal about what it does, and we know how it is naturally synthesized within plants and animals. We know that ascorbate, *and it alone*, prevents scurvy in the few animals that do not produce it. This has been exhaustively studied in the guinea pig, by *Ginter* and others. (Ginter 1982)

Ascorbate, and it alone, has been shown to have a strong effect of preventing and shortening the duration of the common cold. Early experiments found that bioflavonoids provide no additional benefits in this regard , either alone or added to ascorbate. (Pauling 1986)

Ascorbate, in the form of the salt sodium-ascorbate, can be injected intravenously to control and inactivate viral infections. This is well documented in Thomas *Levy's Vitamin C Infectious Diseases and Toxins: Curing the Incurable* (2002).

Intravenous sodium ascorbate recently made news based upon reports from Mark Levine at the National Institutes of Health, and others, that it can kill cancer cells at high blood concentrations. (Padayatty 2006)

Ascorbate by itself can detoxify the body of heavy metals, including the toxic metal mercury. (Levy 2002)

Vitamin C, as ascorbic acid and vitamin E cut intensive care unit deaths in half in a randomized, placebo controlled trial. (Nathans 2002)

Recently, medical research at John Hopkins University discovered that Ascorbate supplements, in conjunction with vitamin E, significantly reduces the risk of Alzheimer's by 78% and provided an 88% reduction in cognitive dementia. (Zandi and others 2004)

Other recent findings, of which the Vitamin C Foundation is aware, include the ability of vitamin C as ascorbic acid to reduce the risks of stroke and cataract, and to extend life. The risk of stroke was 70% higher among those in the lowest quartile for serum vitamin C than among those in the highest. (Yokoyama 2000) Women who took vitamin C supplements for at least 10 years proved only 23 percent as likely to develop cataracts as women who received the vitamin only in their diet. (Jacques 1997 , Mares-Perlman)

Low blood vitamin C concentrations (ascorbic acid) in the older British population strongly predict mortality. Other vitamins had no effect on mortality. In

fully adjusted models, there was no evidence for an influence of alpha-tocopherol (*vitamin-E*), beta-carotene, or retinol (*vitamin-A*) on total mortality. (Fletcher and others 2003). Researchers in Japan artificially decreased age-dependent telomere shortening by 52-62% over untreated control with an enrichment of intracellular vitamin C. (Furumoto 1998)

Ascorbic acid, *and not a complex*, has been shown to inhibit the HMG CoA Reductase enzyme which controls the production of cholesterol. (Harwood 1986)

Arguably the most important result from a chronic deficiency of ascorbate, as is commonly present in most human beings, is the condition medically referred to as heart disease, or Cardiovascular Disease (CVD). As first proposed by the Canadian medical doctor and researcher G.C. Willis in the 1950s, and later verified by Linus Pauling and Matthias Rath in 1989, this condition is primarily attributable to low vitamin C. (Willis 1952, 1953, 1954, 1957, Pauling 1992)

Among its many metabolic functions, vitamin C as ascorbate is required in the manufacture of the protein collagen. (Pauling 1986) Collagen provides strength and structural integrity to animal tissues. The repair and maintenance of tissue induces a daily need for new collagen. In the human scurvy, the body disintegrates from a lack of collagen and the disease only appears in the few animal species which do not synthesize vitamin C.

Humans compensate for their chronic scorbutic condition by creating plaster-like casts in the arteries. Atherosclerosis, and the resulting high incidence of cardiovascular and heart disease now common in human populations, according to Pauling and his associates, is caused by the lack of vitamin C. (Pauling 1992) <u>CVD in those on western diets is reversible only by taking high amounts of ascorbate, amounts that are impossible to achieve using natural vitamin C, or any plant derived complex.</u> Incidentally, cellulose, not collagen, provides structural integrity for plants.

A 15-year study of 85,000 nurses at Harvard found that a daily vitamin C pill as ascorbic acid reduces heart disease almost 30%. Interestingly, dietary intake of vitamin C seemed to have little effect on coronary heart disease risk. But if women used vitamin C supplements, their risk was reduced by 27 percent. According to the numbers in the Harvard study, a 360 mg vitamin C pill daily would save more than 300,000 lives per year. (Osganian 2003)

The biochemist Sherry Lewin writes in his book *Vitamin C: Its Biology and Medical Potential* (1976) about the exact biochemical nature of vitamin C. Lewin, perhaps the greatest authority on vitamin C other than Pauling never mentions even the possibility of a vitamin C-complex.

A good review of the basic scientific method, as well as the science of vitamin C, can be found in the recent superb book by pharmacology professors Steve Hickey and Hiliary Roberts, *ASCORBATE: The Science of Vitamin C*. (2004, www.lulu.com/ascorbate). Their subsequent analysis of the absurd government recommended daily allowance of vitamin C can be found in their important book *The Ridiculous Dietary Allowance* (2005, www.lulu.com/ascorbate)

This is not to say that plant complexes, containing bioflavonoids, are devoid of health benefits. Linus Pauling himself advised eating a wide variety of foods because there is a chance that not all the molecules a healthy body requires have been discovered.

The most common health benefit of the bioflavonoids, such as the quercetin and rutin commonly found with vitamin C, that are mentioned in the literature is that they strengthen walls of tiny capillaries. However, there is no evidence that any molecule other than ascorbate, the same molecule which is produced by the liver of most animals, can replace vitamin C to prevent scurvy or provide equivalent metabolic properties.

Fortunately for humanity, synthetic vitamin C is inexpensive, offering the hope of better health to everyone. Vitamin C researcher Ralph Lotz points out that the 100 mg

of the "natural vitamin C complex" sold by one company is 1,315 times more costly than synthetic vitamin C.

The Problem With Natural Vitamins

If the naturalists are wrong about vitamin C, perhaps their arguments favoring other "natural" vitamins are spurious also. Human beings require more than 50 essential substances from the diet. The necessary inorganic substances are called minerals; organic substances that cells require and which contain nitrogen are called amino acids. Other organic trace substances are generally called vitamins. Most of these substances can be found in plants, however plants generally depend on not being eaten for their survival, and not all natural plants make good foods.

Poison Ivy is a plant which does not provide any known nutritional value, and that is in fact harmful to the animals which happen to touch it. If natural plants can be poisonous, what methods do the naturalists use to determine "good foods?" Why make the assumption that components in food complexes always act to preserve the best health of the animal eating it?

The story of the development of the statin prescription cholesterol-lowering drugs is a story of how a "natural" plant-derived substance that is poisonous to its predators was isolated and engineered into a prescription drug. Author and former pharmaceutical chemist Shane Ellison explains in *Hidden Truth About Cholesterol Lowering Drugs*:

> *"In a natural response to the threat of a predator, red yeast produces the drug known as lovastatin (as well as other chemicals). Utilizing fundamental laboratory research, the discovery and isolation of lovastatin from red yeast rice was paid for by the U.S. government in the 1970s.[?]*
>
> *Commercially, lovastatin is known as Mevacor. It was the first statin drug, released in 1987 by the U.S. government-influenced company named Merck. Using a technique known as combinatorial chemistry, other drug companies have since unleashed their own versions. These versions include Zocor, Lipitor, Pravachol and Crestor.*
>
> *As a toxic agent, the consumption of lovastatin via red yeast rice by its predators leads to sickness and in some cases, death. This is true for humans as well.*

Lovastatin's (and all other statin drugs) toxicity is attributed to its ability to block cholesterol and CoQ10 production. " (Ellison 2006)

Statins have become the number one selling class of prescription drug after decades of marketing and scare tactics about the supposed dangers of high cholesterol.

Orthomolecular Nutrition

At the cellular level, DNA controls the metabolic machinery in both plants and animals. The question reduces to whether plant or animal DNA holds the key to the food which produce the best of health in humans? According to Linus Pauling, the study of evolution and the single celled organisms provides an important clue. Primitive cells, bacteria and even plants are examples of organisms that must be able to synthesize more of the chemicals that they require for existence than the organisms capable of movement require.

" We are accustomed to thinking of human beings as the highest of all species of living organisms. In one sense they are: They have achieved effective control over a large part of the earth and have even begun to extend their realm as far as the moon and Mars. But in their biochemical capabilities they are inferior to many other organisms, including even unicellular organisms, such as bacteria, yeasts, and molds.

The red bread mold (Neurospora), for example, is able to carry out in its cells a great many chemical reactions that human beings are unable to carry out. The red bread mold can live on a very simple medium, consisting of water, inorganic salts, an inorganic source of nitrogen, such as ammonium nitrate, a suitable source of carbon, such as sucrose, and a single vitamin, biotin. All other substances required by the red bread mold are synthesized by it, using its internal biochemical mechanisms. The red bread mold does not need to have any amino acids in its diet, because it is able to synthesize all of them and also to synthesize all of the vitamins except biotin.

The red bread mold owes its survival, over hundreds of millions of years, to its great biochemical capabilities. If, like humans, it were unable to synthesize the various amino acids and vitamins, it would not have survived. because it could not have solved the problem of obtaining an adequate diet". (Pauling 1986,2006)

The forces helping to continue the existence of plants work in opposition to the evolutionary interests of the animals. As Pauling explains, the animals evolved to eat the immovable plants which must make many of the molecules required for life.

The animals began to delegate important biological functions to the DNA of plants making animals dependent on plants for their very existence. Plants have had to evolve protections from being eaten into oblivion. Nature is the balance between these two diametrically opposing evolutionary forces.

Generally, the type of molecules that animals delegated to plant DNA require many steps to synthesize (introducing greater opportunities for mutation) and several of the vitamins have lipid as well as protein components. These molecules are required in small amounts by the animal but are found in relatively large amounts in plants. Many of the essential vitamins are coenzymes, as coenzymes survive the many chemical reactions they help facilitate.

Vitamin C as ascorbic acid is unique among the vitamins. Ascorbic acid is produced by most animals in large amounts. Rather than a complicated coenzyme, ascorbic acid is a rather simple sugar-like molecule and the animals synthesize it using a 4-step process. Few species have survived after losing the ability to synthesize ascorbate.

This has created a valid argument as to whether vitamin C is really a "vitamin" (the term vitamin implies a trace factor), or whether humans require this substance in much higher amounts. There are high concentrations of ascorbate in the adrenal glands, and animals produce more when they are under stress. Irwin Stone suggested that a more descriptive term for ascorbic acid is the "missing stress hormone."

Patrick Holford expands on this version of the vitamin C isn't really a vitamin argument, and explains how the animals make their ascorbate.

> *"Vitamin C isn't a vitamin at all. It isn't a necessary component of diet, at least for all mammals with the exception of guinea pigs, fruit eating bats, the red vented bulbul bird and primates - which includes us. All other species make their own.*
>
> *This they do by converting glucuronic acid derived from glucose into ascorbic acid (C6H8O6). Three enzymes are required to make this conversion. One of these enzymes, or part of the enzyme system, is missing in primates. Irwin Stone proposed, in 1965, that a negative mutation may have occurred in these species so as to lose the*

ability to produce vitamin C. In primates this is thought to have occurred in the region of 25 million years ago." (Holford 1994)

Holford's argument is not whether ascorbic acid is required. Holford, Stone, and others argue that humans suffer a genetic defect and that they require more than mere *vitamin-like* amounts for the best of health. (Stone 1972)

According to the Pauling/Rath unified theory of cardiovascular disease, humans have adapted for their loss of the ability to make vitamin C by producing the Lp(a) cholesterol molecule as the vitamin's surrogate. (Pauling 1992)

The plants are not necessarily producing any more organic molecules than the minimum levels required to ensure the continued existence of the animals. A better indicator of optimal animal nutrition may be the production and serum levels of a needed substance in animals that still retain the capacity to make it. For example, *Coenzyme Q10,* or CoQ10, is the complicated vitamin-like molecule that is required by all cells for the production of energy.

The DNA in humans encodes for the 17-step sequence to synthesize CoQ10 requiring at least seven vitamins (*vitamin B2 - riboflavin, vitamin B3 - niacinamide, vitamin B6, folic acid, vitamin B12, vitamin C, and pantothenic acid*) and several trace elements. According to John Ely, the amount of CoQ10 humans endogenously produce is about 500 mg per day, while humans might obtain less than 5 mg from the ordinary diet. (Ely 2006)

Although the complex coenzyme Q10 molecule is similar to other vitamins, especially vitamin K, over the course of evolution no vegetarian animal has delegated its needed CoQ10 to plant DNA. This is probably because more CoQ10 is required in animals than plants to support their motion. Therefore the DNA of immobile plants provide little help in determining the proper amount of CoQ10 to supplement.

The DNA of most animals encodes for both CoQ10 and ascorbate. The amount of CoQ10, synthesized by animals can be compared with the amount of ascorbic acid

synthesized to estimate the human requirement for vitamin C. The amount of ascorbic acids that animals make is roughly ten times more than the CoQ10 they make by weight. Using this ratio, after adjusting for body weight, an orthomolecularist might predict the need for 5000 mg of ascorbate daily in human blood and tissue. To obtain this level, we might have to ingest more than 10,000 mg of ascorbic acid by mouth. (Pauling and Lewin determined that about ½ the ascorbate taken orally is broken down before reaching the cells and becomes biologically unavailable.) (Pauling 1986, Lewin 1976)

The naturalist model, based on vitamin complexes in food, would predict a smaller requirement for vitamin C, perhaps even less than the 2300 mg found in 2500 kcal (or one day's food) on the paleolithic diet. (Pauling 1986) They might also argue that the need for vitamin C isn't that great; after all, several high-level primates lost the ability to synthesize it. Studies with primates show that adjusted for body weight they require 1750 mg to 3500 mg of ascorbate in their diets. (Pauling 1986)

Where is this False Information About Vitamin C Coming From?

The Vitamin C Foundation was disappointed, but not surprised, when the U.S. government's National Institutes of Health (NIH) turned down our grant request to study vitamin C and heart disease. (McDade 2002) We were shocked by the rejection of Bedell's *National Foundation for Alternative Medicine.* NFAM did not, and perhaps still does not believe that ascorbic acid is vitamin C.

Mr. Bedell told us over the phone that what the Vitamin C Foundation were proposing in our study proposal was "*not the real vitamin C.*" He said he based this on the advice and counsel of his daughter with medical training. She had attended a lecture given by the highly respected *Standard Process* company regarding natural vitamins. Bedell and the leaders of NFAM became concerned that patients in the Pauling therapy study receiving the "synthetic" vitamin C might be harmed.

Royal Lee and Standard Process

The basis of the naturalist view comes from the writings of Royal Lee who guided the formation of *Standard Process*. Royal Lee's ideas on natural vitamins is generally credited with originating the naturalist school of vitamin complexes. Lee's ideas cannot be ignored. He popularized the belief that foods supply the vitamins in the best and right amounts. It is the notion that a divine force, or human evolution, created foods with the ideal contents and proportions that lead to optimal health for human beings

There is little doubt of the sincerity of Royal Lee, or his naturalist followers. There is certainly some truth in their assertions. After an animal loses its ability to produce a given molecule, it must eat plants that produce it, or the animal species will become extinct. However, intentions aside, the followers of Lee are mistaken about the ascorbic acid and the vitamin C-complex, and probably wrong about natural vitamin-complexes in foods as well.

The Vast Pharmaceutical Conspiracy - Kooks or Dupes?

The Vitamin C Foundation verified that almost all *Standard Process's* vitamin C products do, in fact, use synthetic ascorbic acid. It then began investigating the origin of the "natural vitamin C" and "vitamin C-complex" articles that appear widely on the Internet. At first we thought that spreading the natural C-complex misinformation among naturalists who are prone to believe was a clever ploy to make these well intentioned nutrition advocates appear unscientific in the eyes of allopathic medical doctors. As we have documented elsewhere, there is a stream of media stories, disguised as news, that deliberately distort the science behind vitamins in favor of prescription drugs. One obvious purpose of such media propaganda is to encourage conventionally trained physicians to dismiss alternative claims regarding vitamin C.

However, given the stature and convictions of some of the nutrition authorities involved, who should know better, we now wonder if there is more to this. It is not inconceivable that the spread of the "Vitamin C isn't Vitamin C" idea is more than a

marketing ploy or merely an attempt to make the naturalists appear kooky. As far fetched as this seems to any student of Linus Pauling, if the "Vitamin C isn't Vitamin C" idea somehow became generally accepted, then the FDA might be able to strictly regulate ascorbic acid under current law.

All vitamins are currently protected as foods by the Federal Dietary Supplements Health Education Act (DSHEA) that was passed soon after the new Congress arrived in 1994. This law protects ascorbic acid from FDA interference or regulation as a prescription drug on the basis that ascorbic acid is vitamin C. That which prevents the vitamin C deficiency disease scurvy. However, should the notion that the "real" vitamin C is the ill defined C-complex found in plants prevail, then it, the C-complex, not ascorbate, would enjoy the protection afforded vitamins and foods by DSHEA

Natural Vitamin E

We will concede natural vitamin E to the naturalists. There are cases of molecules apparently required in the diet, but manufactured solely by plants. Animal DNA may never have encoded for these molecules, and even single cell organisms may not encode for them. It is probable that these molecules evolved entirely in plants, and we humans and other animals have evolved to be healthier by eating the plant versions of such molecules, perhaps even containing a complex.

Once such case is vitamin E, or the *d-alpha-tocopherol* form. No animals are known to synthesize vitamin E, there is no readily identifiable deficiency disease, and its molecular structure is therefore unknown. The naturalists' concern about the synthetic form of vitamin E (the *dl-alpha tocopherol* form) is probably legitimate. We speculate that rather than a vitamin, vitamin E is better classified as a *vitamin-like* substance, only required in humans to spare the low amount of vitamin C normally present in the tissues on a typical low-ascorbate diet. Higher amounts of natural vitamin E have been shown to provide many health benefits. The vitamin C foundation recommends 400 to

3200 iu of naturally derived forms of vitamin E, as recommended by the Shute brothers.

Summation

It is a serious error for an alternative practitioner to identify orthomolecular substances, such as ascorbic acid, as dangerous. Orthomolecular, or bio-identical molecules are by definition indistinguishable from their naturally created counterparts. These molecules are transported to the cells, regardless of whether they are eaten or endogenously manufactured by other animal cells. There is no experimental evidence that such molecules behave differently in the blood stream or within cells. There may be, in fact, fewer impurities than what appears in our plant foods.

The naturalist arguments have a broad appeal, especially to those concerned about the unnatural and toxic nature of prescription drugs. Naturalists and orthomolecularists share a common concern with pharmaceuticals. Drug companies often change natural or orthomolecular molecules so that they may be patented and become more profitable. Such molecular changes make drugs toximolecular (not orthomolecular) and potentially dangerous.

Much of what we know about the molecules required for life comes from the study of the simple organisms, such as some microbes and yeasts. These simple organisms manufacture most of the vitamins they require within their single cell. Fixed plants must also retain the genetics to manufacture more of the chemicals needed to reproduce than animals require. Higher order organisms including plants have evolved into colonies of cells, each colony with a specific function, but many if not all the molecules required for the organism are made by some colony within the plant.

A vitamin is a substance among a group of trace substances, including vitamins, minerals and amino acids that an animal cell doesn't make but that is a requirement for life. As life progressed, animals emerged that began eating plants. This food contained some of the same molecules animals cells were then making. Over time, species lost

their genetic instructions necessary to create these essential molecules. The essential substances are what cells require, less what all the colonies in the organism manufactures and distributes to other cells.

Plant evolution is the model for naturalists, yet plants have evolved to protect themselves from being eaten. As animals ate and became dependent upon plants, a risky relationship developed. Plant DNA has literally become an extension of animal DNA and animals that don't get a minimal amount of any one of the vitamins they require will die of the deficiency.

Comatose patients can be kept alive indefinitely on man-made products containing all the synthetic vitamins, plus the trace minerals and necessary protein, fats and carbohydrates. One such complete nutrition product is the Ross Laboratories ***Ensure™***. When the product was originally developed, *biotin* was not known to be a vitamin. Patients on the early ***Ensure*** became ill and died until *biotin* was added to the formula.

All complete nutrition products, including ***Ensure***, provide vitamin C as ascorbic acid. Not one product offers a vitamin C complex.

The naturalist assertion that vitamin C isn't vitamin C, that instead it consists of a complex of nutrients, raises many questions. Is ascorbic acid the substance whose deficiency leads to scurvy or are thousands of experimental studies wrong? Why is scientific information about the vitamin C-complex hidden? What experiments have been conducted, and where is science about the C-complex published, and how could Linus Pauling, Sherry Lewin, Steve Hickey, Hiliary Roberts, Irwin Stone, Thomas Levy and others have missed this important information? What exactly is the complex? (*Is the C-complex from the orange the same as a green pepper C-complex, the same as the C-complex in the tomato? If not, which C-complex is better?*) Why do almost all animals except humans produce ascorbic acid, yet not one animal has been found that produces the C-complex? Why would the ascorbic acid synthesized by plant DNA be better than the ascorbic acid that all animals synthesize? On what theory are the animals wrong and

the plants right? And how do hospitals keep patients alive with complete nutrition products that contain only ascorbic acid? The naturalists are unable to satisfactorily answer any of these questions.

Today, through the science of chemistry, human beings may now dispense with the need for plant DNA. We encode the process of vitamin synthesis into large chemical manufacturing processes making these pure molecules reliably, plentifully and at low cost. Such manufacturing makes it possible for many more people to experience their benefits. Orthomolecular vitamin molecules, however, are biologically identical to the molecules synthesized by living organisms.

> *" I discovered, or rediscovered what Linus Pauling had to say about heart disease I have already five heart operations including a quad bypass and various stent operations. I suffered the last heart attack (my fourth) and went through another heart operation (my fifth) in December of 2003. Last October of 2005 I did intensive research (on the Internet) to discover what i could do to stay alive. I was having more chest pain and I realized I was over due for another heart attack and operation (based on my previous ten years experience).*
>
> *I read all of Linus Pauling's books. I was very impressed and I finally understood my situation. this led me to search for more information about vitamin C . [By following Pauling's recommendations] my chest pain is gone. I have not felt this good in over twelve years! I now consider Linus Pauling to be the greatest most significant scientist of this era."* - 'Richard' - Read Richard's entire store at the Vitamin C Foundation On-Line Forum at www.vitamincfoundation.org/forum

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