

# Cantron: Its Beneficial Role Against Health Damaging Free Radicals

A study and comprehensive discussion of the antioxidant power of Cantron and related formulas

*Tests performed at Brunswick Laboratories and Cayman Laboratories.*

*Research Project overseen by Daniel Hetrick, PhD.*

*Research Report and discussions compiled by Jerome Godin*

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According to recent studies...

## Cantron is The World's Most Effective Free Radical Scavenger

### Independent laboratory tests demonstrate that Cantron is...

- \*Up to 1769 times more powerful than vitamin E on fat-soluble peroxy radicals
- \*Up to 424 times more powerful than vitamin C on water-soluble peroxy radicals
- \*Up to 45 times more powerful than Gallic acid on hydroxyl radicals
- \*Effective in blocking the formation of all superoxide radicals in the test system

The results of recent studies conducted by 2 independent laboratories demonstrate that Cantron is extremely effective against health damaging free radicals, in fact, the most potent free radical scavenger ever tested. This is great news for those who wish to prevent or reverse serious health conditions. Previously it was believed that OPC - a substance that comes from grape seeds and pine bark - was the world's most powerful antioxidant supplement. These studies, however, prove that Cantron is head and shoulders above OPC and all other antioxidants in its ability to scavenge a wide range of the dangerous "Reactive Oxygen Species" of free radicals.

How much more effective is Cantron than other potent antioxidants? OPC is reported to be 20 times more effective than the vitamin C standard on water-soluble peroxy radicals and 50 times more powerful than the vitamin E standard on fat-soluble peroxy radicals (these standards were established by the US Department of Agriculture). This makes OPC a world-class antioxidant product. It appears, however, that based upon the outcome of the study, Cantron is in a league of its own. Not only is it up to 1769 times more powerful than the vitamin E standard on fat-soluble peroxy radicals and up to 424 times more powerful than the vitamin C standard, it is also 45 times more powerful than Gallic acid on hydroxyl radicals (the most reactive form of free radicals) and completely blocked the formation of superoxide radicals in the test system. Indeed, it cannot be denied that Cantron is a powerful countermeasure against a number of different free radicals that are responsible for multitudes of diseases in mankind.

### What are free radicals?

In the most simplistic terms, free radicals are unstable molecules inside the body that attack stable molecular structures. When chronic and in the absence of sufficient defenses, these attacks cause damage to healthy tissues, organs, cell membranes, blood vessels, proteins, fats, carbohydrates and even DNA strands within the cell. This resultant damage has a cumulative effect and can lead to many disease states. Degradation of DNA in cells caused by free radicals has serious biological consequences such as mutation, carcinogenic transformation, pathologies and cellular aging. It is even reported that free radicals may lead to programmed cell death (apoptosis).

According to the National Cancer Institute (<http://www.cancer.gov>): "Free radicals are molecules with incomplete electron shells which make them more chemically reactive than those without incomplete electron shells. In humans the most common form of free radicals is oxygen. When an oxygen molecule (O<sub>2</sub>) becomes electrically charged or "radicalized" it tries to steal electrons from other molecules, causing damage to the DNA and other molecules. Over time, such damage may become irreversible and lead to disease including cancer."

The world's leading testing facility of antioxidants - Brunswick Biomedical Technologies Lab - describes the effects of free radical damage accordingly: "Overall, free radicals have been implicated in the development of at least 50 diseases! A partial list includes arthritis and other inflammatory diseases, kidney disease, cataracts, inflammatory bowel disease, colitis, lung dysfunction, pancreatitis, drug reactions, skin lesions and aging to mention a few. Heart disease and cancer are two of the most widespread diseases associated with free radical damage. Heart disease is the leading cause of death in America today, killing an estimated one in every three Americans. Literally, free radicals are the major factor of aging."

Other disease states of which free radicals are responsible for are Parkinson's disease, Alzheimer's disease, lupus, atherosclerosis, strokes, rheumatoid arthritis, age-related hearing loss, liver disease, age associated neurological disorders, retinopathy, macular degeneration, TMJ symptoms, cerebral palsy, Down's syndrome, ALS, sepsis, Huntington's disease, loss of skin elasticity (breakdown of collagen), and the list is still growing as ongoing research continues.

There are more than 300 theories to explain the aging phenomenon. Among all theories, the free radical theory of aging, postulated first by Dr. Denham Harman at the University Of Nebraska, is the most popular and widely tested. Aging is thought to occur as a result of constant exposure to Reactive Oxygen Species of free radicals with a cumulative damage, through the entire life, along with the gradually decreasing repair capacity and increasing degenerative changes in the organs, tissues and individual cells. The body has enzymes, which can repair much of the damaged proteins, but when these enzymes become damaged themselves, repair processes are compromised.

"It is difficult these days to open any medical journal and not find some paper on the role of "Reactive Oxygen Species" or "free radicals" in human disease. The species have been implicated in over 50 diseases. This large number suggests that radicals are not something esoteric, but that they participate as a fundamental component of tissue injury in most, if not all, human diseases." ...from the American Journal of Medicine, Sept 30, 1991 v91 n3C p12S (9); Oxidants and Antioxidants: Pathophysiological Determinants and Therapeutic agents, Author: Halliwell, Barry.

### **What causes Free radicals?**

There are many internal and external factors which form free radicals: tobacco smoke, excessive alcohol, radiation including ultraviolet radiation from the sun, auto exhaust, pesticides, herbicides, pollution, prescription drug use, chemotherapy, surgery, breakdown of bacteria by white blood cells, microbial or viral infections, metabolism of toxins, inflammatory processes, byproducts of oxygen metabolism, stress, shock, trauma, hypoxia, enzymatic reactions, calorie consumption, poor diet and many food materials especially oxidizing hydrogenated oils.

A single free radical can destroy an enzyme, a protein molecule, a strand of DNA, or an entire cell, but even worse, in a nano-second it can unleash torrential chain reactions in our bodies. Each free radical can initiate and perpetuate millions of other free radicals, setting off chains of biologically damaging reactions. This damage is at the molecular and cellular levels. Ironically, the underlying mechanisms that most chemotherapeutic agents and ionizing radiation have is not to neutralize free radicals but to produce more free radicals which leads to irreversible tissue injury.

### **What are antioxidants?**

In the most simplistic terms, the role of antioxidants is to interact with free radicals and "quench" them or render them harmless. Researchers believe that increased dietary intake of antioxidants can slow the process of free radical damage and associated disorders. By removing free radicals, antioxidants help to: protect against DNA damage in cells, protect cell membranes, protect against all forms of cancer, protect the brain against various forms of dementia, protect against the harmful cross-linking of proteins with sugars that cause cell damage and may help slow the aging process. Antioxidants have been shown to provide: blood vessel strength and protection, enhanced memory and learning function, healthy lung function, bone and joint flexibility.

According to the National Cancer Institute, "Antioxidants are substances that may protect cells from the damage caused by unstable molecules known as free radicals. Free radical damage may lead to cancer. The antioxidants interact with and stabilize free radicals and may prevent some of the damage free radicals otherwise might cause. Considerable laboratory evidence from chemical, cell culture, and animal studies indicate that antioxidants may slow or possibly prevent the development of cancer. Antioxidants are often described as "mopping up" free radicals, meaning they neutralize the electrical charge and prevent the free radical from taking electrons from other molecules."

US Federal Courts have recently instructed the FDA to allow the claim that antioxidants may prevent cancer (Whitaker vs. Thompson {2002}, Pearson vs. Shalala {1999} and Pearson vs. Shalala 2 {2001}). These landmark rulings benefit the general public, which now has access to this extremely important health information that may help millions of people reduce the risk of this dreaded disease and live longer as a result of using antioxidants in their diet.

Two principal mechanisms of action have been proposed for antioxidants, first is stabilizing free radical present in the system, and the second mechanism involves the removal of chain initiating catalysts. Furthermore, antioxidants can act by scavenging biologically important reactive oxygen species, by preventing their formation, or by repairing the damage that they do. Antioxidants can suppress apoptosis (programmed cell death), act as reducing agents, chelate metal compounds and affect directly or indirectly the expression of genes in tissues. A diet high in antioxidants may even bolster the body's own defenses against biological invaders transmitted by germ warfare, mosquitoes or other delivery methods.

The body's arsenal of antioxidants appear to be sufficient for keeping oxidation in check in children and in youths, but once we reach our 20's, the effectiveness of the body's antioxidant defense mechanisms lessen and free radicals are given greater rein to do damage. For example, the antioxidant enzyme, superoxide dismutase, appears to diminish with age and the antioxidant capacity in human plasma decreases. While the body's antioxidant defenses are reduced, the number of free radicals in the body rises dramatically. Studies also show that cells from old individuals are more susceptible to oxidative damage than cells from younger donors and that some of this damage can actually be prevented by antioxidants.

Researchers found that cancer patients with small cell lung cancer who used antioxidants showed increased long-term survival rates as compared with previously published studies. It was also noticed that patients receiving antioxidants were able to tolerate chemotherapy and radiation treatment well. It was concluded that antioxidant treatment could potentiate orthodox cancer treatments by decreasing the likelihood of side effects and increasing the host immune defense. Ralph Moss, PhD, author of the best selling book, "The Cancer Industry," former assistant director of public affairs at Memorial Sloan-Kettering Cancer Center, and producer for several documentaries, including, "The Cancer War," stated in his newsletter of 8/17/2003; "I would argue that the preponderance of evidence already suggests that antioxidants reduce the side effects of chemotherapy and radiation, without, however, interfering with their effectiveness.

As the body's own antioxidant defenses are gradually overwhelmed by the aging process or disease or both, fruits, vegetables, herbs, spices, and concentrated dietary supplements should be consumed as they contain the largest amounts of antioxidants to help replenish and augment the system.

### **Various Forms of Free Radicals and Antioxidants**

There are 6 common reactive species of free radicals existing in the body. Radicals of oxygen compromise the variety of reactive molecules that can constitute oxidative stress to the cells. The reactive oxygen species are the peroxy radical, hydroxyl radical and superoxide ion. Nitric oxide, singlet oxygen and peroxynitrite are the other reactive forms of radicals.

As free radicals are all different, likewise, all antioxidants are not alike. Not only do antioxidants differ in their potency but also on what type of free radicals they work upon. For example, Vitamin C only works on water-soluble peroxy radicals, vitamin E scavenges fat-soluble peroxy radicals, superoxide dismutase and catalase is only effective on superoxide radicals, etc. It is rare to find an antioxidant that can work effectively on more than one type of radical let alone all 3 forms of the harmful reactive oxygen species. To properly understand the significance of our independent study, a brief discussion of the three reactive oxygen species that Cantron was tested on is necessary.

## The Peroxyl Radical

Peroxyl radicals are the most abundant free radicals in the human body and have been suggested as a major cause of atherosclerosis, cancer, liver disease, Alzheimer's Disease, hearing loss and the aging process. There are two types: water-soluble and lipid (fat) - soluble.

Free radicals attack all major classes of bio-molecules, but lipids are the most susceptible and the easiest to damage. The peroxyl radical species is reasonably stable and not very reactive but they are reactive enough, however, to attack adjacent fatty acid side chains, as well as enzymes, receptors, and other structures found in cell membranes. The cell membrane is a rich source of polyunsaturated fatty acids, which are easily attacked by oxidizing radicals including the peroxyl radical. The destruction of polyunsaturated fats causes damage by unleashing a chain reaction of chemical events that can collapse cell membranes. Once one peroxyl free radical forms, and an appropriate antioxidant is not available to stop the process, the chain of events keeps occurring until the cell membrane literally collapses. As the cellular membrane becomes compromised, the cell bursts open, spews its contents and dies. This series of damaging breaks in the cellular membrane can be prevented by antioxidant defenses and the cells can remain intact. However, it has been demonstrated that total peroxyl radical scavenging antioxidant capacity (TRAP) in human plasma decreases with age.

Peroxyls are formed by several routes especially during the breakdown of organic peroxides, oxidation of lipids or other organic molecules in oxidative stress. They are formed within the delicate cellular membrane. If a free radical within or on the outside of a cell attacks the fatty acid cell membrane structures, they create peroxyl free radicals. These radicals are also formed as a byproduct of the clash between hydroxyl radicals and polyunsaturated fatty acids derived from vegetable oils.

## The Hydroxyl Radical

Of all the reactive oxygen species (ROS), the hydroxyl reactive oxygen species is the most reactive. It is, in fact, the most reactive radical known to chemistry and the most physiologically harmful, being suspected in such pathologies as atherosclerosis, oncogenesis, cataractulargenesis and DNA mutation.

These dangerous radicals can attack and damage almost every molecule found in living cells because they react as soon as they come in contact with another molecule. Since it is so reactive, hydroxyl radicals generated in vivo do not persist for even a microsecond as they rapidly combine with molecules in their immediate vicinity as fast as they collide. Hydroxyl radicals can be produced at an enormous rate, have easy access to every portion of the cell, are capable of causing great damage within a small radius of their site of production and are highly carcinogenic. In addition to damaging unsaturated fats in cell membranes, hydroxyls are reactive enough, aggressive enough, and persist long enough to damage the less susceptible proteins (including the fragmentation of vital proteins in plasma), nuclear acids, enzymes and carbohydrates.

Russell Reiter, PhD, professor of neuroendocrinology at University of Texas Health Center has highlighted the dangers of the hydroxyl radical; "If the function of radicals is to destroy molecules and tissues, then the hydroxyl radical would be the radical's radical. It reacts at diffusion rates with virtually any molecule found in its path including macromolecules such as DNA, membrane lipids, proteins and carbohydrates. In terms of DNA, the hydroxyl radical can induce strand breaks as well as chemical changes in the deoxyribose and in the purine and pyrimidine bases. Damaged proteins, many of them crucial enzymes in neurons lose their efficiency and cellular function wanes. Protein oxidation in many tissues, including the brain, has been proposed as an explanation for the functional deficits associating with aging."

In addition to the direct damage caused by hydroxyls, they play a major role in forming peroxyl radicals and stimulating the free radical chain reaction known as lipid peroxidation. Peroxyl radicals are formed when oxygen combines with the hydrogen radical. One hydroxyl radical can result in the conversion of many hundred fatty acids side chains into lipid hydroperoxides. As hydroxyl radicals react with carbohydrates it leads to chain breaks in important molecules in a process involving the peroxyl radical as an intermediate. Since hydroxyls do such direct damage, work in conjunction with and create harmful peroxyl radicals, then supplementation of hydroxyl scavenging antioxidants may be extremely important.

## The Superoxide Radical

The Superoxide Radical can cause damage to the hereditary material (DNA) and propagate cancer cells. It is implicated in cataracts, macular degeneration, atherosclerosis, rheumatoid arthritis and joint inflammation. In the presence of superoxide anions, Low Density Lipoprotein (LDL) deposited on arterial cell walls undergo peroxidation, become fibrous, then calcified, thereby, blocking blood flow. Synovial fluids in joints are oxidized by superoxide; unfortunately joint fluids lack sufficient superoxide dismutase. Superoxide is the most important source of initiating radicals in vivo. Once you get a superoxide radical you are going to have radicals propagating damage throughout the biological system until you have a termination- that is -until that superoxide radical and all resultant radicals are quenched. Therefore in biological systems, the superoxide anion is a very important free radical. The superoxide anion is not a particularly reactive molecule and it can diffuse considerable distances from its site of production. The greatest danger from superoxide is that these radicals can be converted to more damaging radicals by a chain reaction. They combine with other reactive species such as nitric oxide to yield more reactive species such as peroxy nitrite radicals and they give rise to the highly reactive hydroxyl radical species. Peroxynitrite is a strong oxidant that attacks proteins, cysteines and methionines. As previously mentioned the hydroxyl is the most reactive and physiologically harmful free radical.

The body utilizes important antioxidants to deal with superoxide radicals, in particular the enzyme Superoxide Dismutase (SOD). Decreased SOD favors Superoxide anion formation. This antioxidant is so necessary that its very absence would be lethal. The problem is that SOD levels in the body decline with age and supplementation with SOD tablets is not that effective because they are poorly absorbed into the bloodstream.

## To Recap

- \* It is a well-established fact that free radicals have been implicated in over 50 degenerative diseases including heart disease, cancer and aging.
- \* Consumption of antioxidants may eradicate dangerous free radicals and help prevent disease.
- \* The federal court has forced the FDA to allow the claim that antioxidants may prevent cancer.
- \* The body's storehouse of antioxidants diminish with age and leads to the onset of disease and premature aging.
- \* There are many forms of free radicals. Peroxyl radicals are the most abundant, hydroxyl radicals are the most dangerous and superoxide anions are the greatest initiator of other dangerous free radicals.
- \* One free radical engenders many other free radicals, causing a chain reaction of biological events.
- \* Cantron is not only the most potent antioxidant known to man, but works against a number of radicals that are responsible for multitudes of diseases in men.
- \* To obtain the equivalent antioxidant protection of just one daily dose of Cantron (1 1/2 teaspoons), one would have to consume 44 ounces of orange juice (5 1/2 cups) for its peroxyl scavenging activities, 26 teaspoons of concentrated green tea extract with 95% polyphenols for its hydroxyl radical scavenging ability, and mega-doses of superoxide dismutase and/or catalase tablets.
- \* Supplementation of antioxidants, along with a healthy diet of antioxidant foods and beverages should be exercised by anyone who values good health or who is seeking "Wellness." A wide variety of antioxidant substances are recommended in our "Cantron Total Wellness Program" and our "Cantron Total Wellness Diet."

## **Cantron: Laboratory Studies of its Scavenging Abilities against the Reactive Oxygen Species of Free Radicals (peroxyl radical, hydroxyl radical, and superoxide anion)**

Cantron has been known to be a powerful antioxidant. Research was needed, however, to determine just how potent Cantron is in relation to other powerful antioxidants and to ascertain which types of Reactive Oxygen Species (ROS) it works upon. Most antioxidants usually scavenge only one specific type of radical species, for example, vitamin C only works upon water-soluble peroxyl radicals and has no effect upon fat-soluble peroxyl radicals, hydroxyl radicals, or superoxide radicals.

Nutraceutical chemistry consultant, Daniel Hetrick, PhD., was commissioned to design, implement and oversee this project. It was decided to test Cantron on all 3 of the reactive oxygen species that wreak havoc on the body and cause severe illnesses. It was also decided to test previous generations and other variations of the Cantron formula including: Sheridan's Entelev, Sopcak's Cancell, and 3 different variations of the Cantron formula (our original Sopcak/Feather version, our current New Millennium Version and an experimental version). All versions of this formula have the same basic ingredients - the only difference being the quantities and ratios of those components that are created in the manufacturing process. The results of the different variations were not expected to vary widely, if at all. Cantron was also tested for its phenolic content. Phenolic and polyphenolic compounds are known as powerful antioxidant substances that exist in many plant foods and herbs.

Samples were sent to Brunswick Laboratories in Wareham, MA ([www.brunswicklabs.com](http://www.brunswicklabs.com)) to test for phenolic content and activity against peroxyl and hydroxyl radicals. To test for activity of superoxide radicals, samples were sent to Cayman laboratories in Ann Arbor, MI ([www.caymanchem.com](http://www.caymanchem.com)).

### **Oxygen Radical Absorption Capacity and Hydroxyl Radical Absorption Capacity of Cantron and Related Formulas**

The oxygen radical absorption capacity test (ORAC) and Hydroxyl Radical Absorption Capacity test (HORAC) was carried out at Brunswick Laboratories, a state of the art facility with highly skilled scientists. Brunswick serves the nutraceutical, pharmaceutical, food and cosmetic industries. Their antioxidant team developed proprietary high throughput technologies in antioxidant screening and has accumulated the world's largest antioxidant database on a wide variety of natural product compounds. Their expertise has made them a leader in antioxidant activity profiles. Brunswick Labs is the inventor of the improved and automated ORAC assay (US patent Pending). This assay is the second generation of the ones used by the National Institute of Health and US Department of Agriculture and is more accurate than its predecessors. Brunswick screens natural products, antioxidant supplements, beverages, pure chemicals, plasma, serum, and urine in their antioxidant assays.

The ORAC test measures the antioxidant activity against peroxyl radical by determining how many peroxyl free radicals can be absorbed by a given antioxidant as compared to a vitamin E analog (Trolox) as the test standard and vitamin C. Since Cantron is an aqueous product, the test radicals utilized in this study were hydrophilic peroxyl radicals (note: vitamin E is lipophilic). The original ORAC assay was primarily for water-soluble antioxidant activity against peroxyl radicals. Recently Brunswick Laboratories expanded the ORAC method to incorporate fat-soluble antioxidant activity.

The HORAC measures the activity of a given antioxidant against hydroxyl radicals. Cantron and related formulations were to be tested and to be compared to the test standard, Gallic Acid, one of the most common and powerful antioxidants found in green vegetables such as broccoli and spinach. Since Cantron is an aqueous product, the test radicals utilized in this study were hydrophilic hydroxyl radicals.

In February 2003, two samples of the Cantron formula were sent to Brunswick Laboratories: the current New Millennium version and an experimental version. Brunswick was to test the Cantron samples and to send the raw scores expressed in units to Dr. Hetrick who in turn was to make the necessary calculations comparing Cantron to the various test standards.

For the ORAC test, Trolox, a water-soluble Vitamin E analog, is used as the calibration standard and the ORAC unit is expressed as micromole Trolox equivalent (TE) per liter ( $\mu\text{Mole TE/L}$ ). The ORAC value for the vitamin E standard is 1200 units ( $1200 \mu\text{Mole TE/L}$ ) and the value for the vitamin C standard is 5000 units ( $5,000 \mu\text{Mole TE/L}$ ). Because Cantron is a liquid formulation we also decided to compare its ORAC values to that of an equivalent amount of orange juice, which contains vitamin C, bioflavonoids and other antioxidant factors. Orange juice has a value of 7,400 units, which is slightly higher than the vitamin C standard. For the HORAC test, Gallic Acid is used as the calibration standard and the HORAC result is expressed as mg. Gallic Acid equivalent (GAE) per liter. Gallic Acid is a potent antioxidant that exists in vegetables such as broccoli. The HORAC value for Gallic acid is 1,000 units ( $1,000\text{mgGAE/gL}$ ).

Because each variation of Cantron has a slightly different density, in order to make a proper comparison, the raw scores of the study needed to be adjusted for the density of the sample, before illustrating the comparative values. The results of these 2 samples came back on February 19, 2003 (copies of the report are available upon request). The phenolic content of Cantron was measured at an incredibly high  $86,659.24 \text{ mg/L}$  and the results of the Cantron formula against peroxy and hydroxyl radicals were astonishing based upon the values of other potent antioxidant substances that have previously been tested throughout the years.

The ORAC score for the New Millennium version of Cantron - after adjusting for density - was a whopping 1,081,886 units as opposed to a mere 1200 for vitamin E and 5,000 for vitamin C. Comparatively speaking, this version was 902 times more powerful than the vitamin E standard, 216 times more powerful than vitamin C standard and 142 times more powerful than orange juice against peroxy radicals. The experimental version was even more potent against peroxy radicals. It scored 1,135,591 making it 942 times more effective than vitamin E, 226 times vitamin C and 153 times orange juice. Surprisingly, however, while the experimental formula worked better against peroxy radicals, the New Millennium version was far superior on hydroxyl radicals, scoring 45,003 (45 times Gallic Acid) to 33,180 (33 times Gallic Acid).

Samples of 3 other variations of the formula were sent to Brunswick Labs in April 2003. These samples included: a bottle of Entelev that was manufactured by the original developer, James V. Sheridan, in 1982, a bottle of Cancell that was manufactured by Edward Sopcak in 1988, and a bottle of 1997 vintage Cantron manufactured by Medical Research Products. This 1997 version of Cantron utilized the same manufacturing procedures as Ed Sopcak did in his Cancell formulation and was chemically identical; therefore, results were expected to be identical or closely similar. MRP manufactured and distributed this version from 1984 to 1998 before the new, improved version was released. Andy Johnson a member of the Hope Foundation provided the bottles of Entelev and Cancell.

On May 1, 2003, Brunswick completed their report (copies available upon request). Unexpectedly, the results of these samples were dramatically different than the first two samples. The 1982 Entelev formula scored 879,050 in the ORAC test, the 1997 Cantron scored 2,122,527, and the 1988 Cancell product scored 1,882,618. The 97 Cantron and 88 Cancell formulas worked significantly better on peroxy radicals than the first samples, but rather surprisingly; they had almost no effect on hydroxyl radicals - the most dangerous radical of all. None of these 3 formulas were as effective as the Gallic Acid standard of 1,000 units. Entelev scored 161, 1997 Cantron scored 236 and 1988 Cancell scored 215 as compared to New Millennium Cantron's 45,003.

Because Cantron is in liquid form - not in pill form as contrasted to the established test standards of vitamin C and E in the ORAC study - the comparison of Cantron to liquid orange juice has been included in this report. Orange juice, which has an ORAC value of 7,400 (slightly higher than the vitamin C standard) contains vitamin C, bioflavonoids and other antioxidant substances. The problem with this comparison, however, is related to dosage/consumption. Although an equivalent volume of New Millennium Cantron is 142 times more effective than orange juice, the daily dosage for Cantron is small ( $1\frac{1}{2}$  teaspoons). Obviously, one is able to consume a great deal more orange juice than Cantron. But the small daily dose of Cantron still provides tremendous antioxidant benefits. To obtain equivalent peroxy scavenging protection of a daily dose of Cantron, one would have to consume 44 ounces of orange juice ( $5\frac{1}{2}$  cups). And since orange juice is not effective upon hydroxyl or superoxide radicals, to get the equivalent protection of a daily dose of Cantron one would also have to consume  $1\frac{1}{2}$  cups (12 oz.) of green tea that contains at least 95% polyphenols and mega doses of superoxide dismutase and/or catalase. Naturally, one could further increase their antioxidant protection by taking the above-mentioned antioxidants or other potent antioxidants along with Cantron.

Brunswick Laboratories has compiled a vast and comprehensive antioxidant database. Green Tea was by far the greatest hydroxyl radical scavenger on their chart; in fact, it is 9.2 times more potent than the next highest antioxidant (elderberry extract). Volume for volume, Cantron is 16 times more powerful than Green Tea (147 times elderberry extract), which demonstrates its vast superiority to all other hydroxyl radical scavengers. Superoxide Dismutase and Catalase do not absorb well, and data is not available at this writing that could quantify the actual intake of these substances, which that would be equivalent to one dose of Cantron, but it would certainly take a significant amount. When data is available, it will be reported on Cantron.com.

The extraordinarily high phenolic content of Cantron (86659.24 mg/L) is ascribed to the presence of a series of quinones, which cross-react in the phenol assay. Cantron does not contain free phenol.

Conclusion- Cantron has an extremely high phenolic content and all variations of the formula have extremely high antioxidant activity. Some of the formulas were more active on peroxy radicals, while others were more effective against hydroxyl radicals. Cantron New Millennium formula had the most balanced antioxidant activity, having substantial activity against both hydroxyl and peroxy radicals.

## HORAC Scores

Formula/Variation	Brunswick ID #	Raw HORAC Score	Horac Score Adjusted for Density	#Times More Potent Than Gallic Acid
Cantron, New Millennium Lot # 322363	03-222	39,339	45,003	45
Cantron, Experimental Lot # 322363E	03-223	29,106	33,180	33
Entelev, 1982 Sheridan, Lot #102	03-708	140	161	<1
Cantron, 1997 vintage Lot # 61797	03-709	205	236	<1
Cancell, 1988 Sopcak No Lot # provided	03-710	187	215	<1

## ORAC Scores

Formula	Brunswick ID #	Raw ORAC Score	ORAC Score Adjusted For Density	# Times More Potent Than Vitamin E	#Times More Potent Than Vitamin C	# Times More Potent Than OJ
Cantron, New Millennium Lot # 322363	03-222	945,705	1,081,886	902	216	142
Cantron, Experimental Lot # 322363E	03-223	991,783	1,135,591	942	226	153
Entelev, 1982 Sheridan, Lot #102-L	03-708	783,386	879,050	732	176	119
Cantron, 1997 vintage Lot # 61797	03-709	1,798,752	2,122,527	1769	424	287
Cancell, 1988 Sopcak No Lot #	03-710	1,727,173	1,882,618	1569	377	233

### **Cantron: An Assay of Superoxide Radical Scavenging Ability**

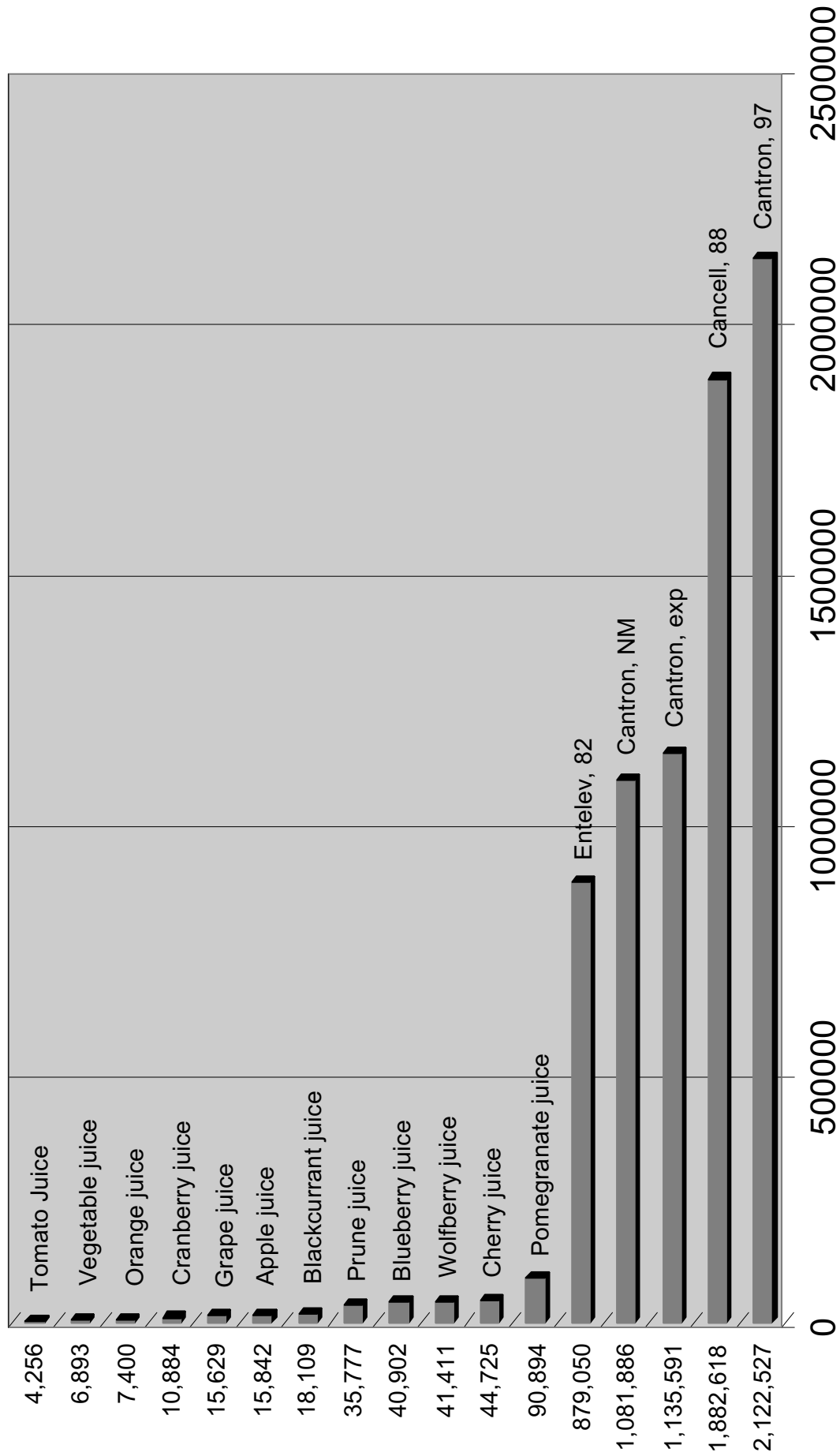
Scavenging of superoxide radicals cannot be directly quantified. Instead, measurements of the activity of the superoxide specific antioxidant enzyme, superoxide dismutase (SOD), are taken after samples of a given antioxidant are added to a solution of superoxide anions.

The Cayman Laboratories assay for SOD activity utilizes superoxide anions generated from Xanthine Oxidase. The anion production is used to measure the activity/concentration of SOD. The assay is modified by inserting the test samples- in this case Cantron and related formulations- after the generation of superoxide anions, but before the addition of SOD. Thus if the Cantron samples inactivate the superoxide anion, activity of SOD will be less than the untreated controls. The reduction in SOD activity/concentration is expressed in units/ml and is the measure of Cantron's ability to destroy the superoxide anions.

Cayman assayed the samples of Cantron at solutions ranging from 1:1 to 1:16,000. At the lower dilutions, the opacity of the samples often interfered with the absorbency measurements and blocked the readings. The first readable sample was at a dilution of 1:10 (diluted 10 times). At this dilution, all of the Cantron samples tested were able to scavenge all of the generated superoxide anions. The endpoint dilution for activity of the samples lies somewhere between 1:10 and 1:100. All dilutions beyond that had no inhibitory effect. The control value at the dilution of 1:10 was + .129 units/ml. Therefore, any score less than this figure would result in a decrease in SOD activity. A zero or negative number indicates no SOD activity whatsoever, and conversely, complete blockage of Cantron against superoxide radicals. All formulas received a negative score.

Conclusion- At a dilution between 1:10 to 1:100, all samples tested had high activity as superoxide anion scavengers or inactivators. At dilutions of 1:10, all samples exhibited complete scavenging ability against superoxide radicals.

# ORAC VALUES OF VARIOUS ANTIOXIDANT JUICES & LIQUID CANTRON (ORAC VALUE PER LITER)



**Table: Results for Superoxide Anion Scavenging in the SOD Assay (Cayman Laboratories)**

Formula/Variation	Results in units/ml	Ability to block formation of Superoxide Radicals
Cantron, New Millennium Lot # 3221120	-.039	complete blocking effect
Cantron, Experimental Lot # 322363E	Not tested	N/A
Entelev, 1982 Sheridan, Lot #102	-.053	Complete blocking effect
Cantron, 1997 vintage Lot # 61797	-.066	Complete blocking effect
Cancell, 1988 Sopcak No Lot # provided	-.067	Complete blocking effect
Control	+. 129	0%

*Legend: all dilutions are 1:10, control value is +. 129 units/ml, anything less than control value indicates superoxide-scavenging ability, results that are zero or below represents complete scavenging abilities.*

**Discussion of the Results-**

The results of the scientific studies conducted at both laboratories indicate that Cantron is not only the most potent but also perhaps the most versatile antioxidant ever tested. In addition to being highly effective upon all three forms of reactive oxygen species, the other damaging radical species such as peroxynitrite, hydrogen peroxide and singlet oxygen are also averted because the propagating radicals (superoxide and hydroxyl) are quenched before these other radicals can be formed.

The most puzzling question is why the various formulations differ so widely in their ORAC and HORAC scores. As the components are the same and the ratios of the ingredients are not that different, results were expected to be similar or the same. With only one exception (1982 Entelev), an inverse relationship or “seesaw” effect was manifested, i.e., whenever the HORAC went up, the ORAC simultaneously went down and vice versa. The question is; are the various formulas actually more or less effective against certain radicals or is there another scientific explanation? Hydroxyl radicals are known to initiate the formation of peroxy radicals and peroxy radicals are known to play an intermediary role with hydroxyls, causing a wide range of chain reactions. Could it be that this complex relationship between the two radicals is responsible for changing the research results so dramatically? Could it be that the prevention or interference of certain chain reactions are responsible? These questions will be addressed in future investigations?

As expected, because the 1997 Cantron and the 1988 Cancell utilized the same manufacturing procedure, their performance was virtually the same, albeit, 97 Cantron was slightly more effective. The scores are even closer before the adjustment for density was made. These two samples had the highest

ORAC scores (Cantron 1,798,752 to Cancell's 1,727,173), among the lowest HORAC scores (Cantron 205, Cancell 187), and were equally effective against superoxide anions (Cantron -.66, Cancell -.67). The similar behavior of these two samples certainly proves that they are virtually identical, with 97 Cantron being slightly superior in its scavenging abilities to the Cancell.

It would be hard to dispute that New Millennium Cantron was the most effective and most complete antioxidant formula in this group as it had the highest hydroxyl radical absorption capacity along with a very high-capacity to scavenge peroxy radicals. Hydroxyl radicals are the most dangerous radicals known to chemistry and are also known to initiate peroxy radicals.

### **Final Conclusion-**

Cantron contains a high level of phenolic compounds. Among all formulas tested, New Millennium Cantron has the most balanced antioxidant effect, as it is highly effective upon all three forms of the Reactive Oxygen Species of free radicals. By quenching the initiating radicals it may also help prevent the formation of other dangerous radicals such as peroxy nitrite, hydrogen peroxide and singlet oxygen. Future tests on in vivo activity of Cantron are warranted.

The FDA has not evaluated the statements in this article or the research results.



## **Further Laboratory Studies on Other Variations of Cantron Related Formulas against the Reactive Oxygen Species of Free Radicals.**

In our previous report, five different versions of Cantron and related formulas were tested for their scavenging abilities against the "Reactive Oxygen Species" of free radicals. This study includes 3 other variations of the formulation. Two of these variations (JVS-23 and EJS-50) were developed under the auspices of the children of James V. Sheridan. The other variation (TB) was developed by the consulting chemist of the Sheridan children. The JVS-23 formula has been reported to be the original Enteleev formula and the EJS-50 has been reported to be the original Cancell formula. The TB formula has been called both Enteleev and Cancell, but by all indication it is a variation of the Enteleev formula. To obtain the full picture on all variations, it was deemed important to screen all three of these formulas for their antioxidant abilities as compared to the other variations that were previously studied. Nutraceutical chemistry consultant, Daniel Hetrick, PhD was in charge of the study.

### **ORAC and HORAC Testing of the Three Samples**

In July of 2003, samples of the three formulas were sent to Brunswick laboratories. They were marked JVS-23, EJS-50 and TB. The testing was completed and the report was compiled on 8/6/03 (report is available upon request).

As expected, the results prove that these versions were also very powerful peroxy and hydroxyl radical scavengers. Rather unexpectedly, however, there was very little difference between these three formulas. In contrast to the proclamations of the Sheridan children and their consulting chemist, none of these formulas behaved anything like the original Enteleev manufactured by James V. Sheridan or the original Cancell samples manufactured by Ed Sopcak, which were previously tested.

Conclusion- All 3 variations were highly effective on hydroxyl and peroxy radicals. EJS-50 and TB were virtually identical in their behavior. JVS-23 behaved marginally different and was slightly more effective than the other two. Of all the formulas tested in both studies, Cantron, New Millennium maintains the highest hydroxyl absorption capacity. The three formulas in this study have higher ORAC scores than New Millennium Cantron, but significantly lower ORAC values than the 1997 Cantron, and the 1988 Cancell versions.

## HORAC Scores

Formula/Variation	Brunswick ID #	Raw HORAC Score	Horac Score Adjusted For Density	#Times More Potent Than Gallic Acid
JVS-23	03-1251	33,975	39,071	39
EJS-50	03-1252	33,145	38,116	38
TB	03-1253	33,156	38,240	38

## ORAC Scores

Formula	Brunswick ID #	Raw ORAC Score	ORAC Score Adjusted For Density	#Times More Potent Than Vitamin E	# Times More Potent Than Vitamin C	#Times More Potent Than OJ
JVS-23	03-1251	1,218,247	1,400,984	1,167	280	189
EJS-50	03-1252	1,158,975	1,332,821	1,111	267	180
TB	03-1253	1,150,441	1,320,007	1,100	264	178

### Superoxide radical scavenging ability of the three variant formulations

Samples of all three formulas were sent to Cayman laboratories to conduct superoxide dismutase assays. The results were mixed. The EJS-50 sample showed no effect on blocking superoxide radicals, TB showed a complete blocking effect, while JVS-23 had partial blocking effect.

Dr. Hetrick, however, advised after the study was completed, that the TB sample may have been highly concentrated due to evaporation (possibly inflating the results), and that the EJS-50 sample may have been diluted (possibly deflating the results). Therefore, these studies should be repeated utilizing better samples of TB and EJS-50.

Conclusion- JVS-23 showed partial scavenging ability of superoxide radicals in the essay. EJS-50 and TB need to be retested with better samples.

**Table: Results for Superoxide Anion Scavenging in the SOD Assay (Cayman Laboratories)**

Formula/Variation	Results in units/ml	Ability to block Superoxide Radicals
JVS-23	+0.30	Partial blocking effect
EJS-50	+1.31	No blocking effect
TB	-0.87	Complete blocking effect

# Enetelev/Cantron Variations

## Graph Of Comparative Scores

**HORAC SCORE**

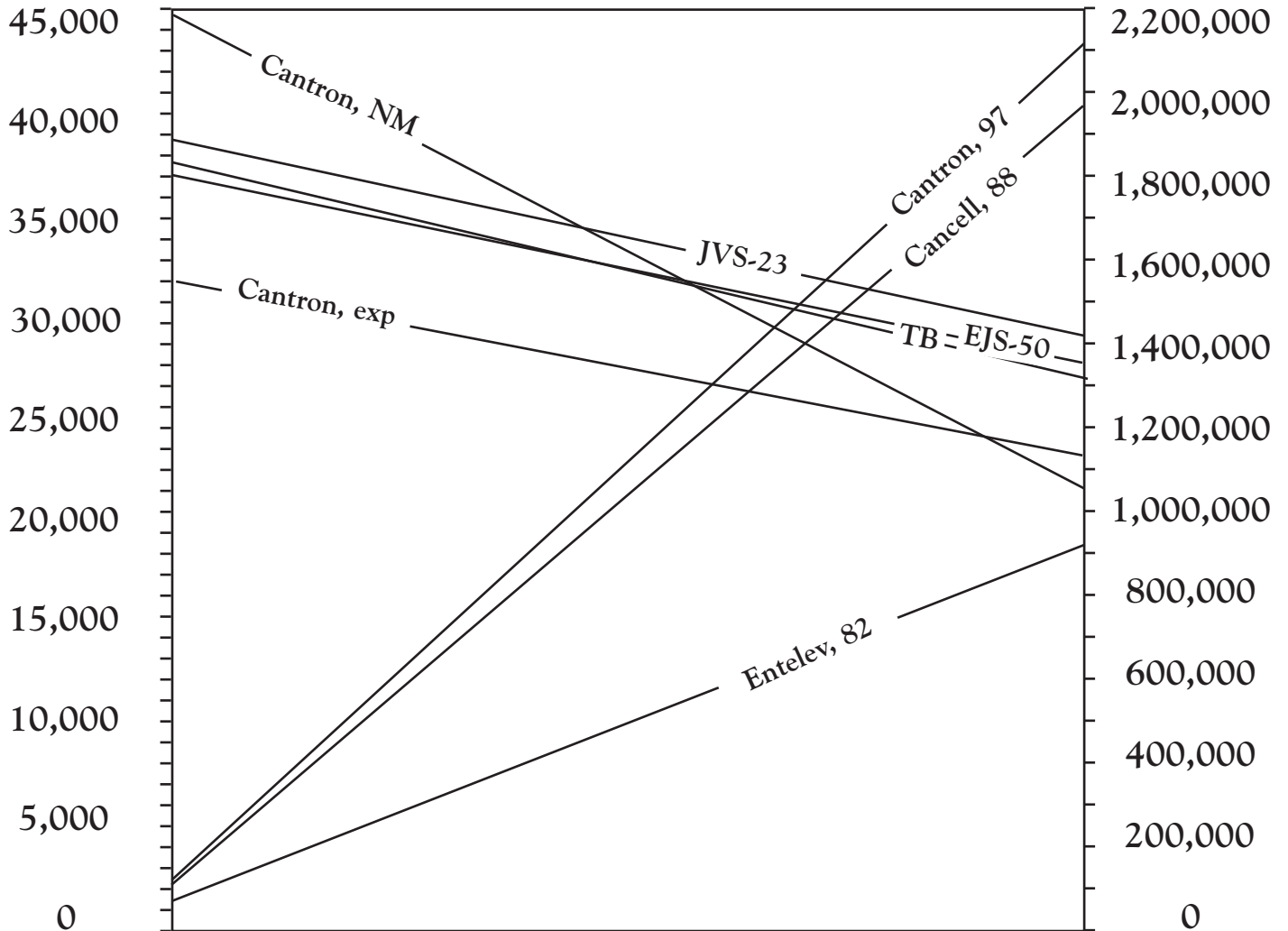
(Hydroxyl Radical Scavenging Ability)

HORAC UNITS\*

**ORAC SCORE**

(Peroxyl Radical Scavenging Ability)

ORAC UNITS\*



\*Horac Unit = uMole GAE/L ORAC unit=uMole TE/L

*Horac & Orac Chart Shows The Inverse Relationship or "SeeSaw" Effect of Horac-Orac Scores. The Graph Shows a Parallel Between JVS-23, EJS-50 and TB Indicating that they are all basically the same formula. It Also Shows Parallel Between Cantron 97 and Cancell 88 demonstrating that they are basically the same formula with Cantron 97 being slightly more active. Cantron, New Millennium has highest HORAC Score. Cantron, 97 has highest ORAC Score.*

## **Discussion of the results-**

As was demonstrated in our previous study, there seems to be an inverse relationship or “seesaw” effect regarding HORAC and ORAC scores. There is a pattern in these studies, that when HORAC scores go up, ORAC scores go down. This phenomenon is manifested again when comparing Cantron, New Millennium, to the three variations tested in this report. The New Millennium version has the highest HORAC (45,003), compared to JVS-23 (39,071); while it had lower ORAC scores (1,081,886) to (1,400,984). JVS-23's ORAC scores, however, are still significantly lower than 1997 Cantron (2,122,527) and 1988 Cancell (1,882,618), but the latter's HORAC scores are much lower, complying with the “seesaw” effect.

Which formula is the best and most balanced antioxidant? One could make convincing arguments for either Cantron, New Millennium, or for JVS-23. It could be argued that because New Millennium Cantron had the highest HORAC scores while maintaining high ORAC scores that it is the best version, especially when considering that hydroxyl radicals are the most reactive and dangerous of all radicals. One can also argue that by scavenging more hydroxyl radicals it will also prevent further peroxy radicals from forming (hydroxyls create peroxy). Each hydroxyl radical that is allowed to exist without being scavenged can cause chain reactions and propagate thousands or even millions of additional peroxy radicals. As Cantron was also a more effective superoxide radical scavenger, the argument for the new millennium version is bolstered even more. One could argue that because JVS-23 is higher in peroxy scavenging abilities that it is the most effective. With that logic, however, one could make the argument that the 1997 Cantron version is the most effective because it had the highest ORAC scores. Deciding which formula is the best is somewhat subjective, but it cannot be denied that both formulas are powerful and versatile antioxidants, which work to quench a large amount of hydroxyl, peroxy and superoxide radicals.

The biggest surprise was how vastly different the Cancell formula was from EJS-50 which was proclaimed to be the Cancell equivalent. Cancell's HORAC is 215 vs. 1,332,821 for the EJS-50 while Cancell's ORAC is 1,882,618 to EJS-50's is 1,332,821. If they were equivalent formulas, they would behave the same. Therefore, it is apparent from these studies that EJS-50 is not Cancell. TB and EJS-50 are almost identical in their results; therefore, it is more likely that EJS-50 is the same formula as the TB formula. Likewise, JVS-23 behaved much differently than Sheridan's Enteleev.

The 1982 Vintage Enteleev formulation was the only sample available for testing that was actually manufactured by James V. Sheridan. It is important to note that Sheridan improved the formula in August 1984. This formula was not tested because a sample was not immediately available. In the future, MRP will manufacture this version according to Sheridan's 1984 specs and test it for comparison to all other versions.

Final Conclusion- All three variations tested in this study are extremely effective scavengers of peroxy and hydroxyl radicals. The TB sample completely blocked formation of superoxide radicals in the assay, JVS-23 was partially effective, and EJS-50 had no effect. The superoxide-screening test for EJS-50 and TB need to be repeated with better samples. Based on their behavior in these assays, it appears that EJS-50 and Cancell are different variations, while EJS-50 and TB appear to be the same. JVS-23 had slightly higher ORAC and HORAC scores than EJS-50 and TB.

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