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The Study of Spirulina

Effects on the AIDS Virus, Cancer and the Immune System

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Spirulina is gaining more attention from medical scientists as a nutraceutical and source of potential pharmaceuticals. There are several new peer reviewed scientific studies about spirulina's ability to inhibit viral replication, strengthen both the cellular and humoral arms of the immune system and cause regression and inhibition of cancers. While these studies are preliminary and more research is needed, the results so far are exciting.

In April 1 1996, scientists from the Laboratory of Viral Pathogenesis, Dana-Farber Cancer Institute and Harvard Medical School Calipatria, California, announced on-going research, saying "Water extract of *Spirulina platensis* inhibits HIV-1 replication in human derived T-cell lines and in human peripheral blood mononuclear cells. A concentration of 5-10 g/ml was found to reduce viral production". HIV-1 is the AIDS virus. Small amounts of spirulina extract reduced viral replication while higher concentrations totally stopped its reproduction. Importantly, with a therapeutic index of > 100, spirulina extract was non-toxic to the human cells at concentrations stopping viral replication.

Another group of medical scientists has published new studies regarding a purified water extract unique to spirulina named Calcium-Spirulan. It inhibits replication of HIV-1, herpes simplex, human cytomegalovirus, influenza A virus, mumps virus and measles virus in-vitro, yet is very safe for human cells. It protects human and monkey cells from viral infection in cell culture. According to peer reviewed scientific journal reports this extract, ". . . holds great promise for treatment of. . .HIV- 1, HSV- 1, and HCM infections, which is particularly advantageous for AIDS patients who are prone to these life-threatening infections."

Calcium-Spirulan is a polymerized sugar molecule unique to spirulina, containing both sulfur and calcium. Hamsters treated with this water soluble extract had better recovery rates when infected with an otherwise lethal herpes virus. How does it work? When attacking a cell, a virus first attaches itself to the cell membrane. However, because of spirulina extract, the virus cannot penetrate the cell membrane to infect the cell. The virus is

stuck, unable to replicate. It is eventually eliminated by the body's natural defenses. Spirulina extracts may become useful therapeutics that could help AIDS patients lead longer, more normal lives.

Spirulina (rhymes with "ballerina") is a traditional food of some Mexican and African peoples. It is a planktonic blue-green algae found in warm water alkaline volcanic lakes. Wild spirulina sustains huge flocks of flamingos in the alkaline East African Rift Valley lakes. It possesses an amazing ability to thrive in conditions much too harsh for other algae. As might be expected, it has a highly unusual nutritional profile. Spirulina has a 62% amino acid content, is the world's richest natural source of vitamin B-12 and contains a whole spectrum of natural

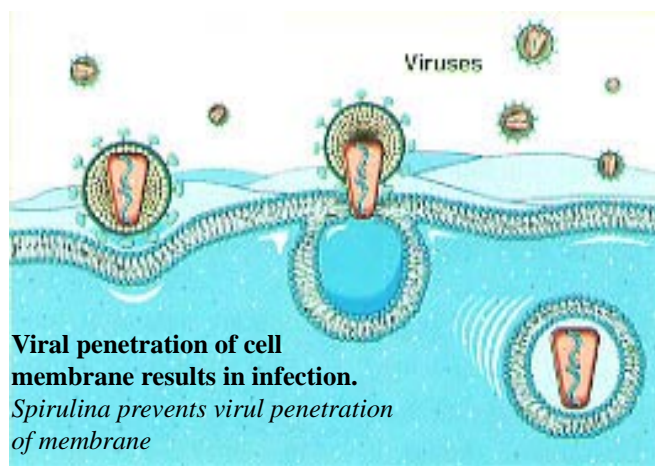
mixed carotene and xanthophyll phytopigments. Spirulina has a soft cell wall made of complex sugars and protein, and is different from most other algae in that it is easily digested.

Millions of people world wide eat spirulina cultivated in scientifically designed algae farms. Current world production of spirulina for human consumption is more than 1,000 metric tons annually. The United States leads world production followed by Thailand, India and China. More

countries are planning production as they realize it is a valuable strategic resource.

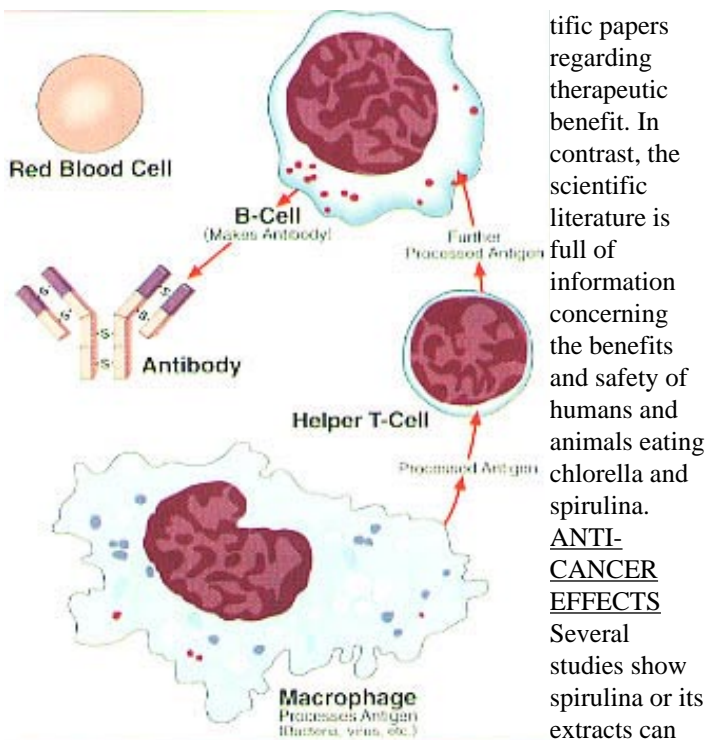
Spirulina is not chlorella, or the blue-green algae harvested from Klamath Lake, Oregon. Chlorella, a green micro-algae, is a nutritious food but does not have the same anti-viral, anti-cancer and immune stimulating properties of spirulina. The chlorella cell wall is made of indigestible cellulose, just like green grass, while the cell wall of spirulina is made of complexed proteins and sugars..

The Klamath Lake bluegreen algae has the scientific name *Aphanizo-menon flos-aquae*. There are serious concerns about the safety of eating it because it can sometimes contain potent nerve toxins. While the scientific literature is full of information concerning the toxicity of *A. flos-aquae* and its dangers to humans and animals, there are few, if any, peer reviewed scien-



Viral penetration of cell membrane results in infection.

Spirulina prevents virul penetration of membrane



tific papers regarding therapeutic benefit. In contrast, the scientific literature is full of information concerning the benefits and safety of humans and animals eating chlorella and spirulina. **ANTI-CANCER EFFECTS** Several studies show spirulina or its extracts can

prevent or inhibit cancers in humans and animals. Some common forms of cancer are thought to be a result of damaged cell DNA running amok, causing uncontrolled cell growth. Cellular biologists have defined a system of special enzymes called endonuclease which repair damaged DNA to keep cells alive and healthy. When these enzymes are deactivated by radiation or toxins, errors in DNA go unrepaired, and cancer may develop.

In vitro studies suggest the unique polysaccharides of spirulina enhance cell nucleus enzyme activity and DNA repair synthesis. This may be why several scientific studies, observing human tobacco users and experimental cancers in animals, report high levels of suppression of several important types of cancer after being fed whole spirulina or treated with its water extracts.

Spirulina is a powerful tonic for the immune system. In scientific studies of mice, hamsters, chickens, turkeys, cats and fish, spirulina consistently improves immune system function. Medical scientists find spirulina not only stimulates the immune system, it actually enhances the body's ability to generate new blood cells.

Important parts of the immune system, the bone marrow stem cells, macrophages, T-cells and natural killer cells, exhibit enhanced activity. The spleen and thymus glands show enhanced function. Scientists also observe spirulina causing macrophages to increase in number, become "activated" and more effective at killing germs.

Feeding studies show that even small amounts of spirulina build up both the humoral and cellular arms of the immune system. Spirulina accelerates production of the humoral system (antibodies and cytokines), allowing it to better protect against invading germs. The cellular immune system includes T-cells, macrophages, B-cells and the anti-cancer natural killer cells. These cells circulate in the blood and are especially rich in organs like the liver, spleen, thymus, lymph nodes, adenoids, tonsils and bone marrow. Spirulina up-regulates these key cells and organs, improving their ability to function in spite of stresses from environmental toxins and infectious agents.

Spirulina has a dark blue-green color, because it is rich in a brilliant blue polypeptide called phycocyanin, which affects the stem cells found in bone marrow. Stem cells are "grand-mother" to both white blood cells that make up the cellular immune system and red blood cells that oxygenate the body. Chinese scientists document phycocyanin as stimulating hematopoiesis (the creation of blood), emulating the affect of the hormone erythropoetin (EPO).

EPO is produced by healthy kidneys and regulates bone marrow stem cell production of red blood cells. Chinese scientists claim phycocyanin also regulates production of white blood cells, even when bone marrow stem cells are damaged by toxic chemicals or radiation.

Based on this effect, spirulina is approved in Russia as a "medicine food" for treating radiation sickness. The children of Chernobyl suffer radiation poisoning from eating food grown on radioactive soil. Their bone marrow is damaged, rendering them immunodeficient and unable to produce normal red or white blood cells. They are anemic and suffer from terrible allergic reactions. Children fed just five grams of spirulina tablets each day make dramatic recoveries within six weeks. Children not given spirulina remain ill.

Spirulina is one of the most concentrated natural sources of nutrition known.

It contains all the essential amino acids, is rich in chlorophyll, beta-carotene and its co-factors, and other natural phytochemicals. Spirulina is the only green food rich in GLA essential fatty acid. GLA stimu-



lates growth in some animals and makes skin and hair shiny and soft yet more durable. GLA also acts as an anti-inflammatory, sometimes alleviating symptoms of arthritic conditions. Spirulina acts as a functional food, feeding beneficial intestinal flora, especially Lactobacillus and Bifidus. Maintaining a healthy population of these bacteria in the intestine reduces potential problems from opportunistic pathogens like E. coli and Candida albicans. Studies show when spirulina is added to the diet, beneficial intestinal flora increase.

Based on this preliminary research, scientists hope the use of spirulina and its extracts may reduce or prevent cancers and viral diseases. Bacterial or parasitic infections may be prevented or respond better to treatment, and wound healing may improve. Symptoms of anemia, poisoning and immunodeficiency may be alleviated.

Scientists in the US, Japan, China, Russia, India and other countries are studying this remarkable food to unlock its potential. More research is needed to determine its usefulness against AIDS and other killer diseases. However, it is already clear that this safe and natural food provides concentrated nutritional support for optimum health and wellness.