

# **Fulvic Acid**

## The Miracle Molecule

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## Introduction

Fulvic acid is rapidly being recognized as one of the key elements in many outstanding health and scientific breakthroughs of the 21st century. Scientists and doctors throughout the world are beginning to discover Fulvic acid, and are starting to recognize its extraordinary potential, interest in the medical community has been escalating rapidly. We have no doubt that this will increase dramatically as our ongoing findings are released to the world.

We are now receiving many requests for Fulvic acid information and resources from prestigious scientists and research clinics in the United States and abroad. The growing interest and excitement is simply amazing.

Until recent only very small amounts of Fulvic acid have been available for scientific testing. Most of the studies to date have been done on plant cells. In reviewing and evaluating these reports, it is important to bear in mind that leading scientists like Roger J. Williams, recognize and agree with the following fact;

*"The building blocks present in the metabolic machinery of human beings are, in the great majority of cases, exactly the same as the building blocks contained in the metabolic machinery of other organisms of extremely different types." Roger J. Williams*

Although the majority of research and experimentation that has been done on Fulvic acid is in relation to plants; it is important to realize that human beings have been ingesting Fulvic acid complexes regularly for over 60 years in supplemental form, and for thousands of years from natural food and plant sources. The new discoveries involving Fulvic acid are very similar in nature to the recent important discoveries of valuable phytochemicals in vegetables that have always existed, but were hitherto unknown. Fulvic acid has always occurred naturally in organic plants and soils, yet its recent discovery and tremendous value is now just beginning to be recognized.

Accumulating testimonials from regular users continue to substantiate the fact that the same beneficial properties related to plant studies and cells, hold true in relation to animals and humans as well. Clinical studies on animals and humans are beginning, and updated information will be forthcoming. Preliminary findings show that the most prominent diseases and health problems of our day have been dramatically affected in positive ways by supplementation or treatment with Fulvic acid and other preparations enhanced, extracted, or chelated using Fulvic acid.

Uses beneficial to humans are not the only focus here. The known agricultural benefits have enormous potential to heal soils of the world. Yet the majority of the agricultural community is virtually unaware of the implications. Industrial use for treatment of sewage and landfill waste, neutralization of radioactive and toxic wastes, and a myriad of other uses are just beginning to be realized. Fulvic acid has been found to have tremendous potential.

## Fulvic Acid Major Attributes

### One of Nature's Most Powerful Organic Electrolytes

Fulvic acid is an organic natural electrolyte that can balance and energize biological properties it comes into contact with<sup>2</sup>. An electrolyte is a substance that is soluble in water or other appropriate medium that is capable of conducting electrical current<sup>3</sup>.

The power of an electrolyte has been shown in repeated tests on animal cells (giant amoebae), to be able to restore life in what researchers termed “a beautiful demonstration” and “astonishing.” When the electrolyte potential was taken away during the test, the cell ruptured and disintegrated into the surrounding fluid causing death. Upon reintroducing electrical potential the cell reconstructed and became active and healthy!<sup>4</sup>

It was also determined from these same studies, that similar results could be expected of the progressive weakness among humans that results from unchecked hemorrhage, overwhelming emotional stress, uncontrolled infections, unbalanced diet, prolonged loss of sleep, and surgical shock. These examples are all accompanied by a steady decrease in electrical potential that can eventually be reduced to zero at death. These studies show convincingly that the physical well being of plants, animals, and humans is determined by proper electrical potential.<sup>5</sup>

Fulvic acid has proven to be a powerful organic electrolyte, serving to balance cell life. If the individual cell is restored to its normal chemical balance and thereby in turn its electrical potential, we have given life where death and disintegration would normally occur within plant and animal cells<sup>6</sup>. Fulvic acid has the outstanding ability to accomplish this objective in numerous ways<sup>7</sup>.

### Promotes Electrochemical Balance as Donor or Receptor

Fulvic acid is available at times as an electron donor and at other times as an electron acceptor, based on the cell's requirements for balance<sup>8</sup>. One of the reactions that occurs is an oxidation reaction in which the chemical species loses electrons as a donor. The other reaction is a reduction in which the active species gains electrons as an acceptor<sup>9</sup>. A recent study of the binding of a donor molecule to Fulvic acid in solution revealed direct evidence for donor-acceptor charge transfer mechanisms.<sup>10</sup> Trace minerals in the Fulvic acid electrolyte could also be beneficial in this process by serving as electrodes.<sup>11</sup>

### One of the Most Powerful Natural Free Radical Scavengers & Antioxidants Known<sup>12</sup>

Free radicals of Fulvic acid behave as electron donors or acceptors, depending upon the need for balance in the situation.<sup>13</sup> Fulvic acid can in the same way take part in oxidation-reduction reactions with transition metals.<sup>14</sup> (See the detailed report on free radicals and antioxidants beginning on page 21.)

### Complexes & Dissolves Minerals & Trace Elements<sup>15</sup>

Fulvic acid is especially active in dissolving minerals and metals when in solution with water. The metallic minerals simply dissolve into ionic form, and disappear into the Fulvic structure becoming bio-chemically reactive and mobile. The Fulvic acid actually transforms these minerals and metals into elaborate Fulvic acid molecular complexes that have vastly different characteristics from their previous metallic mineral form. Fulvic acid is nature's way of “chelating” metallic minerals, turning them into readily absorbable bio-available forms. Fulvic acid also has the unique ability to weather and dissolve silica that it comes into contact with.

## **Enhances Nutrients<sup>16</sup>**

Fulvic acid enhances the availability of nutrients and makes them more readily absorbable. It also allows minerals to regenerate and prolongs the residence time of essential nutrients. It prepares nutrients to react with cells. It allows nutrients to inter react with one another, breaking them down into the simplest ionic forms chelated by the Fulvic acid electrolyte.

## **Transports Nutrients<sup>17</sup>**

Fulvic acid readily complexes with minerals and metals making them available to plant roots and easily absorbable through cell walls. It makes minerals such as iron, which are not usually very mobile, easily transported through plant structures. Fulvic acids also dissolves and transports vitamins, coenzymes, auxins, hormones, and natural antibiotics<sup>18</sup> that are generally found throughout the soil, making them available. These substances are effective in stimulating even more vigorous and healthy growth<sup>19</sup>. These substances are produced by certain bacteria, fungi, and actinomycetes in decomposing vegetation in the soil. It has been determined that all known vitamins can be present in healthy soil<sup>20</sup>. Plants manufacture many of their own vitamins, yet these from the soil further supplement the plant. Upon ingestion these nutrients are easily absorbed by animals and humans, due to the fact that they are in the perfect natural plant form as nature intends. Fulvic acid can often transport many times its weight in dissolved minerals and elements.<sup>21</sup>

## **Catalyzes Enzyme Reactions<sup>22</sup>**

Fulvic acid has close association with enzymes.<sup>23</sup> It increases activity of enzymes, and especially influences respiratory catalysts. Fulvic acids increase the activity of several enzymes including alkaline phosphates, transaminase, and invertase.

## **Increases Assimilation<sup>24</sup>**

Fulvic acid metal organic complexes are of a low molecular weight<sup>25</sup>, and because of this they are also of low molecular size, and are capable of a high degree of penetration into cells. Fulvic acid complexes and chelates are able to readily pass through semi permeable membranes such as cell walls. Yet it is important to note that it has also been determined that Fulvic acids not only have the ability to transport nutrients through cell membranes, they also have the ability to sensitize cell membranes and various physiological functions as well.<sup>26</sup>

## **Stimulates Metabolism<sup>27</sup>**

Fulvic acid appears to cause the genetic mechanism of plants to function at a higher level. It has been concluded that any means by which plant cells are exposed to Fulvic acid can improve growth.<sup>28</sup> Oxygen is absorbed more intensely in the presence of Fulvic acids.<sup>29</sup> Fulvic acid aids in penetrating roots and then quickly transports to the shoots of plants.<sup>30</sup> Fulvic acid relieves oxygen deficiency and increases the vital activity of cells. Fulvic acids change the pattern of the metabolism of carbohydrates, resulting in an accumulation of soluble sugars. These soluble sugars increase the pressure of osmosis inside the cell wall and enable plants to withstand wilting. Fulvic acid enhances growth and may stimulate the immune system.<sup>31</sup>

## **Detoxifies Pollutants<sup>32</sup>**

An important aspect of humic substances is related to their sorptive interaction with environmental chemicals, either before or after they reach concentrations toxic to living organisms.<sup>33</sup> The toxic herbicide known as Paraquat is rapidly

detoxified by humic substances (Fulvic acids).<sup>34</sup> Fulvic acids have a special function with respect to the demise of organic compounds applied to soil as pesticides.<sup>35</sup> It has been established that Fulvic acid is vital in helping to form new species of metal ions, binding with organic pollutants such as pesticides and herbicides, and catalyzing the breakdown of toxic pollutants. Radioactive substances react rapidly with Fulvic acid, and only a brief time is required for equilibrium to be reached.<sup>36</sup> All radioactive elements are capable of reacting with Fulvic acid and thus forming organo metal complexes of different adsorptive stability and solubility.

### **Dissolves Silica**

Fulvic acids are especially important because of their ability to complex or chelate metal ions and interact with silica.<sup>37</sup> It has been shown that these interactions may increase the concentrations of metal ions and silica found in water solutions to levels that are far in excess of their assumed dissolution ability<sup>38</sup>.

### **Synthesizes or Transmutates Minerals<sup>39</sup>**

Fulvic acid complexes have the ability to bio react one with another, and also interreact with cells to synthesize or transmute new mineral compounds. The transmutation of vegetal silica and magnesium to form calcium in animal and human bones is a typical example of new synthesis of minerals.<sup>40</sup> (See Fulvic Acid & Vegetal Silica beginning on page 40.) Enhances Cell Division and Elongation<sup>41</sup> Fulvic acid stimulates and balances cells, creating optimum growth and replication conditions.

### **Enhances the Permeability of Cell Membranes<sup>42</sup>**

Fulvic acids act as specific cell sensitizing agents and enhance the permeability of the cell membrane.<sup>43</sup>

### **Increases Metabolism of Proteins<sup>44</sup>**

Fulvic acid intensifies the metabolism of proteins, RNA, and DNA.<sup>45</sup> It has been found that Fulvic acid definitely increases DNA contents in cells<sup>46</sup>, and also increases and enhances the rate of RNA syntheses.<sup>47</sup>

### **Catalyzes Vitamins within the Cell<sup>48</sup>**

Fulvic acid has the ability to complex vitamins into its structure, where they are presented to the cell in combination with complexed minerals. In this perfect natural condition, they are able to be catalyzed and utilized by the cell. In absence of adequate trace minerals, vitamins are unable to perform their proper function.

### **Chelates All Monovalent & Divalent Elements to which it is exposed**

Fulvic acid has the power to form stable water soluble complexes with monovalent, divalent, trivalent, and polyvalent metal ions. It can aid the actual movement of metal ions that are normally difficult to mobilize or transport.<sup>49</sup> Fulvic acids are excellent natural chelators and cation exchangers, and are vitally important in the nutrition of cells.

## Fulvic Acid, Origin and Overview

### In the Beginning

In the beginning the Earth was blessed with optimum organic growing conditions. The soil had a wealth of minerals, trace elements, and rich humus soil teaming with microbes. The Earth's minerals had not yet leached and eroded into the seas, and because of that, the soil was exceptionally fertile. The vegetation was very lush and abundant, as is evidenced by ancient remains that we know were formed into coal and oil deposits.

### Humic Deposits

But there have been found other most unusual remains that geologists call humic deposits. They also came from that ancient lush vegetation. These humic deposits never did turn into oil or coal, because they were not exposed to the same tremendous pressures, and were very near the surface where there was abundant microbial activity. These deposits are quite rare and can be found in various areas of the world. Some of these deposits are exceedingly rich in a little known substance called Fulvic acid.

### Fulvic Acid

Fulvic acid has been discovered to be one of the most important natural miracles related to life itself. Fulvic acid is part of the humic structure in rich composting soil. It is an acid<sup>50</sup> created in extremely small amounts by the action of millions of beneficial microbes, working on decaying plant matter in a soil environment with adequate oxygen.<sup>51</sup> It is of low molecular weight<sup>52</sup> and is biologically very active. Because of its low molecular weight, it has the necessity and ability to readily bond minerals and elements into its molecular structure causing them to dissolve and become mobilized Fulvic complexes. Fulvic acid from humic deposits usually carries 60 or more minerals and trace elements dissolved into its molecular complexes. These are then in ideal natural form to be absorbed and interact with living cells.<sup>53</sup> Plant roots and cells readily absorb high amounts of Fulvic acid, and maintain it in their structure.<sup>54</sup> In fact it has been discovered that these Fulvic acid complexes are absolutely essential for plants to be healthy.<sup>55</sup>

### Microbial Action

We know that ancient plant life had ample Fulvic acid as is evidenced by the exceedingly rich and unusual deposits that are located in various areas of the world. Fulvic acid in these deposits came from massive amounts of vegetation and its further decomposition by microbes. Fulvic acid is then a naturally occurring organic substance that comes entirely from microbial action on decomposing plants, plants themselves, or ancient deposits of plant origin.

### Fulvic Acid is Lacking in Food Crops

It seems obvious that most of the agricultural and food crops of today would also contain adequate amounts or at least some Fulvic acid and its related mineral complexes, but few do. As human beings it would be reasonable to assume that we should be consuming Fulvic acid complexes in the plants we eat, and consequently have Fulvic acid in our systems. It is obvious that this is the way nature intended it. But this not the case, nor has it been for a long time.

Our soils are sick from poor agricultural practices, pesticides, chemical fertilizers (see page 43 for the most revealing story of the "Father of N-P-K"), erosion, and mineral depletion,<sup>56</sup> as well as sterile conditions brought on by these practices, that prohibit microbial activity. Because of this our plants are sick, containing very little nutrition, especially minerals. For generations adequate Fulvic acid, that should have been contained in the plants we eat, has been missing from our diets,

yet it is essential for our cell metabolism. Scientists have found that nutritionally we need 90 different nutrients in our diets. Over 60 of these are minerals and trace elements. We are simply not getting them today from the plants we eat.

Re-mineralization of soils would be of little benefit without Fulvic acid and return to better farming practices. Remineralization of our bodies without the Fulvic acid that should be contained in the plants we eat, has proven just as useless. People are sick with degenerative and deficiency related diseases now more than ever. With Fulvic acid supplementation and return to proper diet and farming practices these situations have the potential to be reversed.

## **Science & Medicine**

Fulvic acid is still not well known or understood by most of the scientific<sup>57</sup> or medical community. Fulvic acids have not been able to be synthesized by chemists<sup>58</sup>, and are unable to be clearly defined<sup>59</sup> because of their extremely complex nature. This perplexity warrants little opportunity for science or medicine to exploit Fulvic acid, or profit from new patents. Accumulating claims of encouraging health benefits by the public have been simply remarkable (see testimonials beginning page 45). Many of these health assertions have also shown that they could be disease preventative in nature and dramatically increase longevity.

This demonstrates that Fulvic acid could potentially pose a substantial long range threat to the future of pharmaceutical companies, medical doctors, and health professionals. It is good news for the public and the alternative health industry. Yet until now, Fulvic acid has been entirely overlooked or misunderstood by the majority of alternative health concerns as well.

## **Benefits of Fulvic Acid**

Scientists have recently been studying Fulvic acid, and have come up with some amazing facts. They tell us that Fulvic acid is one of the finest natural electrolytes known to man. It helps with human enzyme production, hormone structures, and is necessary for the utilization of vitamins. It has been found to be essential to living cells in carrying on metabolic process. It maintains the ideal environment<sup>60</sup> for dissolved mineral complexes, elements, and cells to bioreact electrically with one another causing electron transfer, catalytic reactions, and transmutations into new minerals.<sup>61</sup> It is also one of the most powerful natural antioxidants and free radical scavengers known. It has the unique ability to react with both negatively and positively charged unpaired electrons and render free radicals harmless. It can either alter them into new useable compounds or eliminate them as waste. Fulvic acid can similarly scavenge heavy metals and detoxify pollutants. Fulvic acid helps to correct cell imbalances.

## **Fulvic Acid Mineral Complexes are better than True Colloidal Minerals<sup>62</sup>**

You may have heard all the excitement about colloidal minerals lately. But actual true colloidal minerals don't really work (see further information beginning page 25). It is the fulvic acid in conjunction with the minerals that works! Colloidal minerals themselves are not readily useable by cells. Until now, the alternative health community has praised the virtues of colloidal minerals. Most so called colloidal mineral preparations have Fulvic acid in them, yet it may be of low or inconsistent volume or stability, and are usually incorrectly labeled as colloidal by suppliers. These dealers are obviously totally unaware of Fulvic acid or its values.

Buyers beware! Some dealers are marketing highly diluted or counterfeit preparations. It has been determined that some preparations may have had sulfuric acid or other acids added to the extraction vats to help them increase the dissolved solid content. Some of the preparations, especially those coming from certain ancient lake beds could be very unsafe. True colloidal minerals are still in metallic form only smaller in size. To discern if a preparation is truly colloidal you can obtain a laser penlight from Radio Shack for about \$20. A simple laser test will show

a beam of light as visible in passing through a colloidal mineral solution (unless it has nothing in it), because the light is reflecting off of solids. A solution with an adequate level of stabilized Fulvic acid containing the very same minerals shows no visible beam because the minerals are dissolved into a molecular Fulvic complex. In fact the solution can contain much higher mineral concentration<sup>63</sup> when dissolved<sup>64</sup> into Fulvic acid.<sup>65</sup> It is most important to realize that Fulvic acid is the perfect vehicle provided and intended by nature for transport of minerals to living cells.<sup>66</sup> If a product has Fulvic acid in it you can usually tell by the unusual acidic taste that is unique only to Fulvic acids.

### **Hidden Treasures**

Good quality Fulvic acid from humic deposits has over 60 different mineral and trace element complexes that naturally occur along with the Fulvic acid. These complexes are hidden treasures of the past, 13 in the perfect plant form, just as nature provides. These trace minerals are an additional bonus to the miracle of Fulvic acid. These Fulvic complexes are hundreds of times smaller than living cells, and are amazingly absorbable by them. It is most important to know that Fulvic acid has the unique ability to enhance, potentiate, and increase absorption of many other compounds such as vitamins, herbs, minerals, tinctures, and foods with which it is combined. Fulvic acid is one of nature's miracles of unparalleled proportion!

## Fulvic Acids Further Defined

**Fulvic Acids: What are they? Where do they come from? What can they do?**

**Why do we need them?**

Though virtually unknown to the layman, there is perhaps no substance more vital to life, (with the possible exception of oxygen and water) than the biologically derived compounds known as HUMIC and FULVIC ACIDS. Fulvic acids enter into all life processes within plants and animals and as such wears many hats. When necessary; they act as "free radical"<sup>67</sup> scavengers, supply vital electrolytes,<sup>68</sup> enhance and transport nutrients,<sup>69</sup> make water wetter,<sup>70</sup> catalyze enzyme reactions,<sup>71</sup> increase assimilation,<sup>72</sup> stimulate metabolism,<sup>73</sup> chelate and humanize essential major and trace elements,<sup>74</sup> and demonstrate amazing capacity for electrochemical balance.<sup>75</sup>

### Unknown Fulvic

Despite the fact that scientists worldwide have published thousands of papers relative to "Fulvic acids" and their effect on living matter, they have received limited public exposure because of the inability to produce and commercialize these substances. Researchers consider water extracts of 30 parts per million (ppm) as being a high concentration. For obvious reasons the knowledge of Fulvic acids have been confined primarily to a small specialized sector of the scientific community.

### How are they Formed?

Fulvic acid is a derivative of microbial degradation of humic substances. Microorganisms are essential to the process<sup>76</sup>. Each gram of healthy top soil has in excess of four billion microorganisms that participate in manufacturing biochemicals essential to healthy plants<sup>77</sup> and animals. If they were to fail our lives would cease. A better perspective of their importance can be gained by looking at the work they do. Microorganism activity in preparing one acre of top soil, expends the equivalent energy of 10,000 people doing the same amount of work in the same amount of time.<sup>78</sup>

### What Humic Substances doing the Soil

Scientists claim organic substances stimulate plant cellular growth and division, including auxin type reactions.<sup>79</sup> They enhance plant circulatory systems and promote optimum plant respiration<sup>80</sup> and transportation systems.<sup>81</sup> They decrease plant stress and premature deterioration.<sup>82</sup> They dramatically improve seed germination and promote greater fibrous root growth.<sup>83</sup> They increase the size and numbers of legume root nodules and increase resistance to drought and insect infestation.<sup>84</sup>

### The Fulvic Plant Miracle<sup>85</sup>

In addition to duplicating many of the positive functions of humic acid, Fulvic acid will:

- Stimulate plant metabolism
- Give positive effect on plant RNA & DNA
- Act as a catalyst in plant respiration
- Increase metabolism of proteins
- Increase activity of multiple enzymes<sup>86</sup>
- Enhances the permeability of cell membranes

- Enhance cell division and cell elongation
- Aid Chlorophyll synthesis
- Increase drought tolerance, and prevent wilting<sup>87</sup>
- Increase crop yields
- Assist denitrification by microbes
- Buffer soil pH
- Contribute electrochemical balance as a donor or an acceptor
- Synthesize new minerals
- Chemically weather inorganic substances<sup>88</sup>
- Decompose silica to release essential mineral nutrients<sup>89</sup>
- Detoxify various pollutants (pesticides, herbicides, etc.)

## **Who and What are We?**<sup>90</sup>

Biologically as humans we consist of varying amounts of the following major and minor elements;

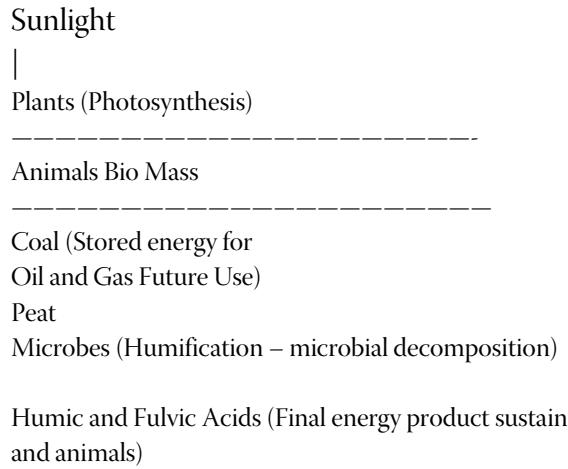
Calcium
Iron
Oxygen
Carbon
Iodine
Phosphorus
Chlorine
Magnesium
Potassium
Hydrogen
Sulfur

Plus traces of aluminum, bromine, cobalt, copper, fluorine, manganese, nickel, silicon, sodium, zinc, and all the additional (as yet) undiscovered trace element needs being added to the list as our knowledge increase.

## **The Body Cellular**

The elements we are composed of (plus or minus a few billion) are components of approximately 60 trillion cells. An average cell contains about 1 quadrillion molecules, which is about 10,000 times as many molecules as the Milky Way has stars. Individual cells when properly nourished, are capable of producing many of their own amino acids, enzymes, and other factors necessary for all metabolic processes. Each cell, in addition to other processes, burns its own energy, maintains itself, manufactures its own enzymes, creates its own proteins, and duplicates itself.<sup>91</sup> It is essential to understand that the total metabolism of the body is the sum of the metabolic operations carried on in each individual cell.

## The Energy Continuum (illustration)



Note: THE TWO MAJOR LIFE FUNCTIONS WHICH CANNOT BE DUPLICATED BY MAN ARE PHOTOSYNTHESIS AND HUMIFICATION

## Growth & Maintenance Nutrients

Scientists have identified at least 90 growth and maintenance nutrients which must be continuously supplied to the body to sustain healthful life. These growth and maintenance nutrients include amino acids, major and trace minerals, vitamins and other nutritional factors.<sup>92</sup> When these factors are supplied to our cells, the cells then create the building blocks for the total metabolic machinery of our life process.

The building blocks present in the metabolic machinery of human beings are (in the great majority of cases) the same as the building blocks contained in the metabolic machinery of other organisms of extremely different types.<sup>93</sup>

Organisms vary in their capacity to produce some of these building blocks internally. Some organisms are capable of producing all amino acids within their cells. Humans can produce all but eight. Some organisms can produce many of the vitamins within their cells. We can only produce one<sup>94</sup>. The very complex processes of all metabolic functions are carried on within the cell. If we fail to supply the cell with the essential growth and maintenance nutrients we will experience a breakdown of these functions. When this breakdown is substantial we have the onset of disease or the manifestation of some related defect.

## Nutritional Deficiencies

Total deficiencies in one or more of the growth and maintenance nutrients which human cells need for healthful metabolism is now a rare occurrence, but substantial deficiencies in the growth and maintenance nutrients is a common factor to every degenerative disease we experience.<sup>95</sup>

## Sick Soils, Sick Plants, Sick People

All naturally fertile soils contain adequate amounts of humic and Fulvic acids produced by resident microbes within the soil. Humic and Fulvic acids assist the plant in obtaining its complete nutrition. Our modern agriculture aims at one goal (with few exceptions) which is market. Food quality is sacrificed for food quantity. Since the farmer is paid by the bushel, yield is paramount to nutritional content. In his frantic effort for yield, he has succumbed to the Pied Pipers of agro-

chemical companies with products to sell. He is further decoyed by bad advice from county agents and higher schools of learning that protect the "grant" status of moneys received from these same agro-chemical companies, who advocate the application of excessive amounts of nitrate fertilizers to the soil. Such practices stun and destroy the indigenous microbial life within the soil. When microbial life is inhibited or destroyed, vital humic and Fulvic acids are exhausted.

## **Gone are the Minerals**

When microbes are depleted from the soils, they are no longer present to convert inorganic minerals into organic minerals needed by plants. Excessive use of nitrate fertilizers inhibits the formation of normal plant proteins and stimulates an overabundance of unused amino acids that attracts insects.<sup>96</sup> Since pests were created to eat diseased plants this introduces the ideal environment for increased infestation because of increased insect food supply. The farmer's reaction is more pesticides and fungicides to save his infested crop. This in turn inhibits or destroys even more vital microorganisms that are essential to mineral conversions to plant nutrients.

## **Unsafe Foods**

These deficient, pesticide laden products are turned into "cash" which the farmer thinks is the bottom line. Lacking in organic trace elements and other nutritional factors, but long on chemical residues from pesticides, insecticides, herbicides, these nutritionally hollow products end up on the tables of America. Without taste, and deficient in organic minerals and nutrients, we peel, boil and overcook what remains and ask, "Why do I hurt?"

## **Can Good Foods Be Found?**

A very small percentage of the agricultural lands of America are fertile enough to produce nutritious and healthy foods. An honest effort in attempting to select a healthful diet from grocery shelves may be a nutritional disaster. Unless you are fortunate enough to organically grow your own foods, supplementation is a necessity.

## **The Vitamin Connection**

In this century common vitamin deficiency diseases have been reduced dramatically due to our awareness of the role of vitamins in nutrition. New breakthroughs are just beginning to emerge in the use of increased dosages for treatment of some ailments. It should be noted however that vitamins cannot complete their function in the cell's metabolism without the presence of certain minerals. This may explain the fascinating effects of humic and Fulvic acids at work in living organisms. Fulvic acid chelates and binds scores of minerals into a bioavailable form used by cells as needed. These trace minerals serve as catalysts to vitamins within the cell<sup>97</sup>. Additionally, Fulvic acid is the most efficient transporter of vitamins into the cell.

## **The Enzyme Connection<sup>98</sup>**

An enzyme is a catalyst that does not enter into a reaction but speeds up or causes a reaction to take place. Enzymes are complex proteins. The burning of glucose in cells for instance, requires the action of several enzymes, each working on the substrate of the previous reaction. Each cell of the body (when properly nourished) is capable of producing the enzymes needed for complete metabolism.<sup>99</sup> Research has shown that Fulvic acid improves enzymatic reactions in cells and produces maximum stimulation of enzyme development.<sup>100</sup> The Fulvic acid molecule often contains within its structure coenzymes and important factors which the cells may utilize in stimulation of enzyme reactions and the manufacturing of, and formation of enzymes<sup>101</sup>.

Fulvic acid will in all probability, be found to be one of the key factors of enzyme reactions with all living cells.

## Free Radicals & Antioxidants

Free radicals are highly reactive molecules or fragments of molecules that contain one or more unpaired electrons.<sup>102</sup> They circulate through the body causing great mischief in bonding to and injuring the tissues. In addition to destroying tissue, they magnify the probability that injured cells will become susceptible to a great many infections and disease, or mutate and cause cancer.

## Super Antioxidants

In recent years frantic efforts have been made to locate and isolate compounds with extraordinary affinity for free radicals. Entire industries have evolved around such efforts, with nearly every vendor of health food products offering suitable solutions. Because of the limited public knowledge concerning the great contribution Fulvic acid plays as a bi-directional super antioxidant, we need to consider certain facts.

## Fulvic Acid and the Free Radical Connection

To gain knowledge of how antioxidants tie up free radicals we must understand their workings, and explode a general misconception. For an antioxidant to bind a free radical the antioxidant molecule must have unpaired electrons of equal and opposite charge to that of the unpaired electrons of the free radical. In a sense the free radical scavenger is itself a free radical or it could not mate and neutralize the destructive effects of free radicals.

## Who Wears the White Hat?

We have found that Fulvic acid is a powerful, natural electrolyte that can act as an acceptor or as a donor in the creation of electrochemical balance. If it encounters free radicals with unpaired positive electrons it supplies an equal and opposite negative charge to neutralize the bad effects of the free radicals. Likewise, if the free radicals carry a negative charge, the Fulvic acid molecule can supply positive unpaired electrons to nullify that charge.

## Antioxidants and Beyond

Being a bio-available chelated molecule that can “also” chelate, Fulvic acid wears the white hat. As a refiner and transporter of organic minerals and other cell nutrients, it has the ability to turn bad guys into good guys by chelating and humanizing free radicals. Depending upon the chemical makeup of the free radical, they can be incorporated into and become a part of life sustaining bio-available nutrients. They may become an asset instead of a liability. In the event that the chemical makeup of the free radical is of no particular benefit, it is chelated, mobilized, and carried out of the body as a waste product.

Bibliography to Fulvic Free Radical Data

Mowrey, Daniel B., Ph. D. (1993). P.34 *Herbal Tonic Therapies*. Keats Publishing Inc.

Todd, Gary Price, M.D., (1985). p.20-24, 113-118, *Nutrition Health & Disease*. Whitford Press.

Stelenk, C.A., & Tollin, G. (1962). "Biochimica Biophysica Acta". p.59, 25-34.

Senesi, N., Chen, Y., & Schnitzer, M. (1977). *Soil Biology & Biochemistry*.

Vaughan, D., Malcolm, R. B., & Ord, I. G. (1985). *Soil Organic Matter & Biological Activity*. Dordrecht, Netherlands: Martinus Nijhoff.  
Jackson, William R., Ph D. (1993). p. 261-282. *Humic, Fulvic and Microbial Balance: Organic Soil Condition*. Evergreen, Colorado.

## The Human Experience

The following public statement was made by the late Dr. Clyde Sandgrin prior to the discovery and naming of active ingredients in humic extract solutions later found to be fulvic acid mineral complexes:

*"If I had to choose between the liquid mineral and electricity, electricity would have to go."*

### Reported claims of benefits are little short of astonishing.

For internal use they are:

- Increased energy
- Alleviates anemia
- Chelates body toxins
- Reduces high blood pressure
- Potentizes vitamin & mineral supplements
- Magnifies the effect of herbal teas and tinctures
- Chelates all monovalent and divalent metals
- Is a powerful natural electrolyte
- Restores electrochemical balance
- Stimulates body enzyme systems
- Helps rebuild the immune system

### Reported claims of external beneficial use:

- Treating open wounds
- Healing burns with minimum pain or scarring
- Eliminating discoloration due to skin bruises
- Killing pathogens responsible for athletes foot
- Acting as a wide spectrum antimicrobial and fungicide
- Treating rashes and skin irritations
- Helping to heal cuts and abrasions
- Helping heal insect bites and spider bites
- Neutralizing poison ivy and poison oak.

## Human Experiences with Fulvic

### The Healing & Regenerative Influences of Low Molecular Weight Humic Substances (Fulvic Acid) On Human Tissues and Cells

Tests<sup>103</sup> were conducted by Dr. W. Schlickewei<sup>104</sup> and five associates<sup>105</sup> at the University Hospital in Freiburg, German, on human patients requiring transplantation or replacement of bone during surgery. The transplantation of bone tissue is required in about 15% of all cases of replacement surgery of the locomotor apparatus, and it is generally applied to reconstitute and repair actual defects in bone.

Human donor tissues have become scarce due to special legal requirements and necessary additional testing because such tissues have a high danger of transmitting the HIV virus and hepatitis. There are also obvious disadvantages to using bone grafts from other areas of the same patient's body because they require a second operation and prolong the length of time in surgery. The only other known substitute source available in large enough quantities for clinical use, was animal bone in the form of inorganic calcium compounds (bovine calcium hydroxyapatite), and although these were well tolerated by the body, they showed no signs of being resorbed.

Remarkable bone regeneration and resorption characteristics were identified when the animal bone implants were impregnated with a low molecular weight Humic substance (Fulvic acid) prior to transplant in to patients. The bone implant then became highly osteoconductive, and served the host tissue as a "guideline" for the deposition of newly developing bone tissue. The same transplant procedure without the Fulvic acid showed no signs of regeneration during the course of the experiment.

While on the lookout for a new group of active agents with the ability to promote wound healing, the doctors came across the Humic substances. The doctors said that the bone resorption is most easily explained by the known ability of humate to induce the activation of leucocytes. They said that previous experiments had established that the Humic substances are able to bind to calcium-containing compounds, stimulate granulocytes, and block the infectivity of the HIV virus.

#### **Summary:**

In this clinical test and previous experiments, Fulvic acid has been shown to activate and stimulate white blood cells, promoting healing, turn inorganic calcium into an organic bio-active cellular regenerative medium conducive to new bone growth, stimulate cellular growth and regeneration, and inhibit the HIV virus.<sup>103</sup>

## Animal Experiments with Fulvic

Early studies with livestock animals were conducted by Dr. Charles S. Hansen, D.V.M. in the state of California from the early 1960's through 1967 on an experimental basis. Dr. Hansen's tests included a blend of Fulvic acid and Humic acid used as a feed additive. He also used Fulvic acid alone as a treatment for specific ailments in livestock. The results of supplement feeding and treatment included.

### Dairy Cows

- After 2 months on supplement no bacterial or viral infections.
- Herd of over 300, after 3 months on supplement, increased butterfat production by 15%
- Herd on supplement cut back on high protein rations with no decrease in production.
- All cows on supplement experienced more complete digestion.
- Cows with bacterial infection (mastitis) treated with 1 pint of Fulvic acid solution recovered to full production in 12 to 24 hours.
- When using antibiotics to treat mastitis the recovery was only 50%-70% after 2-3 weeks.

### Hogs

- Animals on the supplement experienced better and more complete digestion.
- The free choice supplement in 36 hrs acted as an excellent vermicide (de worming agent).
- The supplement completely eliminated Necro, a bloody diarrhea in hogs.

### Mink

- Animals on the supplement experienced more complete digestion.
- When on the supplement were less vicious, more docile.
- Supplemented animals ceased fur chewing.
- Successfully eliminated most diseases common to mink herds.

### Poultry

- Supplementing to feed acted as a vermicide.
- Pullets given supplement were free of most diseases.
- Pullets on supplement experienced more complete digestion of other feeds in diet.
- Pullets on the supplement produced eggs of superior shell hardness and quality.

The results of these early tests support the known benefits which Fulvic acid provides to all living systems, plant or animal. They indicate that Fulvic acid may very possibly become the most important factor in health management in the future.

## Information Concerning Possible Toxic Minerals

*"Poisons in small doses are the best medicines, and the best medicine in too large doses are poisonous." A famous quote by Wm. Withering*

**1.** Consumption of plant derived mineral Fulvic complexes by humans for many years has shown that they will not build up in the body tissues as do metallic minerals. The following observations and theories describe the reasons why:

- a) Cells have the ability to accept or reject minerals, including aluminum, lead, arsenic, mercury, etc., at their discretion when presented as organic Fulvic complexes. It should be considered that these minerals may not necessarily be present to "nourish" cells, but are needed to act as "electrodes" in the Fulvic electrolyte solution. In that capacity they are probably most essential for bioreactions, electron transfer, catalytic reactions, and transmutations.
- b) Fulvic acid carries complexed minerals in "trace" amounts only, at similar levels as is commonly found in healthy plants grown in mineral rich soil under optimum organic growing conditions. These "trace" mineral complexes should not be confused with metallic minerals.
- c) Fulvic acid has the ability to complex and remove toxic metals and other minerals from the system. Fulvic acid mineral solutions have been ingested by people for many years, yet have never been shown to cause toxic mineral buildup in humans.
- d) It is obvious that when metals, minerals, and trace elements become complexed into Fulvic acid, they take on an entirely new property of availability, unlike their original form.
- e) It is when fulvic acid is not present that one should seriously worry about toxic build up from any source. This could account for the health problems that are causing concern today in our "Fulvic starved" society.

**2.** Aluminum makes up 12% of the Earth's crust, and is the most abundant metallic element

- a) Aluminum is found in biological quantities in most plants grown in soil. Most of our food crops contain 20-200 ppm or more of aluminum. In crops today this concentration would normally be in the absence of Fulvic acid.
- b) Known biological function of Aluminum is to activate the enzymes succinic dehydrogenase. It increases survival rate of newborn infants, and according to professor Gerhardt Schrauzer, head of the department of chemistry at UCSD, is an essential mineral for human nutrition.
- c) The Harvard University newsletter recently published a statement that none of the scientific reports regarding the relationship between Alzheimer's disease and aluminum stated what form the aluminum was in.
- d) In a study that appeared November 5, 1992 in the science journal, NATURE, Frank Watt, et al (University of Oxford) used a highly accurate laboratory technique to quantify the levels of aluminum in the brains of Alzheimer's patients. To their great surprise, they found the same levels of aluminum in the brains of non-Alzheimer's control as they did in Alzheimer's patients. Watts believes that aluminum contaminated stains gave faulty results in the early studies that highlighted aluminum as a health risk.

**3. Science is just learning about other supposedly toxic minerals**

- a) It is now generally accepted that arsenic is in fact, in trace levels, an essential element for optimal health and longevity. The levels of arsenic that most people ingest in food or water are not usually considered to be of health concern.
- b) Despite all the adverse health effects associated with arsenic exposure, there is some evidence that low levels of exposure may be beneficial to good health. Test animals maintained on a diet deficient in arsenic did not gain weight normally, and they became pregnant less frequently than the control animals maintained on a diet containing a more normal (but low) concentration of arsenic. Also, the offspring from the deficient animals tended to be smaller than normal, and some died at an early age.
- c) Arsenic has been found to be essential for survivability of newborn babies and also neonatal growth. Arsenic has been shown to promote the growth rate in animals.
- d) Like most plants, tobacco contains trace amounts of cadmium and lead. It is interesting to note that people who smoke tobacco have about twice as much cadmium in their bodies as do nonsmokers. Higher levels of lead are also found in smokers. It would stand to reason that burning converts the natural organic plant forms of these metals.
- e) The metabolic antagonism between mercury and selenium results in the protection from selenium poisoning by mercury and the protection against mercury poisoning by selenium. A mutual antagonism between the two exists.
- f) Taking in too little zinc is at least as important a health problem as taking in too much zinc. Without enough zinc in the diet, people can experience loss of appetite, decreased sense of taste and smell, slow wound healing, and skin lesions. In severe cases in children, too little zinc can cause poorly developed sex organs and dwarfism.

References:

Agency for Toxic Substances and Disease Registry, Public Health Statements: Arsenic, Aluminum, Mercury, Zinc, Selenium, Cadmium, Lead.

Kehoe, R.A., et al.: Manganese, Lead, Tin, Aluminum, Copper and Silver in Normal biological Material. J. Nutr. July, 1940. Pages 85-98.

## Aluminum, Friend or Foe?

### False Information

Undocumented information being disseminated throughout the health food industry regarding aluminum toxicity, has caused undue concern to health conscious individuals everywhere. Because of the persistence of such claims it would be well to examine the issues from the standpoint of documented evidence and reason. Aluminum is one of the most abundant elements on Earth, with one seventh of the Earth's crust being made up of that element. It is never found in its pure form but is always combined with other elements, silica being one of the most common.

### Healing Clays

Aluminum combines with oxygen and silica, to make up the major elements in montmorillonite clays; which people have beneficially used (externally and internally) for thousands of years. Any clay compound found in health food stores contains very high levels (tens of thousands of parts per million) of aluminum. Aluminum is a major component in all soils and enters the food chain at every level, be it plant or animal. If natural compounds of "organic" aluminum were toxic or hazardous to human health, life as we know it on planet Earth would cease.

### Where Did It Start?

Aluminum received a bad rap when a foundry worker in England who pulverized aluminum pellets into powder, died of aluminum toxicity. Without goggles, mask or protective clothing he continued his occupation until he became dysfunctional. At his death an autopsy revealed abnormal quantities of aluminum in his lungs, cells and tissues, all of which contributed to his untimely death. Health advocates immediately manned the torch and spread the word that aluminum is a toxic poison which should be banned in any form from contaminating food, drink or medicine.

### Iron Toxicity

Any major or trace element used under identical circumstances to that of the English foundry worker would produce toxicity. Essential trace elements are "essential" only when used in trace amounts. When used in excess they become toxic (poison). The same is true with the "major" elements such as iron. When used in excess they become toxic. The fact that most natural compounds of aluminum are inert and pass through the system without harm coupled with the fact that aluminum is never found in nature in the pure form, points to the absurdity of the claims that all forms of aluminum are toxic (poison).

### Animals Studies

Controlled studies on rats receiving high levels of aluminum in the form of potassium aluminum sulfate, revealed no appreciable differences between the control groups receiving the aluminum-free diet and animals receiving the "high" aluminum diets. The researchers reported;

*"Minute traces of aluminum were found in the various tissues on all of the diets. The aluminum-containing diets were fed for four generations, with no noticeable differences from the animals on the normal diet in behavior or in growth curves beyond a slightly greater initial growth in the rats receiving aluminum."*

An investigation similar to that above was conducted on dogs. As was the case with rats, smaller amounts of aluminum were found in the tissues of the normally fed dogs, and these amounts were not appreciably changed except in the liver,

following prolonged ingestion (three months) of aluminum in amounts of 230 ppm and 1550 ppm daily (6 and 2 animals respectively). No detrimental effects were noted in the health of the animals.

A few analyses for aluminum in human autopsies are reported. These in general are in accord with the figures reported for the rat and dog, with the exception that the figures for the liver are lower and for the heart and brain higher.

## Poison from the Garden

Most food crops contain 20-200 parts per million of aluminum; **with beans testing 1640 parts per million**<sup>106</sup> (46.5 mg per ounce). The internationally recognized, Oregon State University scientist, Dr. Melvin N. Westwood, states; that of the thousands of analysis of plant and fruit fibers which he has tested, not one sample has ever shown the absence of aluminum. Nor does he believe that samples run in an “aluminum-free” culture could be grown without the presence of aluminum... since **all** seeds contain that element.

All green-leafy vegetables used in salads and green-drinks contain “high” levels of aluminum. Onions are especially high in aluminum, and the strawberry receptacle is loaded with natural compounds of “organic” aluminum. Reported in parts per million; mint leaves contain 160 ppm plantain leaves 56 beets 28 beet leaves 72 with various marine algae 40-98 ppm of aluminum. Even our good friends such as spinach contain 102 ppm of aluminum. If natural forms of aluminum are toxic why do we classify most of the above as health foods? And here again what of the question of build up in the body?

## The Alzheimer’s Myth

Beans and other legumes are especially high in aluminum (1640 ppm) which simply stated, means that if natural forms of aluminum contributed in any way to Alzheimer’s disease, all ethnic groups eating legumes as a staple part or their diet would manifest epidemic numbers suffering from Alzheimer’s disease. We would suggest that anyone believing that all forms of aluminum are toxic should use extreme caution in eating anything from the garden.

## The Team

Nutrients always work as a team. When there is an abnormal concentration of one element, it results in an upset metabolic balance. Human effort to produce super concentrates of any nutrient with total disregard to the overall systems ability to deal with the same element in high concentration is a deadly poison. Organic arsenic in trace amounts is essential, yet in higher concentrations is a poison. Selenium in trace amounts is absolutely essential. The same element in high concentrations is a deadly poison. Organic arsenic in trace amounts is essential, yet in higher concentration is a poison. (We should not mistakenly assume that because certain elements are lethal in high concentrations, that they are also harmful in “trace” amounts.) (Such concentrates, results in harm to the user.)

## To Be, Or Not To Be (Natural & Unnatural)

All trace elements found in organic beds of ancient origin must be assumed to be of importance. These elements have been placed there by nature and not by man. Because we find natural forms of aluminum in all our food chains we cannot assume that “plant derived” aluminum is non-essential. To refine out aluminum, arsenic and other trace elements from minerals extracted from naturally occurring organic beds, is to change from a “natural” to an “unnatural” state. To refine out aluminum, arsenic and other trace elements from minerals extracted from naturally occurring organic beds, is to change from a “natural” to an “unnatural” state.

Since organic aluminum is in all plant foods without exception, one of the surest methods of determining whether a product is natural is the presence (or absence) of aluminum. If there is no aluminum it cannot be natural. All we need to clear our vision concerning the essential nature of trace elements is to review the literature with respect to trace-elements once considered nonessential and see the surprising number of those same elements that have since been discovered to be "very" essential. To be "slow-learners" is better than to be "no-learners" even if we do have to eat humble pie.

In all likelihood, Aluminum (as contained in plants) may yet prove to be one of our closest friends. (Especially in the complex with fulvic acid.)

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## Colloidal Minerals vs. Complex Minerals.

### Definition of Colloid and Colloidal

"A colloid is: A state of matter in which the matter is dispersed in or distributed throughout some medium called the dispersion medium. The matter thus dispersed is called the disperse phase of the colloid system. The particles of the disperse phase are larger than the ordinary crystalloid molecule, but not large enough to settle out under the influence of gravity."<sup>107</sup>

"Colloids as defined in physical chemistry are: (a). A colloidal system, one in which a finely divided solid is suspended in a liquid: such colloids range from solutions to gels (b). A colloidal suspension. (c). A substance that when suspended in a liquid will not diffuse easily through vegetable or animal membrane."<sup>108</sup>

According to Remington's Pharmaceutical Sciences: "colloidal mineral particles each consist of many aggregates, and each aggregate contains many molecules." Thus it stands to reason that colloidal minerals exist in particle sizes many times larger than some other mineral forms.

Because of their size, colloidal minerals are not absorbed by the body.<sup>109</sup>

*"A colloidal mineral is one that has been so altered that it will no longer pass through cell walls or other organic membranes."*<sup>110</sup>

*Dr. Royal Lee*

## Fulvic Acid and Colloid Questions and Answers

**Q.** What is a colloid?

**A.** Colloids are solid particles of extremely small size that (when mixed with a liquid) will not settle out. If the particles dissolve they are no longer colloidal but are dissolved solids. Undisclosed colloids or particles will always reflect light to a greater or lesser degree. Depending on the number & size of the particles present.

**Q.** How can the ordinary person determine if a solution contains colloidal minerals?

**A.** All colloids in suspension reflect light. Using a laser pen-light a person can direct its beam through a solution supposedly containing colloids. If colloids are present the beam will be distinct and very visible, depending upon the strength of the solutions. If there are no colloids present there will be no visible beams. Any product claiming to be colloidal minerals but which produces no visible beam with a laser, is falsely labeled colloidal.

**Q.** Do plants produce & use colloidal minerals?

**A.** Plants do not produce or use colloidal minerals.

**Q.** How then, do plants get needed minerals?

**A.** Plants do not produce nor use colloidal minerals but are supplied dissolved mineral complexes from soil microorganisms that can and do use colloidal minerals. Through photosynthesis, plants manufacture sugars and exude some of these mucopolysaccharides at the root level. Being slippery the mucopolysaccharides lubricate the soil and help the roots enlarge and grow. Microorganisms relish polysaccharides and rapidly increase in numbers. In return, the microorganisms supply soluble, organo-complexed minerals that plants need for health and vital growth.

**Q.** What happens when the microorganisms that supply essential organo-complexed mineral are destroyed?

**A.** The plants lose their flavor, nutrition and vitality, and humans develop deficiency diseases in epidemic proportions.

**Q.** Has the microorganism-produced biochemical been identified that is responsible for complexing and mobilizing minerals for assimilation by plants, and in turn animals and humans?

**A.** Yes, this extremely complex substance has been isolated. It is called Fulvic acid and is produced in extremely small amounts in organically rich soils teaming with vital microorganisms.

**Q.** Can, or has Fulvic acid ever been synthesized?

**A.** No, nor is it ever likely to be, considering the extremely complex nature of the material.

**Q.** Has Fulvic acid ever been extracted commercially?

**A.** Yes, but beware of counterfeits.

**Q.** How is it extracted?

**A.** It is extracted from ancient composted material from once living matter and contains all the major and trace elements present when these organically rich deposits were laid down. Fulvic acid chelates, solubilizes and

complexes all monovalent and divalent minerals into bio-nutrients of the highest degree of absorbability for both plants and animals. It is the strongest natural electrolyte known, and is capable of potentizing and enhancing the beneficial effects of the various nutrients, herbs or tinctures with which it may be combined. Without it life would cease to exist as we know it.

**Q.** In what amounts can it safely be used?

**A.** Since it is a catalyst as well as a cell nutrient and an extremely effective antioxidant, it should be used with all prudence and reason.

**Q.** Does Fulvic acid contain colloidal minerals?

**A.** No, Fulvic acid does not contain colloidal minerals (suspended particles) but contains complexed and dissolved minerals and trace elements in the same form our Creator intended for us to use them.

**Q.** When Fulvic acid is used to complex or dissolve other metals or minerals, will it then respond to the laser light?

**A.** When Fulvic acid is used to complex other metals or minerals, they become complexed and dissolved becoming a part of the life-giving molecule of which Fulvic acid is composed. Therefore metals and minerals complexed with Fulvic acid will not respond to the laser light; hence a Fulvic solution containing hundreds, or thousands of parts per million (ppm) of dissolved metal or minerals will not respond to a laser light. There are no suspended particles in solution to reflect light.

## Myths

**Myth:** Plant roots turn metallic minerals into colloids.

**Truth:** Fulvic acid created by microbes turn metallic minerals into molecular complexes, which in turn are available to plant roots.

**Myth:** Extracts from ancient Humic deposits contain colloidal minerals.

**Truth:** Extracts from ancient Humic deposits contain Fulvic acid mineral complexes in varying ratios and concentrations.

**Myth:** Colloids are readily absorbable by human or plant cells.

**Truth:** The term “colloids” was incorrectly used by some confused individuals, and the industry has continued to build upon it. True colloidal minerals are not readily absorbable, except for a low number in some samples that have been reduced to ionic size. These would still be metallic in form and not good for the body. The term colloids is being mistakenly used to refer to Fulvic acid complexes, which are readily absorbable and in the perfect electrolyte form to react with cells.

**Myth:** The T.J. Clark, Rockland Mine, and related small claims in Emery County, are the only ones of their kind to have ever been discovered.

**Truth:** There are considerable other deposits far richer than these claims. Fulvic acid is continually being formed wherever substantial amounts of Humic material, microbes, and suitable culture conditions exist. It can be found worldwide.

## Analysis of Fulvic Acid

### Structure Problem

An accurate evaluation of the trace minerals and elements in the chelated structure of Fulvic acid is complicated by the fact that no scientific attempts to identify its molecular structure have succeeded to date.<sup>111</sup> It is known that Fulvic acid is a substance that is continuously formed by microbes from decaying plant and animal matter. Many of the beneficial effects of Fulvic acid to plants and animals are also known and the list is increasing dramatically. Still only the microbes who formed Fulvic acid know how to make it and how it is structured. Every human attempt to either duplicate it or unmask its structure has failed.

### Mineral Affinity

Though Fulvic acid is usually found having a molecular weight of less than 700, it is capable of complexing or chelating 2 to 6 times more metals than other higher molecular weight complexing agents.<sup>112</sup>

Russian scientists conducted some comparative studies on weathering which involved the chelation of inorganic minerals into the Fulvic acid complex. The Fulvic acid was brought to a neutral solution by the 100th day of the testing but continued to actively chelate through 200 days. Another 200 days were added to the experiment and the chelating action still continued. The experiment was concluded without knowing how long the action would continue.<sup>113</sup>

### Cellular Action

It is known also that Fulvic acid is readily admitted into living cells. This may be in part to its low molecular weight, its electrical potential, its biotransporting ability or factors yet to be discovered. It is known however that once inside the living cell it participates in selective trading or supply of minerals and other nutrient factors inside the cell.<sup>114</sup> In addition to supplying essential nutrients to the cell it has been shown that the Fulvic acid can chelate toxins reducing them to a harmless state. The Fulvic and Humic acids are effective in neutralizing such a wide range of toxic materials from heavy metals, radioactive waste, petro-chemicals and industrial waste that tests are soon to be conducted on a new system designed to compost land fill refuse using the Fulvic and Humic acids to safely render all toxins harmless. On the cellular level Fulvic acid is superior for neutralizing toxins, heavy metals and other harmful substances and carrying these intruders out of the body.<sup>115</sup>

### Conventional Testing Approaches

Having established the ability of Fulvic acid to chelate or complex with minerals and other micro-nutrients, and its ability to carry these factors into the cells while picking up harmful substances in exchange for safe disposal out of the cell, let us now turn to the challenge of finding out what the Fulvic acid had chelated with. Reports from a distributor of a mineral solution which contained an unknown amount of Fulvic acid reveled that conventional Mass Spec tests submitted to several laboratories resulted in large variations for the same samples of the material. The variances in the total minerals shown were from under 40 to over 50 and this on the same sample. The variance in the amounts of each mineral present in the analysis ran from 50% to 60% difference in detected amounts. These kinds of results were of no value at all. This experience is not unusual with any conventional testing of Fulvic or Humic acid. Whether one used Mass Spec, Atomic Absorption, Fire Assay or other conventional detection approaches to find out what is complexed into these natural organic acids, and in what specific amounts, you will never come up with a uniform result. There are obvious factors in both the Fulvic and Humic acid complexes which at times mask

elements from view and at other times show such high readings as to be totally out of reason. The key to unlock this riddle is yet to be discovered or announced to the scientific community. It may be reasonable to assume that this discovery will appear upon the heals of the discovery of the molecular structure of Fulvic and Humic acids.

### **Analysis Information and Observations by two Major Producers of Fulvic Acid Containing Mineral Extracts.**

What Westwood Enterprises says about analysis of their product:

1. "Through the cross reference of various tests we have had run on the Fulvic acid mineral complex that we produce, we are confident that it contains 60 trace minerals elements. The nature of our source for Fulvic acid clearly reveals that it is resting in the material from which it was originally formed by the microbes. This fact insures that it has chelated all the elements and minerals in its complex from the balance of these elements which exists in living things."
2. "We do have various Mass Spec laboratory reviews that were done on our product. Those reviews vary significantly in both quantity (ppm) and number or variety of minerals and elements from one lab to the next even on the same sample. An overview of all reports, and an averaging of data shows what we felt to be a reasonable estimation. These tests do show however that in a cross section of all reports, there are in excess of 60 trace minerals in our natural Fulvic acid solutions."
3. "In reviewing our Mass Spec laboratory reports for publishing, we have determined that they also contain confidential information relating to, and combined, with proprietary research on new products and procedures which are yet unknown to the industry. Reports for public review will be available in the future."

What T.J. Clark & Company says in regard to an analysis:

1. "Using a metal assay (analysis), as a tool to select a trace mineral product for human consumption is not a valid use, except to show the levels of potentially toxic materials."
2. "There are literally millions of potential complexes that can exist in this environment. It is impossible to break these colloids down and give you an accurate picture of each one. Most of these complexes have not been identified and the knowledge does not exist to explain their function." Analysis explanation, from T.J. Clark official literature and directive.
3. "With the standard method of testing, known as spectroscopy, the results are only approximate and are variable from lab to lab. To our knowledge there are only two super electron microscopes in the country that could possibly detect particles down to the size of the very small colloids found in our product. No known method can establish the exact form they are in."
4. "These assays are limited in their ability to detect the very small colloids and none of them are equipped to determine the complexed from they are in, or if they are truly plant derived." In a Technical International, Inc., on the T.J. Clark & Company letterhead.

## Radioactive Reactions with Fulvic and Humic Substances

**According to Szaloy, radioactive elements react with Humic substances and require only a brief time until equilibrium is reached.<sup>116</sup>**

F.W. Pauli stated that the solubility, migration, and accumulation of uranium are influenced by Humic and Fulvic acids. The fuel discharged from the light water reactors is contaminated with substantial amounts of plutonium and uranium. These ions react with Humic compounds at a much more rapid rate than do copper, nickel, lead, or cadmium ions. <sup>117</sup>

Pillai and Mathew agreed that it would not be unrealistic to presume that the geochemical behavior of plutonium and uranium is influenced by Humic substances. They reported the presence of plutonium in purified organic material extracted from coastal sediments and indicated the possibility of the accumulation of plutonium on organic surfaces because the concentration of plutonium increased over time. As they confirmed that the organic matter solubilized the plutonium, they discovered that the addition of organic matter inhibited the hydrolysis and precipitation of the added plutonium. It was further reported that this scenario duplicates the action with uranium and other radioactive elements.

<sup>118</sup>

Rashid stated that nuclear reactor wastes contain unused uranium, the basic fuel, and long-lived fission product nuclides and actinides, including plutonium, strontium-90, zirconium-95, iodine-129, cesium-137 and cesium 135, all in abundance. Activated metals such as cobalt-60, iron-59, and manganese-54 also are present in reactor waste. He states that the basic reactions of these materials with humic substances are parallel to those of other transition and trace metals.

<sup>119</sup>

*"Radioactive elements have an affinity for Humic and Fulvic acids. They form organometal complexes of different adsorptive stability and solubility. Uranium and plutonium are influenced by Humic substances as are other polluting metals, each being solubilized and absorbed, thereby annihilating that specific radioactivity."* <sup>120</sup>

## Fulvic Acid & Vegetal Silica

### Most Calcium Supplements Don't Seem To Be Effective

It has become obvious that calcium supplements are not working properly. People continue to suffer deficiency and degenerative diseases in spite of efforts from the medical profession to remedy the problem. People that have had large amounts of calcium in their water supply, milk, and other mineral sources, show no improvement either.

How is the human body meant to obtain calcium? It is a well known fact that the human body was meant to eat a diet high in fresh fruits, vegetables, and grains. In that knowledge is the answer and key to the problem.

### Fulvic Acid & Vegetal Silica

Fresh food crops grown in balanced organic soil, high in compost and teaming with microbes would contain ample Fulvic acid and vegetal silica. Yet today our crops are grown in near sterile soil with few microbes, little Fulvic acid, and are picked, refrigerated and stored until they are often not very fresh anyway. Yet how would vegetal silica and Fulvic acid help with calcium?

### Vegetal Silica Trans mutates into Calcium

The public will be interested to learn that major calcium benefits are best derived from vegetal silica and not from calcium. As more and more information is discovered about the profound importance of silica in the human diet, noted researchers are suggesting that silica should be listed as an "essential" element. Among those researchers is Professor Louis C. Kervran, a former Minister of Health in France. Aided by the official laboratories of France, Kervran and associates concluded that the calcium needed by animal cells seldom is derived from mineral calcium, rather, it is the product of "biological transmutations" from silica and other elements.

### Professor Louis C. Kervran's Research

They found that chickens totally deprived of calcium produced soft shelled eggs. When "mica" was added to their diets, the hens' ability to lay calcium rich, hard shelled eggs was restored. Mica contains no calcium; but, it does contain potassium and silica, both of which can be biologically trans mutated into calcium.

Kervran found that an analysis of incubated chicken eggs revealed that hatched chick's contained 400% more calcium than did the egg from which they came. Examination of eggs prior to incubation, revealed the yoke and the white to be separated from the shell by a membrane rich in organic silica. After incubation, the membrane was no longer present. The silica had trans mutated into calcium, which accounted for the four fold increase of calcium in the hatched chicks.

These same researchers conducted other controlled animal experiments. When vegetal silica was added to the diets of animals with broken bones, the bones healed much faster and stronger than the bones of a control group of animals deficient in vegetal silica but rich in mineral calcium.

### Absence of Silica in Conjunction with Degenerative Disease

Patients with degenerative diseases nearly always show a considerable deficiency of silica in their bodies. It has been found that geographical areas rich in vegetal silica have lower cancer rates, while the opposite is true of locales with high calcium intake and low soluble silica.

It becomes obvious then, that Fulvic acids complexed with vegetal silica, which is in nature perfect organic plant form, can provide components necessary for transmutation to calcium in our bodies. Fulvic acid has been found to be especially good at dissolving organic silica. Fulvic acid also provides the perfect electrolyte to allow bio reactions associated with transmutations of minerals to take place in the cell. It is believed through observations, that vegetal silica complexed with Fulvic acid has the unique ability to help dissolve metallic minerals in diseased tissue and trans mutate and relocate useable new mineral complexes to other areas needed by the body.

### **Vegetal Silica vs. Mineral Silica**

Professor Kervran also found that vegetal silica transforms to mineral silica as plants age or over mature. Experiments showed that the mineral silica became more harmful because it decalcifies the body.

So it is important to realize that only young fresh rapidly growing plants contain soluble vegetal silica. And it is important to know that this form of silica in conjunction with natural enzymes and biofactors found in Fulvic acid, most likely maximizes benefits essential to production of calcium in our bodies.

It is also important to understand that most commercial sources of vegetal silica are unreliable as to the age and maturity of plants, and often contain mature mineral silica. Farmers and suppliers will often sell whatever they can get to meet market demand. They don't really understand the implications.

It is important to bear in mind that it is imperative to have a very reliable source to obtain high concentrations of helpful vegetal silica. It must be harvested from actively growing young plants to be of proper benefit.

Ultimately the answer to the calcium crisis lies in the human consumption of crops grown under optimum organic conditions with abundant natural Fulvic acid and trace minerals that would be high in soluble vegetal silica. In the mean time supplementations with Fulvic acid complexed with vegetal silica extract will accomplish similar results.

### **Noted Observations Concerning Fulvic Acid, Vegetal Silica, & Arthritis**

Fulvic Acid and vegetal silica appear to have the unique ability to interact positively with degenerative calcium deposits and unhealthy cone structures in the body.

Arthritis sufferers taking a combination of Fulvic acid and vegetal silica have noticed an immediate and marked increase in discomfort, and this has continued for 1 to 2 weeks or sometimes longer after beginning of use.

This discomfort is believed to be due to the breakdown of calcium deposits in the joints and its ongoing and subsequent mobilization, dissolution, and removal.

It is further believed that these calcium deposits react with the Fulvic acid minerals, and silica and trans mutate in to more suitable forms that become beneficial to the body.

After the painful period, the discomfort begins to diminish and noted relief of symptoms begins. Some arthritis sufferers notice the beginning of relief in 2 to 3 weeks. Others may take longer, yet show signs of relief after several months of use.

Some people notice significant relief of arthritis symptoms in about 30 days.

A significant number of people report total relief in 1-5 months.

## Science has a Lesson to be Learned

### The Wisdom of Man, and the “Theory” of Chemical Fertilizers

#### The Story of Justis von Liebig

The man that is given credit for being responsible for the origin of chemical fertilizers is Justis von Liebig. You might call him the “Father of N-P-K” (nitrogen, phosphorus, potash), because of his agricultural studies and discoveries with regards to the use of these three elements. He lectured before the British Association for the Advancement of Science. His reasoning was that one could analyze the produce of an acre and return the nutrients removed, along with adding a little extra. He argued that man and animals received nourishment and support from plants, whereas plants derive their means from only inorganic substances. These lectures took place in about 1841. Eventually he was convincing enough that they accepted his “build up program.” Agricultural science went on from that day to build their entire basis on his premise, and has continued to this day in these practices without ever looking back.

In 1843, Justis von Liebig recorded the following observations concerning his previous work, but it was too late, few listened:

“I had sinned against the wisdom of our Creator, and received just punishment for it. I wanted to improve his handiwork, and in my blindness, I believed that in this wonderful chain of laws, which ties life to the surface of the earth and always keeps it rejuvenated, there might be a missing link that had to be replaced by me this week powerless nothing.

“The law, to which my research on the topsoil led me, states, ‘On the outer crust of the earth, under the influence of the sun, organic life shall develop’. And so, the great master and builder gave the fragments of the earth the ability to attract and hold all these elements necessary to feed plants and further serve animals, like a magnet attracts and holds iron particles, so as no piece be lost. Our master enclosed a second law unto this one, through which the plant bearing earth becomes an enormous cleansing apparatus for the water. Through this particular ability, the earth removes from the water all substances harmful to humans and animals all products of decay and putrefaction, of perished plant and animal generations.

“What might justify my actions is the circumstance, that a man is the product of his time, and he is only able to escape the commonly accepted views if a violent pressure urges him to muster all of his strength to struggle free of these chains of error. The opinion, that plants draw their food from a solution that is formed in the soil through rainwater, was everyone’s belief. It was engraved into my mind. This opinion was wrong and the source of my foolish behavior.

“When a chemist makes mistakes in rating agricultural fertilizers, don’t be too critical of his errors, because he has had to base his conclusions upon facts which he can’t know from his own experience, but rather, he has to take from agricultural <sup>35</sup> texts as true and reliable. After I learned the reason why my fertilizer wasn’t effective in the proper way, I was like a person that received a new life. For along with that, all processes of tillage were now explained as to their natural laws. Now that this principle is known and clear to all eyes, the only thing that remains is the astonishment of why it hadn’t been discovered a long time ago. The human spirit, however, is a strange thing; ‘Whatever doesn’t fit into the given circle of thinking doesn’t exist’.”

#### References:

1. Liebig, J. v. 1841. Organic chemistry and its application to agriculture and physiology. Translated by J.W. Webster and Owen J. Cambridge.
2. Liebig, J. v. 1843. Translation and observations from family members; Available 1992, Switzerland. Provided by David Larson and Charles Martin. Translated to an unpublished memo.
3. Liebig, J. v. 1856. On some points of agriculture chemistry. Journal of the Royal Agriculture Society, 17, 284-326.

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## Footnotes

- <sup>1</sup> Senesi, N. (1990). *Analytica Chimica Acta*, 232, 51-75. Amsterdam, The Netherlands: Elsevier.
- <sup>2</sup> Vital electrolytes – Baker, W.E. (1973). *Geochimica et Cosmochimica Acta*, 37, 269-281.
- <sup>3</sup> Gamble, D.S., & Schnitzer, M. (1974). *Trace Metals and Metal-Organic Interactions in Natural Waters*. Ann Arbor, Mi: Ann Arbor Science.
- <sup>4</sup> Power of an electorlyte – Crile, G. (1926). *A bipolar theory of living porcesses*. New York: McMillan.
- <sup>5</sup> Decrease in electrical potential- Crile, G. (1926). *A bipolar theory of living porcesses*. New York: McMillan
- <sup>6</sup> powerful electrolyte – Jackson, William R. (1993). *Humic, Fulvic and Microbial Balance: Organic Soil Conditioning*. 329. Evergreen, Colorado: Jackson Research Center.
- <sup>7</sup> New Electronic Encyclopedia. (1991). *Photosynthesis*. Grolier Electronic Publishing.
- <sup>8</sup> Donor and acceptor – Jackson, William R. (1993). *Humic, Fulvic and Microbial Balance: Organic Soil Conditioning*. Evergreen, Colorado: Jackson Research Center.
- <sup>9</sup> Donor and receptor – Rashid, M.A. (1985). *Geochemistry of marine humic substances*. New York: Springer-Verlag.
- <sup>10</sup> Donor, receptor- Sposito, G., Holtzclaw, K.M., LeVesque, C.S., & Johnston, C.T.(1982). Trace metal chemistry in aridzone field soils amended with sewage sludge. II. Comparative study of the fulvic acid fraction. *Soil Science Society America Journal*, 46, 265-270.
- <sup>11</sup> Mineral complexes in fulvic may serve as electrodes – Rashid, M.A. (1985). *Geochemistry of marine humic substances*. New York: Springer-Verlag.
- <sup>12</sup> Free radical – Senesi, N. (1990) *Analytica Chmica Acta*, 232, 51-75. Amsterdam, The Netherlands: Elsevier.
- <sup>13</sup> Free radical – Senesi, N., Chen, Y., & Schnitzer, M. (1977b). The role of humic acids in extracellular electron transport and chemical determination of pH in natural waters. *Soil Biology and Biochemitstry*, 9, 397-403.
- <sup>14</sup> Oxidation reduction – Senesi, N., Chen, Y., & Schnitzer, M. (1977b). The role of humic acids in extracellular electron transport and chemical determination of pH in natural wates. *Soil Biology and Biochemistry*, 9, 397-403.
- <sup>15</sup> Dissolves metals and minerals – Ong, H.L., Swanson, V.D., & Bisque, R.E. (1970) *Natural organic acids as agents of chemical weathering* (130-170). U.S. Geological Survey Professional Paper 700 c. Washngton, DC: U.S. Geological Survey.
- <sup>16</sup> Enhance and transport nutrients – Christman, R.F., & Gjessing, E.T. (1983). *Aquatic and terrestrial humic materials*. The Butterworth Grove, Kent, England: Ann Arbor Science. Also: Prakash, A. (1971). Terrigenous organic matter and coastal phytoplankton fertility. In J.D. Costlow (Ed), *Fertility of the sea*, 2, 351- 368. (*Proceedings of an International Symposium on Fertility of the Sea*, Sao Paulo, Brazil, London, and New York: Gordon and Breach Science)
- <sup>17</sup> Enhance and transport nutrients – Prakish, A. (1971). *Fertility of the Sea*, 2, 351-368.
- <sup>18</sup> Williams, S. T. (1963). Are antibiotics produced in soil? *Pedobiologia*, 23, 427-435.
- <sup>19</sup> Stimulate growth- Konovona, M.M. (1966). *Soil organic matter*. Elmsford, NY: Pergamon.
- <sup>20</sup> All known vitamins in soil – Konanova, M. M. (1966). 52 *Soil organic matter*. Elmsford, NY: Pergamon.
- <sup>21</sup> Many times its weight- Deb, B. C. (1949). The movement and precipitation of iron oxides in podzol soils. *Journal of Soil Science*, 1, 112-122.
- <sup>22</sup> Catalyzes enzyme reactions – Khristeva, L. A., Luk'yanenko, M.V. (1962). Role of physiologically active substances in soil-humic acids, bitumens and vitamins B, C, P-P A and D in the life of plants and their replenishment. *Soviet Soil Science*, 10, 1137-1141.
- <sup>23</sup> Fulvic and enzymes – Pardue, H.L., Townshend, A., Clere, J.T., VanderLinden (Eds.), (1990, May 1). *Analytica chimica Acta*, Special Issue, *Humic and Fulvic compounds*, 232 (1), 1-235. (Amsterdam, Netherlands: Elsevier Science Publishers)
- <sup>24</sup> Increase assimilation- Buffle
- <sup>25</sup> low molecular weight, Aiken, G.R., McKnight, D.M., & VacCarthy, P.1985). *Humic substances of soil, sediment and water*, New York: Wiley-Interscience.
- <sup>26</sup> Sensitize cell membranes- Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Spriner- Verlag.
- <sup>27</sup> Stimulte metabolism-Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer-Verlag.

- 28 Genetic and growth-Jackson, William R. (1993). Humic, Fulvic and Microbial Balance: Organic Soil Conditioning, 538. Evergreen, Colorado: Jackson Research Center.
- 29 Oxygen is absorbed – Kononova, M.M. (1966). Soil organic matter. Elmsford, NY: Pergamon.
- 30 Rapid transport to shoots- Kononova, M.M. (1966). Soil organic matter. Elmsford, NY: Pergamon
- 31 immune system – Syltic, P.W. (1985). Effects of very small amounts of highly active biological substances on plant growth. Biological Agriculture and Horticulture, 2, 245-269; and, Research reports and studies, Appropriate Technology Ltd. Dallas, TX: Murray Sinks II of ATL (Publisher).
- 32 Modify damage by toxic compounds – Christman, R.F., & Gjessing, E.T. (1983). Aquatic and terrestrial humic materials. The Butterworth Grove, Kent, England: Ann Arbor Science. Also: Prakash, A. (1971). Terrigenous organic matter and coastal phytoplankton fertility. In J.D. Costlow (Ed.), Fertility of the sea, 2, 351-368. (Proceedings of an International Symposium on Fertility of the Sea, Sao Paulo, Brazil, London, and New York: Gordon and Breach Science)
- 33 enviromental chemicals -
- 34 paraquat – Fisher, A.M., Winterle, J.S., & Mill, T. (1967). Primary photochemical processes in photolysis mediated by humic substances. In R.G. Zika & W. J. Cooper (Eds). Photochemistry of environmental aquatic system (141-156). (ACS Symposium Series 327). Washington DC: American Chemical Society.
- 35 Pesticides – Aiken, G.R., McKnight, D.M., & MacCarthy, P. (1985). Humic substances os oil, sediment and water. New York: Wiley-Interscience.
- 36 Radioactive properties – Szalay, A. (1958). The signifi- icance of humus in the geochemical enrichment of uranium. Proceedings of the 2<sup>nd</sup> International Conference on the Peaceful Uses of Atomic Energy, 2, 12-186 (London: Pergamon)
- 37 dissolves and weathers silica- Huang, W.H., & Deller, W.D. (1970). Dissolution of rock-forming silicate minerals in organic acids; simulated firststage weathering of fresh mineral surfaces. American Mineralogical Journal, 55, 2076-2094.
- 38 Dissolves silica- Kodama, H., Schnitzer, M., & Jaakkimainen, M. (1983). Chlorite and biotite weathering by fulvic acid solutions in closed and open systems. Canadian Journal of Soil Science, 63, 619-629.
- 39 Transmutate or synthesis of new minerals – Shnitzer, M., Dodama. H. (1977). Reactions of minerals with soil humic substances. In J.B. Dixon & S.B. Weed (Eds.), Minerals in soil environments (Chap.21)). Madison, WI: Soil Science Society of America.
- 40 See “The Fulvic Acid, Vegetal Silica Miracle” later in this report, and further documentation of Kervran, Louis C., Biological Transmutations.
- 41 Cell elongation – Poapst, P.A., & Schnitzer, M. (1971). Fulvic acid and adventitious root formation. Soil Biology and Biochemistry, 3,215-219.
- 42 Enhance permeability of cell membranes – Christman, R.F., & Gjessing, E.T. (1983). Aquatic and terrestrial humic materials. The Butterworth Grove, Kent, England: Ann Arbor Science. Also: Prakash, A. (1971). Terrigenous organic matter and coastal phytoplankton fertility. In J.D. Costlow (Ed.), Fertility of the sea, 2, 351-368. (Proceedings of an International Symposium on Fertility of the Sea, Sao Paulo, Brazil, London, and New York: Gordon and Breach Science) low molecular weight, Aiken, G.R., McKnight, D.M., & VacCarthy, P. 1985). Humic substances of soil, sediment and water, New York: Wiley – Interscience.
- 43 Sensitizing agent – Prakash, A. (1971). Terrigenous organic matter and coastal phytoplankton fertility. In J.D. Costlow (Ed.), Fertility of the sea, 2, 351-368. (Proceedings of an International Symposium on Fertility of the Sea, Sao Paulo, Brazil, London, and New York: Gordon and Breach Science)
- 44 increase metabolism of proteins – Christman, R.F., & Gjessing, E.T. (1983). Aquatic and terrestrial humic materials. The Butterworth Grove, Kent, England: Ann Arbor Science. Also: Prakash, A. (1971). Terrigenous organic matter and coastal phytoplankton fertility. In J.D. Costlow (Ed.), Fertility of the sea, 2, 351-368. (Proceedings of an International Symposium on Fertility of the Sea, Sao Paulo, Brazil, London, and New York: Gordon and Breach Science)
- 45 proteins, DNA, RNA – Khristeva, L.A., Soloche, K.I., Dynkina, R.L., Kovalenko, V.E., & Gorobaya, A.I. (1967). Influence of physiologically active substances of soil humus and fertilizers on nucleic acid metabolism, plant growth and subsequent quality of the seeds. Humus et Planta, 4, 272-276.
- 46 Proteins, DNA, RNA – Jackson, William R. (1993). Humic, Fulvic and Microbial Balance: Organic Soil Conditioning, 569-570. Evergreen, Colorado: Jackson Research Center.
- 47 Synthesis of RNA and DNA – Khristeva, L.A. (1968). About the nature of physiologically active substances of the soil humus and of organic fertilizers and their agricultural importance. In F.V. Hernando (Ed.), Pontifica academec scientarium citta del vaticano (701-721). New York: John Wiley.
- 48 Catalyst to vitamins within the cell – Williams, Dr. Roger J. (1977). The Wonderful World Within You. Bio-Communications Press. Wichita, Kansas.

- 49 Transport metal ions – Schnitzer, M., & Khan, S.U. (1972). Humic substances in the environment New York: Decker. 53
- 50 Acidity of fulvic acid – Schnitzer, M. (1977). Recent findings of the characterization of humic substances extracted from soils from widely differing climatic zones. Proceedings of the Symposium on Soil Organic Matter Studies, Braunschweig (117-131).
- 51 Environment with adequate oxygen – Schnitzer, M. (1977). Recent findings of the characterization of humic substances extracted from soils from widely differing climatic zones. Proceedings of the Symposium on Soil Organic Matter Studies, Braunschweig (117-131).
- 52 Low molecular weight – Aiken, G. R., McKnight, D.M., & MacCarthy, P. 1985). Humic substances of soil, sediment and water, New York: Wiley-Interscience.
- 53 Absorption by cells – Azo, S. & Sakai, I (1963). Studies on the physiological effects of humic acid. Part 1. Uptake of humic acid by crop plants and its physiological effects. *Soil Science and Plant Nutrition*, 9(3), 1-91. (Tokyo)
- 54 translocation of trace elements to leaf tissues – Aiken, G.R., McKnight, D.M., & VacCarthy, P. 1985). Humic substances of soil, sediment and water, New York: Wiley-Interscience.
- 55 Important for the health of plants – Christman, R.F., & Gjessing, E.T. (1983). Aquatic and terrestrial humic materials. The Butterworth Grove, Kent, England: Ann Arbor Science. Also: Prakash, A. (1971). Terrigenous organic matter and coastal phytoplankton fertility. In J.D. Costlow (Ed.), Fertility of the sea, 2, 351-368. (Proceedings of an International Symposium on Fertility of the Sea, São Paulo, Brazil, London, and New York: Gordon and Breach Science)
- 56 Depleted minerals in soil – Senate Document #264.
- 57 Impossible to define- Vaughan, D., & Malcolm, R.E. (1985b). Soil organic matter and biological activity. *Plant and Soil Science*, 16, 1-443. (Dordrecht, Netherlands: Martinus Nijhoff/Dr.W.Junk)
- 58 unable to be synthesized – not clearly defined. Murray, K., & Linder, P.W. (1983). Fulvic acids: Structure and metal binding. I. A random molecular model. *Journal of Soil Science*, 34, 511-523.
- 59 Unable to define – Senesi, N., Chen, Y., & Schnitzer, M. (1977b). the role of humic acids in extracellular electron transport and chemical determination of pH in natural waters. *Soil Biology and Biochemistry*, 9, 397-403.
- 60 Effect on total Earth environment – Buffe, J. (1988). Complexation reactions in aquatic systems: An analytical approach. Chichester: Horwood.
- 61 Transmute or synthesis of new minerals – Shnitzer, M., & Dodama, H. (1977). Reactions of minerals with soil humic substances. In J.B. Dixon & S.B. Weed (Eds.), Minerals in soil environments (Chap. 21)). Madison, WI: Soil Science Society of America.
- 62 See further studies on colloids in later sections of this report.
- 63 complex more metal – Rashid, M.A. (1971). Role of humic acids of marine origin and their different molecular weight fractions in complexing Di-and Triivalent metals. *Soil Science*, 111, 298-306.
- 64 Dissolves more metal – Hoffman, M.R., Yost, E.C., Eisenreich, S.J., & Mairer, W.J. (1981). Characterization of soluble and colloidal phase metal complexes in river water ultra-filtration. A mass balance approach. *Environmental Science Technology*, 15, 655. 54
- 65 Mineral levels in excess of their assumed dissolution ability – Kodama, H., Schnitzer, M., & Jaakkimainen, M. (1983). Chlorite and biotite weathering by fulvic acid solutions in closed and open systems. *Canadian Journal of Soil Science*, 63, 619-629.
- 66 Penetration of fulvic into plant cells – Prat, S., Smidova, M., & Cincrova, A.L. (1961). Penetration and effect of humus substances (fractions) on plant cells. International Congress of Biochemistry, 5th (Abstract Commun. 329). (Moscow)
- 67 “free radical” – Senesi, N. (1990) *Analytica Chimica Acta*, 232, 51-75. Amsterdam, The Netherlands: Elsevier.
- 68 Vital electrolytes – Backer, W.E. (1973) *Geochimica et Cosmochimica Acta*, 37, 269-281.
- 69 Enhance and transport nutrients – Prakash, A. (1971). *Fertility of the Sea*, 2, 351-368.
- 70 Make water wetter – Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer-Verlag.
- 71 Catalyze enzyme reactions – Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer-Verlag.
- 72 Increase assimilation – Buffe, J. (1988). Complexation Reactions in Aquatic Systems: An Analytical Approach. Chichester: Horwood.
- 73 Stimulate metabolism – Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer- Verlag.
- 74 Chelate...major and trace elements – Rashid, M.A. (1971). *Soil Science*, 111, 298-306.
- 75 Capacity for electrochemical balance – Senesi, N. (1990) *Analytica Chimica Acta*, 232, 51-75. Amsterdam, The Netherlands: Elsevier.

- 76 Essential to the process – Christman, R.F., & Gjessing, E.T. (1983). *Aquatic and Terrestrial Humic Materials*. The Butterworth Grove, Kent, England: Ann Arbor Science.
- 77 Essential to healthy plants – California Fertilizer Association. (1985). *Western Fertilizer Handbook*. Danville, IL: Interstate.
- 78 Same amount of time – Greenland, D.J., (1965). *Soils and Fertilizers*. 35(5), 415-532.
- 79 Auxin type reactions – Wilkins, M.D. (Ed.). (1984). *Advanced Plant Physiology*. Marshfield, MA: Pitman.
- 80 Plant circulatory systems – Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer – Verlag.
- 81 Transpiration systems – Kononova, M.M. (1966). *Soil Organic Matter*. Elmsford, NY: Pergamon.
- 82 Deterioration – Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer-Verlag.
- 83 Fibrous root growth – Kononova, M.M. (1966). *Soil Organic Matter*. Elmsford, NY: Pergamon.
- 84 Insect infestation – Salk, P.L., & Parker, L.W. (1986). *A New Agricultural Biotechnology: Potential Applications in Arid and Semi-Arid Zones*. American Association for the Advancement of Science and the Government of LaRioja, Argentina.
- 85 The Fulvic iracle list – Jackson, William R. (1993). *Humic, Fulvic and Microbial Balance: Organic Soil Conditioning*. Evergreen, Colorado: Jackson Research Center.
- 86 Increase enzyme activity – Malcolm, R.D., & Vaughan, D. (1979). Comparative effects of soil organic matter fractions on phosphatase activities in wheat roots. *Plant and Soil*, 51, 117-126. Also: Mato, M.C., Gonzales-Alonso, L.M., & Mendez, J. (1972). Inhibition of enzymatic indoleacetic acid oxidation by fulvic acids. *Soil Biology and Biochemistry*, 4, 475-478.
- 87 Prevents wilting – Rashid, M.A. (1985). *Geochemistry of marine humic substances*. New York: Springer-Verlag.
- 88 Chemical weathering, Simonson, R.W. (1959). Outline of a generalized theory of soil genesis. *Soil Science Society America Proceedings*, 23, 152-156.
- 89 Dissolves silica, Ponomareva, V.V., & Ragim-Zade, A.I. (1969). Comparative study of fulvic and humic acids as agents of silicate mineral decomposition. *Society Soil Science*, 1, 157-165. (Trans. From Pochvovedenic. (1969), 3, 26-36)
- 90 Who and What Are You? – Williams, Dr.Roger J. (1977). *The Wonderful World Within You*. Bio-Communications Press. Wichita, Kansas.
- 91 And duplicates itself – Williams, Dr.Roger J. (1977). *The Wonderful World Within You*. Bio-Communications Press. Wichita, Kansas.
- 92 other nutritional factors – ibid.
- 93 extremely different types – ibid.
- 94 can produce only one – ibid.
- 95 disease we experience – ibid.
- 96 amino acids that attract insects – Chaboussou, F. (1980). *Les Plantes Malades des Pesticides – Bases Nouvelles D'une Prevention Contre Maladies et Parasites*. (Plants made sick by pesticides – New basis for the prevention of diseases and pests). Paris.
- 97 Catalyst to vitamins within the cell – Williams, Dr. Roger J. (1977). *The Wonderful World Within You*. Bio-Communications Press. Wichita, Kansas.
- 98 Mader, S.S. (1990). *Biology* (3rd edition). Dubuque, Ia: William C. Brown.
- 99 for complete metabolism – Williams, Dr.Roger J. (1977). *The Wonderful World Within You*. Bio-Communications Press. Wichita, Kansas.
- 100 maximum stimulation of enzyme development – Jackson, William R. PhD. (1993). *Humic, Fulvic and Microbial Balance: Organic Soil Conditioning*. Evergreen, Colorado.
- 101 enzyme reactions and formation – Jackson, William R. PhD. (1993). *Humic, Fulvic and Microbial Balance: Organic Soil Conditioning*. Evergreen, Colorado.
- 102 free radicals, Senesi, N. (1990). Molecular and quantitative aspects of the chemistry of fulvic acid and its interactions with metal ions and organic chemicals: Bari Italy. *Analytica Chimica Acta*, 232, 51-75. Amsterdam, The Netherlands: Elsevier.
- 103 Schlickewei, Dr. W., (1993). Arch Orthop Trauma Surg 112:275-279, Influence of humate on calcium hydroxyapatite implants.
- 104 W. Schlickewei, Dept. of Surgery (Traumatology), University Hospital, Freiburg, Germany

- 105 U.N. Riede, Dept. of Pathology, University Hospital, Freiburg, Germany. J. Yu, Dept. of Pathology, University Hospital, Freiburg, Germany. W. Ziechmann, Ground chemistry Research Group, University of Gorringen, Germany. E.H. Kuner, Dept. of Surgery (Traumatology), University Hospital, Freiburg, Germany. B. Seubert, Weyl Chemicals, Mannheim, Germany
- 106 dry beans – Bertrand, G. & G. Levy. The Content of Plants, Notably Food Plants, in Aluminum Compt. Rend. Acad. Sci. (Paris), 192 (1931), No. 9 pp. 525-529; Compt. Rend. Acad. Agr. France, 17 (1931), pp 235-238, (E.S.R.) 66, p.193.
- 107 definition of a colloid – Dorland's Illustrated Dictionary, 24th Edition.
- 108 definition of colloids – Random House Dictionary of the English Language, Current Edition
- 109 colloids and their size – Max Motyka, M.S., Albion Laboratories.
- 110 colloids – Lee, Royal, D.D.S. *The Mineral Elements in Nutrition*. The writings of Dr. Royal Lee.(Accredited as being one of the most respected men in the area of nutritional knowledge to have ever lived.)+
- 111 Murray, K., & Linder, P.W. (1983). Fulvic acids: Structure and metal binding. I. A random molecular model. *Journal of soil Science*, 34, 511- 523
- 112 Rashid, M.A. (1971). Soil Sciences, 111, 298- 306. Hoffman, M.R., Yost, E.C., Eiscncich,S.J., & Maier, W.J. (1981) *Environmental ScienceTechnology*, 15, 655.
- 113 Ponomarcva, V.V., & Ragim-Zadc, A.I. (1969). Comparative study of fulvic and humic acids as agents of silicate mineral decomposition. *Society Soil Science*, 1, 157-165.(Trans. From Pochvovedie. (1969), 3, 26-36)
- 114 Rashid, M.A. (1985) Geochemistry of Marine Humic Substances. New York: Springer-Verlag.; Vaughn, D., Malcolm, R.E., & Ord, B.G. (1985) Soil Organic Matter and Biological Activity. (p. 77-108) Dordrecht, Netherlands: Martinus Nijhoff; Vaughn, D., Ord, B., & Malcolm, R.E. (198) *Journal of Experimental Botany*, 29,1337-1344.
- 115 Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer-Verlag.
- 116 Szalay, A. (1958). *The significance of humus in the geochemical enrichment of uranium. Preceedings of the 2nd International conference on the Peaceful Uses of Atomic energy*, 2, 182-186. (London: Pergamon)
- 117 Pauli, F.W. (1975). *Heavy metal humates and their behavior against hydrogen sulfide*. Soil Science, 119, 98-105.
- 118 Pillai, K.C., & Mathew, E. (1976). *Plutonium in the aquatic environment: Its behavior, distribution and significance*. In *Transuranium nuclides in the environment* (pp. 25-45). Proceeding of the Sumposium, International Atomic Energy Agency, Vienna.
- 119 Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer-Verlag.
- 120 W.R. Jackson PhD. (1993) *Humic, Fulvic, and Microbal Balance: Organic Soil Conditioning* (pp. 762-763).