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## **SELENIUM**

Selenium (from selene, Greek for moon) is a nonmetallic grey mineral of the sulfur family. While toxic in high doses, a relatively high intake of selenium in the diet has repeatedly been linked to lower-than-usual incidences of cancer. Since the 1940s, some organic forms of selenium have been used in cancer therapy by alternative physicians, most prominently Emanuel Revici, MD of New York.

It is needed in small amounts to maintain health and there are harmful effects in animals and people from getting too little, as well as too much, selenium. Deficiencies are mainly seen in regions where supply of selenium in the soil or water is limited; in cases of protein-calorie deprivation; and in patients who are medically-controlled "parenteral" nutrition, from which selenium supplements have been omitted. Some scientists still do not accept the need for selenium supplements and argue against its protective effect against cancer and other diseases. Others endorse the value of moderate amounts of selenium added to the diet.

In the laboratory, selenium has shown a wide range of anticancer effects.

- It inhibits chemical substances and viruses that cause cancer in many cells and animals.
- It protects against ultraviolet light.
- It fights against harmful effects of several cancer-promoting minerals.
- It slows cancer growth, causing a reduction in tumor volume, prolonging survival and reducing the "take rate" of transplanted tumors.

Harold Ladas, Ph.D., a Hunter College Professor, gathered references to dozens of such studies in a comprehensive review article on the subject.

The mechanism of selenium's anticancer action is not known, although several explanations have been suggested. For example, selenium might:

- Stop carcinogens from corrupting the genetic material of the cell. Selenium repairs DNA and keeps chemicals from harming the genetic "blueprint." Selenium is found in an enzyme that plays a crucial role in eliminating harmful free radicals.
- Slow the spread of cancer cells. A study at Georgia Tech showed that selenium and other trace minerals were present in significantly higher concentrations in cancerous than in normal tissues. They concluded that this is "possibly an effort of the body to inhibit the growth of tumors" using this anticancer element.

- Enhances the body's normal anticancer immunity. Scientists at the university of Nebraska Medical Centre found that natural killer (NK) cells were greatly enhanced by even small amounts of the mineral. NK cells are relatively inactive in cancer patients. But the Nebraska scientists found that animals receiving selenium supplements had elevated activity of these natural killers.

Scientists believe this may explain why people who have a relatively abundant supply of selenium in their diets experience less cancer. The statistics for breast cancer are particularly striking. "The higher the selenium, the lower the breast cancer," said Prof. Ladas. Similar associations have been found with leukemia, as well as cancers of the intestines, rectum, ovary, prostate, lung, pancreas, skin and bladder.

In Yugoslavia, scientists studied 33 patients with breast cancer. These women has selenium levels in their bloodstream only half those of healthy volunteers. The doctors suggested that examining blood for low serum selenium levels could be used as a non-invasive way of discovering if a woman was developing breast cancer.

In a study of almost 40,000 Finnish men and women from 1968-1972, with ten-year follow up, over 1,000 new cases of cancer were detected. Selenium levels in the blood of men with cancer were significantly lower than for men who did not have cancer. (Amongst women, there was no such correlation, however.) Low selenium levels were particularly associated with cancers of the stomach and the lung.

At the Yunnan Tin Corporation in China there is a very high rate of lung cancer among the miners. Forty healthy miners were given selenium supplements for a year. The selenium, which increased in their blood, boosted a key detoxifying enzyme system while simultaneously decreasing dangerous lipid peroxide levels by nearly 75 percent. It also protected against cancer-causing substances and ultraviolet radiation. Doctors at the Chinese Academy of Medical Sciences concluded that selenium supplements were a safe and effective food supplement for people.

There have also been a number of reports of selenium's toxicity or even its alleged ability to cause cancer. There is no question that excess selenium in the soil (in the form of its compounds, selenite or selenate) can kill grazing animals and could probably in sufficiently large doses kill humans as well. The symptoms of selenium poisoning are readily apparent without a doctor's assistance, according to Dr. Gerhard Schrauzer; a world expert on the topic. These symptoms include a heavy garlic odor, pallor, nervousness, depression, a metallic taste, skin eruptions, irritability, discoloured teeth and hair loss.

There is doubt about the carcinogenicity studies. For instance, one study showed toxic effects for inorganic, but not organic, forms of the mineral. Schrauzer says that the World Health Organisation (WHO) has discredited earlier findings on the mineral's toxicity. Nor does this necessarily pertain to Revisi's (and others') organic forms of the mineral used as a part of cancer treatment.

As a preservative, selenium is generally ineffective unless there is also a high level of **Vitamin E** in the blood. One study of breast cancer in rats showed that selenium was largely ineffective as an anticancer element, if the intake of vitamin E was deficient. Selenium in the diet reduced the total amount of tumor by 45 percent. This dropped to 25 percent when the mice were given less vitamin E. A low vitamin E intake significantly increased the peroxidation of fats, which may contribute to cancer.

Aside from Revici's work, little has been done to investigate the use of selenium as a cancer treatment. In 1911, Prof. August von Wassermann achieved growth inhibition, shrinkage and eventually the disappearance of small tumors in cancer patients, although larger tumors failed to respond.

The National Academy of Sciences advises that no more than 150 micrograms of selenium be taken orally daily. But Revici's "bivalent negative selenium" – a combination of the mineral with various organic substances, such as the fatty acids of sesame oil – is said to be so non-toxic that huge amounts, up to one million micrograms, have been injected (in the treatment of drug addiction), apparently without any ill effects. In treatment of cancer the dosage is generally about 10,000 micrograms, still nearly one hundred times the National Academy of Science's recommended dose.

Revici's treatment is more complicated than just organic selenium. He only uses selenium in patients whom he deems to be in a "catabolic" as opposed to an "anabolic," state. He had devised a number of urine tests to find whether a patient is in one condition or the other. Selenium is given when the urine has a low specific gravity, a high surface tension and a pH above 6.0. The alkalinity of the urine is supposed to reflect the state of the body's defenses against tumors.

In an unpublished study of Revici in 1955, Robert Ravitch, MD evaluated 1,047 patients with advanced cancer. He is said to have found good results in some of the patients treated with amyl selenide, a Revici compound. Prof. Joseph Maisin, a former president of the International Union Against Cancer, is also said to have used Revici's compounds and reported good results. Amyl selenide was tested by NCI in the P388 test system and was found to act against tumors in mice. Doctors at the University of Milan are also said to have used another Revici compound (Rel) in the treatment of cancer and "reported dramatic life extension". Two doctors unconnected to Revici reproduced parts of his work. They found that organic selenium compounds had strong antitumor activity and low toxicity in animal studies.

Scientists sometimes have short memories. In a 1980 review, for example, one doctor seriously stated that no human experiments with selenium had ever been performed. Yet at the time, Dr. Revici had been using organic selenium in his practice for about four decades and had published a medical textbook describing such work (*Research in Physiopathology as Basis of Guided Chemotherapy, with Special Application to Cancer*. Princeton: D. Van Nostrand and Company, Inc., 1961). Prof. Ladas concluded, "The time is long overdue to merge these two lines of research" on cancer prevention and treatment using selenium.