

## IV Vitamin C Therapy

"...Discovery consists in seeing what everybody else has seen and thinking what nobody has thought...." Albert Szent-Gyorgyi, MD, PhD, Awarded the 1937 Nobel Prize in Physiology/Medicine for the discovery of vitamin C, in connection with biological combustion

Albert Szent-Gyorgyi MD, PhD was awarded the 1937 Nobel Prize in Physiology/Medicine for his discovery of the reducing agent (antioxidant) ascorbic acid in animal adrenal cells

Dr. Szent-Gyorgyi coined the term 'biological combustion' with regards to the action of vitamin C in the body. A constant, never ending 'flow of electrons' is needed for directing, controlling and regulating all the cells throughout the body. This subtle flow of electrons generates perpendicular and reciprocal magnetic fields around the body, though not understood, also appear to be involved with optimum health. (1)

This dynamic, never ending exchange of electrons is our 'elixir of life'. As the body is placed under more stress (toxins, trauma, psychological, malnutrition, etc.) there is a need for more electrons to balance this equation. Thus health is a slight over abundance of these electrons, in the form of antioxidants like vitamin C, and illness manifests as this level of electrons decreases in relationship to its need in the body. (2)

The antioxidant system of the body is still being marveled at and invested. So far we know the two components of this system are both non-enzymatic and enzymatic. Meaning that you can take all the antioxidants (vitamin C, etc.) that you want but if you do not have the antioxidant enzymes then the 'biological □electricity' is not unleashed and used by the body. Further, all of the following components within each of these systems must be in balance or equilibrium or they themselves will cause disease and aging.

This is seen in Down's Syndrome patients. These individuals have an extra chromosome 21. This chromosome contains the genetic blueprint for superoxide dismutase. Superoxide dismutase is the antioxidant enzyme which converts the free radical superoxide into hydrogen peroxide. Then catalase breaks hydrogen peroxide into water and oxygen. However, in these individuals the excess of superoxide dismutase and the corresponding lack of needed catalase leaves an over abundance of the very reactive oxidizing agent to wreak havoc in the body. Thus these individuals have accelerated aging, dementia, etc. Vitamin C is a part of this 'biological electrical' scenario but always remember it works in concert with these other components.

## Antioxidant System (13)

### NON-ENZYMATIC

#### ENZYMATIC

<i>Hydrosoluble</i>	<i>Liposoluble</i>	<i>Chelating proteins</i>	
Uric acid	Vitamin E	Transferrin	Superoxide dismutase
Ascorbic acid (vit. C)	Vitamin A	Ferritin	Catalase
Glucose, Cysteine	Carotenoids	Caeruloplasmin	Glutathione peroxidases
Cysteamine, taurine	Coenzyme Q10	Lactoferrin	Glutathione redox system
Tryptophane	Alpha lipoic acid	Haemopessin	Reducing equivalents via NADPH and NADH
Hystidine	Bilirubin	Albumin	
Methionine	Thioredoxin		
Glutathione	Bioflavonoids		
Plasma proteins	Melatonin		
	Lycopene		

When any of the aforementioned non-enzymatic and enzymatic components of the antioxidant system are not evenly balanced then cellular damage can ensue. The first cells that are attacked are cells that are non-self (pathogens), infected/sick cells (infected with viral, bacterial etc. pathogens), and old cells (lacking the full complement of the antioxidant system to counter this oxidative stress). If the imbalance continues then the casualties begin to involve healthy cells. IV vitamin C therapy is aimed at attacking pathogens and defective cells. In low doses it acts as an antioxidant because it is in equilibrium with all the other components of the antioxidant system. In high enough doses (administered in IV form in specific protocols) it becomes a pro-oxidant and attacks the weakest cells in our bodies.

Nearly all mammals, reptiles and amphibians can produce part or all of their needed daily requirements of vitamin C. Most mammals synthesize vitamin C in their livers (8)

while reptiles and amphibians do so in their kidneys (9). Humans, primates, fruit bats and guinea pigs have lost this ability to produce vitamin C. (3)

Not only can these animals produce their own vitamin C but when they are faced with life threatening degrees of infectious or toxic stress they can increase this production to meet these demands. (4, 10, 11) All animals have different requirements of vitamin C but it has been noted that wild animals, in general, produce four times the amount of vitamin C as domestic animals. (5, 9)

Humans do not produce vitamin C because we lack a liver enzyme known as L-gulonolactone oxidase (GLO). This is the last biochemical step in the conversion of glucose to vitamin C. Ironically, we have this DNA coding but it is not 'translated' or turned on. (6, 12)

"...Loss of the gene for GLO could not have been counterproductive for our primate ancestors, or they would have been eliminated by natural selection....In their authoritative text, *Free Radicals in Biology and Medicine*, Halliwell and Gutteridge suggest one possibility. They note that GLO produces hydrogen peroxide as a by-product of vitamin C synthesis. This means that high rates of vitamin C synthesis ...could, ironically, impose an oxidative stress. Given an adequate diet of fruit, which is rich in vitamin C, it might indeed be beneficial to consume, rather than synthesize, vitamin C...." (7)

So here we are back at balancing oxidative stress in the body with the antioxidant system. The production and usage of vitamin C leads to higher levels of hydrogen peroxide in the body. The same hydrogen peroxide that causes aging, dementia, disease, and ultimately death in Down's Syndrome individuals. Maybe this is why our body fights so very hard to keep blood levels of vitamin C within a very narrow physiologic range. Of course, pioneers like Dr. Linus Pauling, have shown us that we can circumvent this protective mechanism by systematically increasing our consumption of oral vitamin C to levels well over 10 grams daily. But the question is, are we also feeding this antioxidant to diseased, infected, and aged cells as well as to healthy cells? Are we feeding 'the enemy' and well as our own troops? Is this why many of us crave sugar or glucose when we are stressed with disease, infection, trauma, etc.?

### **Biological Effects of Vitamin C**

1. Co-factor (a necessary accessory for enzyme function) for the synthesis of collagen that ultimately forms connective tissue; including bone, teeth, cartilage, ligament, skin, and blood vessels. The presence of oxygen is also needed. (14)
2. Synthesis of the amino acid called carnitine. We need carnitine to transport fats into the mitochondria for the production of energy. It also removes waste products (left-over organic acids) from the mitochondria. Decreased carnitine synthesis translates into decreased energy production and fatigue. (14)

3. Synthesis of noradrenaline.(15)
4. Functioning of PAM (peptidyl alpha-amidating mono-oxygenase) which activates many neurotransmitters and hormones throughout the body and especially in the pituitary gland.
  - Corticotrophin releasing hormone: stimulates production of steroid hormones.
  - Growth hormone-releasing hormone: promotes growth and influences energy metabolism.
  - Calcitonin: promotes calcium phosphate absorption and distribution in the bones.
  - Gastrin: stimulant of gastric acid secretion.
  - Oxytocin: stimulates milk ejection and uterine contraction.
  - Vasopressin: regulates water balance and stimulates intestinal contraction.
  - Secretin: stimulates pancreatic and bile secretions.
  - Substance P: vasodilator and sensory neurotransmitter, which mediates our sense of pain, touch and temperature. (15)
5. Needed for the absorption of iron in the intestines. Without this iron for the hemoglobin in red blood cell anemia develops. (16)
6. Regenerates or donates electrons to vitamin E which in turn protects cellular membranes from free radical damage. (17)
7. When white blood cells or neutrophils are 'activated' by bacterial infections they immediately accumulate vitamin C. Levels of vitamin C within the WBC can be 30 to over 100 times the concentration in the plasma. (18)

"... The WBCs use the anti-oxidant abilities of vitamin C to protect themselves from the free radicals and powerful oxidants that they produce (hydrogen peroxide, ozone, hypochlorous acid) to kill bacteria. Since bacteria cannot absorb vitamin C they cannot protect themselves like the WBCs can....". (19)

The WBCs, "...do not absorb vitamin C itself, but only dehydroascorbate, the oxidized forms of vitamin C....". Electrons are taken from glutathione to regenerate vitamin C. In turn, electrons are taken from electron transport chain which changes oxygen and glucose into water and energy for us....This amounts to a long-odds gamble on life itself. The physiological balance of the neutrophil is shifted away from normal respiration – from what amounts to breathing – into an emergency holding pattern, which is dedicated to regenerating glutathione and thus vitamin C. In other words, activated neutrophils trade taking a breath for protection, in the hope that they will survive long enough to kill the bacteria...". (17)

Neutralization of toxins is a very important role that vitamin C plays in our bodies. Calabrese compiled a list of toxins that decreases levels of vitamin C and whose toxicity or cancer-causing effects were modified by vitamin C. This list included:

1. Some chlorinated hydrocarbon insecticides and organophosphate

insecticides.

2. Toxic elements: arsenic, cadmium, chromium, cobalt, copper, cyanide, fluoride, lead, mercury, selenium, silica, tellurium.

3. Industrial hydrocarbons: benzanthrone, benzene, chloroform, glycerol, hydrazine, polychlorinated biphenyls, trinitrotoluene (TNT), and vinyl chloride.

4. Gaseous pollutants: carbon monoxide..... (20)

"....depletion of vitamin C levels in the face of toxicity indicates that toxins are being neutralized as a result of vitamin C's metabolic breakdown in the body. A given chemical toxin can make the body's ability to cope with other challenges all the more difficult by lowering the vitamin C level in the course of its detoxification....a large amount of evidence exists to indicate that the toxin-induced lowering of vitamin C levels actually indicates that available vitamin C is working to neutralize as much toxin as possible. The depleted vitamin C status of the body merits prompt supplementation for no reason other than the fact that it is depleted, reliably weakening the immune system and potentially exposing the body to other medical problems....". (21)

There have been many studies focused on the adaptations that animals and plants make in the production of vitamin C under stress; drugs, pollutants, psychological, etc...Generally, increased stress caused correspondingly increased internal production of vitamin C. (11, 22, and 23)

Some toxins that vitamin C has affects in lessening their affect upon the body are: alcohol (ethanol), barbiturates, acetaminophen, certain molds, amphetamine, cyanides, cyclosporine (used to suppress organ rejection in organ transplant recipients), morphine, nicotine, nitrates/nitrites, PCBs (polychlorinated biphenyl compounds), tetracycline, mushroom poisoning, pesticides, radiation, strychnine and tetanus toxin poisonings, toxic elements (mercury, etc.), and certain venoms (spider, snake, etc.) to name a few. (24)

### **Some Historical Medical Usages of IV Vitamin C**

Fredrick R. Klenner and Cathcart: Successfully treated/prevented these viral infectious disease polio, viral hepatitis, measles, mumps, viral encephalitis, chickenpox, herpes infections, viral pneumonia, influenza, rabies, and non-viral infectious diseases like diphtheria, tetanus, streptococcal infections, etc. (26)

"...At the height of the polio epidemic in 1949, when all young parents lived in fear that their babies and young children would be the next victim, Fredrick R. Klenner, M.D., published that he had successfully cured 60 out of 60 polio patients who had presented to his office or to the emergency room!..." (27)

“...Klenner was also able to demonstrate repeatedly that vitamin C appears to be the idea agent for killing any infecting virus....” (28,29)

Hundreds of scientific references can be found in Dr. Thomas Levy's book, " Vitamin C, Infectious Diseases, and toxins: Curing the Incurable".

### **Safety of High Dose Long Term Vitamin C**

Physicians like Klenner, Casciari (30, 31,32,33) and many more have given IV doses of 4000 mg to 300,000 mg daily for up to 8 weeks without any complications. In fact,"...Cathcart noted that occasional minor complaints of gas, diarrhea, or acid stomach were seen more often in well patients, appearing only rarely in the 'very sick' patients. He asserted that even with these high doses of vitamin C, he 'cannot recall any patient, who has been damaged by large doses of ascorbate,' .....” (34)

### **Concerns About IV Vitamin C Usage**

#### **Kidney Stones**

When vitamin C is oxidized it becomes dehydroascorbic acid (DHAA). Then it is usually reconstituted back to vitamin C by antioxidants and various enzymes (34, 35, 36). When this regeneration does not occur the oxalate or oxalic acid is formed. Calcium oxalate is the major component of kidney stones. However, a vast body of research explains that long term vitamin C usage does not increase the risk of kidney stones in healthy patients. In fact, it lessens their production. (37, 38, 39, 40,41). Many factors can increase the probability of kidney stones like dehydration, increased age, increased urinary calcium, decreased urinary magnesium, and increased intake of 'hard (mineralized) water' to name a few. (42)

One of the reasons that vitamin C does not usually form kidney stones is because over 80% of it is excreted as dehydroascorbic acid (43) and it never get to the end product of oxalate..

#### **Antioxidant and Pro-oxidant.**

Vitamin C losses electrons to or quenches free radicals. However, if an individual has high iron (hemochromatosis, thalassaemia) (44) or high copper (Wilson's disease) then

the donated electron, greatly facilitate the formation of superoxide radicals, hydroxyl radicals and hydrogen peroxide. ( 45 ). This can cause devastating results in the human body.

"...Glucose-6-phosphate dehydrogenase is an enzyme in the red blood cell that is critical to the physical stability of the cell. The prime function of G6PD appears to be in protecting the red blood cell from oxidative damage (46, 47).....deficiency is a genetic disease inherited as an X-linked trait, predisposing the patient to episodes of mild to serious RBC rupture, ( 48). The rupture of RBCs releases iron and this maybe the reason why high dose vitamin C in these people produces oxidative damage. ( 49) The same mechanism is proposed to be at work in the treatment of malaria (50) and cancer ( 51)...."

When IV Vitamin C is used as a medical drug its pro-oxidant effects can be of tremendous help in our battle against many different disease conditions. This ties it into the practice of Bio-Oxidative Medicine and the use of ozone/oxygen, hydrogen peroxide, and ultraviolet photo illumination. That is occurs when IV Vitamin C is given;

1. in the right form,
2. with the proper technique,
3. in frequent enough doses,
4. in high enough doses,
5. along with certain additional agents, and
6. for a long-enough period of time....". (25)

Dr. Mark Levine, the lead researcher and chief of the molecular and clinical nutrition section and senior staff physician National Institute of Diabetes & Digestive & Kidney Diseases, conducted a 're-appraisal study' on the cytotoxic effects of Vitamin C on cancer cells in 2004. (52) This study, which was published in the September 12-16 issue of the Proceedings of the National Academy of Sciences, suggested that the possible mechanism for therapy was the production of hydrogen peroxide by vitamin C. Hydrogen peroxide is a chemical that can kill cancer cells.

Past studies at the Mayo Clinic had found no clinically significant data to support the argument that high dose Vitamin C could kill cancer cells. However, the Mayo Clinic studies used only oral Vitamin C and previous studies had used both oral and IV Vitamin C.

..."At the highest concentration of ascorbic acid, if given intravenously, they don't touch normal cells and they kill lots of cancer cells." Levine said... (72)

The body regulates orally ingested Vitamin C within a very narrow physiological range. However, when Vitamin C is given in IV form the blood levels can be raised to 70 times that of orally ingested Vitamin C. At these levels Vitamin C acts as lethal atomic free radical bomb, ascorbyl radical, to destroy aged/sick cells and cancer cells. (62,63,64,65,66,67,68,69,70,71)

The mechanism of action is still being investigated but this paper and others postulate the following.

"...Intravenous vitamin C may have a role in the treatment of cancer as a result of the plasma concentrations that can be achieved only by this route intravenous vitamin C may produce plasma concentrations as high as 15 000 mol/L. At extracellular concentrations greater than 1000 mol/L, vitamin C is toxic to cancer cells, although mechanisms and interpretation are controversial . (59, 60,61)

The vitamin C free radical species, ascorbyl radical, is detectable in animals only when they receive intravenous vitamin C equivalent to a 10-g dose in humans ( 73). We propose that detectable ascorbyl radical forms only when human plasma concentrations are greater than 1000 mol/L and that either the radical itself or its unpaired electron induces oxidative damage that can be repaired by normal but not cancer cells. Understanding mechanisms of cytotoxicity may further the investigational use of vitamin C in patients with cancer, used alone or with other agents that potentiate such actions (74). Although minimal data are available, intravenous vitamin C is expected to have little toxicity compared with conventional chemotherapeutic agents (11/ 75). In this context and in light of our new pharmacokinetic data, a role for intravenous vitamin C in cancer treatment should be reevaluated... "(52)

..."The newest study will likely set off another round of investigations about vitamin C's cancer-fighting ability", said Dr. Len Lichtenfeld, deputy chief medical officer for the American Cancer Society. He called the study interesting and noted that it was conducted by respected scientists.

However, he said, laboratory findings are a long way from clinical practice and more study is needed.

"If alternative medicine practitioners -- who have continued to use vitamin C treatments for cancer -- provide evidence that it works, this would be the ideal time to step forward with their findings," Lichtenfeld said...(72)

"...Furthermore, when the toxin is a chemotherapy drug, vitamin C quite often will promote the anticancer actions of that drug without increasing the drug-induced toxic effects. In mice with liver tumors, Taper et al (1987) showed that the combination of vitamin C with another vitamin was able to increase the therapeutic effectiveness of six different cytotoxic drugs without increasing their undesirable toxic side effects..." (53, 54)

From our treatment protocols at New Health Insight Clinic, and the other clinics involved in the IRB study, we hope to add positive results to this investigation. For the entire article please go to; <http://www.annals.org/cgi/reprint/140/7/533.pdf>

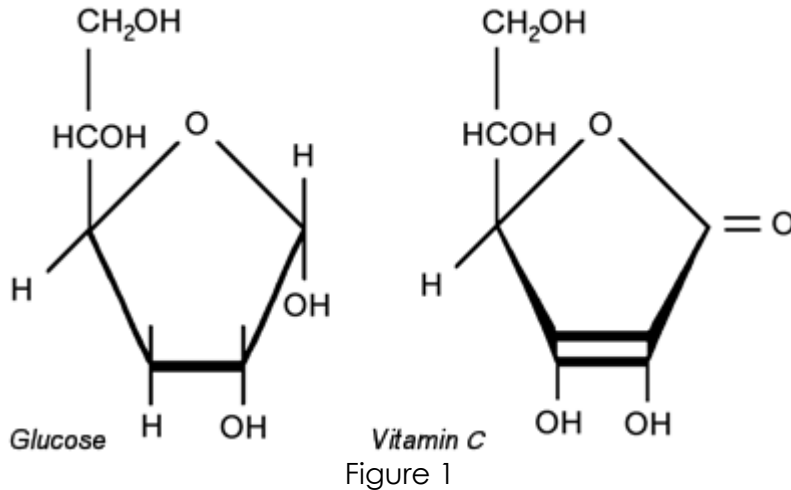
One of the investigators in the aforementioned NIH study was Dr. Hugh Riordan. He was one of the founding members of The Center for the Improvement of Human Functioning International (in Wichita, KS) and RECNAC research center internationally. RECNAC II is a research study aimed at the development of effective, non-toxic cancer treatments. Their three ongoing pilot projects are;

1. The use of 'biological response modifiers' (vitamin c) as anticancer agents.
2. The mitochondrial function of malignant cells (how they produce energy differently than healthy cells and why).
3. How changes in dietary fatty acids (such as omega 6s and 3s) affects tumor cell growth.

Dr. Riordan has added to the work of two-time Nobel prize winner and molecular biologist Linus Pauling PhD in orthomolecular medicine."... Orthomolecular medicine describes the practice of preventing and treating disease by providing the body with optimal amounts of substances which are natural to the body...." ( 55). The main interest has been oral and IV vitamin C administration. The following excerpt is from this organization and it is presented to you to spur your further investigation on this topic and it is not to be construed as the doctrine of New Health Insight.

"... PET scans are commonly ordered by oncologists to evaluate their cancer patients for metastases (cancer spread to other organs). What is actually injected into the patient at the start of the scan is radioactive glucose. Cancer cells are anaerobic obligates, which means they depend upon glucose as their primary source of metabolic fuel. Cancer cells employ transport mechanisms called glucose transporters to actively pull in glucose.

In the vast majority of animals, vitamin C is synthesized from glucose in only four metabolic steps. Hence, the molecular shape of vitamin C is remarkably similar to glucose. (Figure 1) Cancer cells will actively transport vitamin C into themselves, possibly because they mistake it for glucose. Another plausible explanation is that they are using the vitamin C as an antioxidant. Regardless, the vitamin C accumulates in cancer cells.



If large amounts of vitamin C are presented to cancer cells, large amounts will be absorbed. In these unusually large concentrations, the antioxidant vitamin C will start behaving as a pro-oxidant as it interacts with intracellular copper and iron. This chemical interaction produces small amounts of hydrogen peroxide.

Because cancer cells are relatively low in an intracellular anti-oxidant enzyme called catalase, the high dose vitamin C induction of peroxide will continue to build up until it eventually lyses the cancer cell from the inside out! This effectively makes high dose IVC a non-toxic chemotherapeutic agent that can be given in conjunction with conventional cancer treatments. Based on the work of several vitamin C pioneers before him, Dr. Riordan was able to prove that vitamin C was selectively toxic to cancer cells if given intravenously. This research was recently reproduced and published by Dr. Mark Levine at the National Institutes of Health.

As feared by many oncologists, small doses may actually help the cancer cells because small amounts of vitamin C may help the cancer cells arm themselves against the free-radical induced damage caused by chemotherapy and radiation. Only markedly higher doses of vitamin C will selectively build up as peroxide in the cancer cells to the point of acting in a manner similar to chemotherapy. These tumor-toxic dosages can only be obtained by intravenous administration.

Intravenous vitamin C also does more than just kill cancer cells. It boosts immunity. It can stimulate collagen formation to help the body wall off the tumor. It inhibits hyaluronidase, an enzyme that tumors use to metastasize and invade other organs throughout the body. It induces apoptosis to help program cancer cells into dying early. It corrects the almost universal scurvy in cancer patients. Cancer patients are tired, listless, bruise easily, and have a poor appetite. They don't sleep well and have a low threshold for pain. This adds up to a very classic picture of scurvy that generally goes unrecognized by their conventional physicians.

When cancer patients receive IVC, they report that their pain level goes down, and that they are better able to tolerate their chemotherapy. They bounce back quicker since the IVC reduces the toxicity of the chemotherapy and radiation without compromising their cancer cell killing effects. IVC is complementary to oncologic care. IVC is not "either/or" - it's a good "both/and" proposition. IVC can help cancer patients withstand the effects of their traditional therapies, heal faster, be more resilient to infection, develop a better appetite, and remain more active overall. These things promote a better response to their cancer therapy...." ( 55).

One of the connections between vitamin c and bio-oxidative medicine is hydrogen peroxide production. At new health Insight we are gathering information to document the therapeutic effects of all these agents in our patients.

### **Dedications**

This article is dedicated to Dr. Szent-Gyorgyi, Dr. Linus Pauling, Dr. Klenner, Dr. Cathcart  
Dr. Levy, Dr. Lane, Dr. Riordan and all the other clinicians and scientists who have been working diligently to bring the wonders of vitamin C to mainstream healthcare.

### **Disclaimer**

Please remember that we are not saying that vitamin C is the cure for cancer or that anyone should stop their current medical treatment for any of the aforementioned disease conditions. We are just providing or disseminating evolving knowledge and it needs further controlled investigation. Our hope is that by integrating these oxidative therapies (and IV vitamin C and chelation) with present medical therapies that all our patients will benefit. None of these oxidative agents or protocols should ever be provided by any health practitioner without extensive training. That is why our practitioners do extensive medical review of our patients with laboratory and clinical testing and they follow specific universally accepted (in the field of Integrative medicine) protocols with all of their treatments.

## Footnotes

1. Levy, T., " Vitamin C, Infectious Diseases, and toxins: Curing the Incurable", Xlibris corp., 2002, pg. 34.
2. Ibid., pgs. 33-34.
3. Ibid., pg. 39.
4. Ibid., pg. 40.
5. Ibid., pg. 40.
6. Ibid., pg. 41.
7. Lane, N., "Oxygen: The Molecule that created the world", Oxford University Press, 2002, pg. 177.
8. Grollman, A., and A. Lehninger. (1957) Enzymic synthesis of L-ascorbic acid in different animal species. *Archives of Biochemistry and Biophysics*, 69:458-467.
9. Chatterjee, I., A. Majumder, B. Nandi, and N. Subramanian, (1975) Synthesis and some major functions of vitamin C in animals. *Annals of the New York Academy of Sciences* 258:24-47.
10. Stone, I., *The Healing Factor: ' Vitamin C' Against Disease*. New York, NY, Grosset and Dunlap.
11. Conney, A., G. Bray, C. Evans, and J. Burns. (1961) *Annals of the New York Academy of Sciences*, 92:115.
12. Nishikimi, M., T. Koshizaka, T. Ozawa, and K. Yagi. (1988) Occurrence in humans and guinea pigs of the gene related to their missing enzyme L-gulonolactone oxidase. *Archives of Biochemistry and Biophysics*, 267 (2):842-846.
13. Bocci, V.: "Ozone: A New Medical Drug." Springer Publ., 2005, pg. 26.
14. Lane, N., "Oxygen: The Molecule that created the world", Oxford University Press, 2002, pg. 181.
15. Ibid., pg. 182,
16. Ibid., pg. 183.
17. Ibid., pg. 192.
18. Ibid., pg. 191.
19. Ibid., 205.
20. Levy, T., " Vitamin C, Infectious Diseases, and toxins: Curing the Incurable", Xlibris corp., 2002, pg. 215.
21. Ibid., pg. 216.
22. Longenecker, H., R. Musulin, R. Tully, and C. King. (1939) An acceleration of vitamin C synthesis and excretion by feeding known organic compounds to rats. *The Journal of Biological Chemistry*, 129:445-453.
23. Longenecker, H., H. Fricke, and C. King. (1940) The effect of organic compounds upon vitamin C synthesis in the rat. *The Journal of Biological Chemistry*, 135:492-510.
24. Op. cit., Levy, pgs. 218-317.

25. Ibid., pg. 21.
26. Ibid., pgs. 50-174.)
27. Ibid., pg. 2028.
28. Ibid., pg. 21.
29. Klenner, F., (July 1949) The treatment of poliomyelitis and other virus diseases with vitamin C. *Southern Medicine & Surgery*, 111(7): 209-214.
30. Casciari, J., N. Riordan, T. Schmidt, X. Meng, J. Jackson, and H. Riordan. (2001) Cytotoxicity of ascorbate, lipoic acid, and other antioxidants in hollow fibre in vitro tumours. *British Journal of Cancer*, 84(11):1544-1550.
31. Kalokerinos, A., I. Dettman, and G. Dettman. (1982) Ascorbate-the proof of the pudding! A selection of case histories responding to ascorbate. *The Australian Nurses Journal*, 11(2):18-21.
32. Cathcart, R., (1985) Vitamin C: the nontoxic, □calculus-limited, antioxidant free radical scavenger. *Medical Hypotheses*, 18(1):61-77.
33. Cathcart, R., (1993) the third face of vitamin C. *Journal of Orthomolecular Medicine*, 7(4):197-200.
34. Long, W., and P. Carson. (1961) Increased erythrocyte glutathione reductase activity in diabetes mellitus. *Biochemical and Biophysical Research communications*, 5:394-399
35. Basu, S., S. Som, S. Deb, D. Mukherjee, and I. Chatterjee (1979) Dehydroascorbic acid reduction in human erythrocytes. *Biochemical and Biophysical Research Communications*, 90(4):1335-1340
36. Bode, A., C. Yavarow, D. Fry, and T. Vergas. (1993) Enzymatic basis for altered ascorbic acid and dehydroascorbic acid levels in diabetics. *Biochemical and Biophysical Research Communications*, 191(3):1347-13353.
37. Curhan, G., W. Willett, E. Rimm, and M. Stampfer. (1996) A prospective study of the intake of vitamins C and B6, and the risk of kidney stones in men. *Journal of Urology*, 155(6):1847-1851.
38. Curhan, G., W. Willett, F. Speizer, and M. Stampfer. (1999) Intake of vitamins B6 and C and the risk of kidney stones in women. *Journal of the American society of Nephrology*, 10(4):840-845.
39. Gerster, H.,(1999) High-dose vitamin C: a risk for persons with high iron stores? *International Journal for Vitamin and Nutrition research*. 69(2):67-82.
40. Simon, J. and E. Hudes. (1999) Relation of serum ascorbic acid to serum vitamin B12, serum ferritin, and kidney stones in US adults. *Archives of Internal Medicine*. 159(6):619-624.
41. Gaker, L. and N. Butcher. (1986) Dissolution of staghorn calculus associated with amiloride-hydrochlorothiazide, sulfamethoxazole and trimethoprim, and ascorbic acid. *The Journal of Urology*, 135(5):933-934.
42. Op. cit., Levy, pgs. 378-382.
43. Takenouchi, K., K. Aso, K. Kawase, H. Ichikawa, and T. Shiomi. (1966) On the metabolites of ascorbic acid, especially oxalic acid, eliminated in urine, following the administration of large amounts of ascorbic acid. *The Journal of Vitaminology*, 12(1):49-58.
44. Op. cit., Lane, pgs 186-190.)
45. Miller, D., G. Buettner, and S. Aust. (1990) Transition metals as catalysts of 'autoxidation' reactions. *Free radical Biology and Medicine*. 8(1):95-108.

46. Beutler, E.: "Abnormalities of the hexose monophosphate shunt." *Seminars in Hematology*, 1971; 8(4):311-347.
47. Op. cit., Levy, pg 398.)
48. Marks, P.: "Glucose-6-phosphate dehydrogenase in mature erythrocytes." *The American Journal of Clinical pathology*, 1967; 47(3):287-295.
49. Marva, E., Golenser, J., Cohen, A., Kitrossky, R., and Chevion, M.: "The effects of ascorbate-induced free radicals on *Plasmodium falciparum*." *Tropical Medicine and Parasitology*, 1992; 43(1):17-23.
50. Sherman, I.: "Biochemistry of *Plasmodium* (malaria parasites)." *Microbiological Reviews*, 1979; 43(4):453-495.
51. Op. cit., Lane, pg. 189.
52. Mark Levine MD, Sebastian Padayatty MRCP, PhD, He Sun PhD, CBS, Yaohui Wang, MD, Hugh D. Riordan, MD, Steohen Hewitt, MD, PhD, Arie Katz, MD, Robert Wesley PhD: "Vitamin C Pharmacokinetics: Implications for Oral and Intravenous Use." *Annals of Internal Medicine*, April 6, 2004, vol. 140, number 7, pgs 533-537)
53. Op. cit., Levy, pages 214-215
54. Taper, H., J. de Gerlache, M. Lans, and M. Robefroid. (1987) Non-toxic potentiation of cancer chemotherapy by combined C and K3 vitamin pre-treatment." *International Journal of Cancer* 40(4):575-579.)
55. <http://orthomolecular.org/index.shtml>
59. Leung PY, Miyashita K, Young M, Tsao CS. "Cytotoxic effect of ascorbate and its derivatives on cultured malignant and nonmalignant cell lines." *Anticancer Res.* 1993;13:475-80.
60. Sakagami H, Satoh K, Hakeda Y, Kumegawa M." Apoptosis-inducing activity of vitamin C and vitamin K". *Cell Mol Biol*; 2000;46:129-43.
61. Clement MV, Ramalingam J, Long LH, Halliwell B." The in vitro cytotoxicity of ascorbate depends on the culture medium used to perform the assay and involves hydrogen peroxide". *Antioxid Redox Signal.* 2001;3:157-63.
62. Campbell, A. and Jack, T:"Acute reactions to mega ascorbic acid therapy in malignant disease." *Scottish Medical Journal*, 1979; 24(2):151-153.
63. Casciari, J., Riordan, N., Schmidt, T., Meng, X., Jackson, J., and Riordan, H.: "Cytotoxicity of ascorbate, lipoic acid, and other antioxidants in hollow fibre in vitro tumours." *British Journal of Cancer*, 2001; 84(11): 1544-1550.
64. Khaw, K., Bingham, S., Welch, A., Luben, R., Wareham, N., Oakes, S., and Day, N.: "Relationship between ascorbic acid and mortality in men and women in EPIC-Norfolk prospective study: a prospective population study. *European Prospective Investigation into Cancer and Nutrition.*" *Lancet*, 2001; 357(9257):657-663.
65. Kromhout, D., Bloemberg, B., Feskens, E., Menotti, a., and Nissinen, A.: "Saturated fat, vitamin C and smoking predict long-term population all-cause mortality rates in the Seven Countries Study." *International Journal of Epidemiology*, 2000; 29(2): 260-265.
66. Levy, T. MD: "Vitamin C, Infectious diseases, and Toxins: Curing the Incurable." Xlibris Corp, 2002, pgs. 373-404.
67. Loria, C., Klag, M., Caulfield, L., and Whelton, P.: "Vitamin C status and mortality in US adults." *The American Journal of clinical Nutrition*, 2000, 72(1):139-145.
68. Riordan, H., Jackson, J., and Schultz, M.: "Case study: high-dose intravenous vitamin C in the treatment of a patient with adenocarcinoma of the kidney." *Journal of Orthomolecular Medicine*, 1990; 5(1):5-7.

69. Riordan, H., Meng, X., Li, Y., and Jackson, J.: "Intravenous ascorbate as a tumor cytotoxic chemotherapeutic agent." *Medical Hypotheses*, 1995 44(3): 207-213.
70. Riordan, N., Jackson, J., and Riordan, H.: "Intravenous vitamin C in a terminal cancer patient." *Journal of Orthomolecular Medicine*, 1996; 11(2):80-82.
71. Simon, J., Hudes, E., and Tice, J.: "Relation of serum ascorbic acid to mortality among US adults." *Journal of the American College of Nutrition*, 2001; 20(3): 255-263.
72. <http://discovermagazine.com/2005/mar/our-preferred>
73. Wang X, Liu J, Yokoi I, Kohno M, Mori A." Direct detection of circulating free radicals in the rat using electron spin resonance spectrometry." *Free Radic Biol Med*. 1992;12:121-6.
74. Grad JM, Bahlis NJ, Reis I, Oshiro MM, Dalton WS, Boise LH. "Ascorbic acid enhances arsenic trioxide-induced cytotoxicity in multiple myeloma cells." *Blood*. 2001;98:805-13.
75. Levine M, Conry-Cantilena C, Wang Y, Welch RW, Washko PW, Dhariwal KR, et al. "Vitamin C pharmacokinetics in healthy volunteers: evidence for a recommended dietary allowance." *Proc Natl Acad Sci U S A*. 1996;93:3704-9.

### **Recommended Reading**

Lane, N., "Oxygen: the molecule that created the World", Oxford University Press, 2002.  
Levy, T., "Vitamin C, Infectious Diseases, and toxins: Curing the Incurable", Xlibris corp., 2002.

### **Links**

1. [www.orthomed.org](http://www.orthomed.org)
2. [www.orthomolecluar.org](http://www.orthomolecluar.org)
3. Great article on <http://www.medpagetoday.com/HematologyOncology/OtherCancers/tb/2938> discussing how IV C produces intracellular Hydrogen Peroxide which killed cancer cells in three clinical cases!