

Polysaccharides enhance the immune system

In 1979, Russian scientists published initial research on the immune stimulating effects on rabbits from lipopolysaccharides in spirulina.²⁴ More recent studies in China and Japan have shown polysaccharide extracts increased macrophage function, antibody production and infection fighting T-cells.

In 1991-94 in China, polysaccharides and phycocyanin from spirulina increased immunity in mice by enhancing bone marrow reproduction, growth of thymus and spleen and biosynthesis of serum protein.^{25, 26, 27, 28} In 1993 in Japan, hamsters treated with a polysaccharide extract had better recovery rates when infected with a herpes virus. In 1996, a water extract unique to spirulina, Calcium Spirulan, inhibited replication of HIV-1, Herpes Simplex and other viruses, yet was very safe for human cells.

In the USA, a water soluble extract increased macrophage activity in chickens. In further 1993-96 studies, chickens fed a diet with less than 1% spirulina showed improved immune performance without any adverse side effects. The whole immune system array of killer cells, helper cells and antibody production was supercharged.^{29, 30} Similar benefits were found for cats.³¹

Researchers are testing the theory that spirulina and its extracts act much like a broad spectrum vaccine against bacteria. Because it is a safe natural food, this research has created a sensation among animal scientists. They are scrambling to replace ineffective antibiotics with probiotics that strengthen the immune system and prevent disease. Based on this animal research, as little as 3 grams per day may be effective for humans.³²

In 1996, U.S. scientists announced on-going research, documenting that a water extract of spirulina inhibits HIV-1 replication in human derived T-cells and in human blood mononuclear cells.¹ HIV-1 is the AIDS virus. Small amounts of the extract reduced viral replication, while higher concentration totally stopped its reproduction. The extract seemed to prevent the virus from penetrating the cell membrane, therefore the virus was unable to replicate. This spirulina extract was non-toxic to human cells. The scientists said this was only preliminary research, to be followed by animal and human studies.

Sulfolipid extracts from blue-green algae stop the HIV virus

The Natural Products Branch of the National Cancer Institute (NCI) is searching the world for natural plants and organisms that have biologically active anti-cancer agents. The famous periwinkle plant in the Madagascar rain forests is one example of a new cancer cure. Having scoured terrestrial organisms, scientists are now looking towards the sea.

NCI scientists have screened 18,000 extracts of marine organisms for activity against tumors, viruses and fungi and for immune system stimulation properties. Extracts of sea squirts, sea whip soft corals, and sea sponges offer potential new drugs.

In 1986, the NCI began studying thousands of types of blue-green algae for effects against the AIDS virus and 100 types of cancer. In 1989, the NCI announced that chemicals from blue-green algae were found to be "remarkably active" against the AIDS virus.³³ These are the naturally occurring sulfolipid portions of the glycolipids. Sulfolipids can prevent viruses from either attaching to or penetrating into cells, thus preventing viral infection.

NCI emphasized that a larger testing program including tests on humans with the AIDS virus would not begin until sulfolipids can be obtained in much larger quantities. These scientists further speculated that if sulfolipids proved effective, used in combination with drugs like AZT, they would be safer and more effective.

Scientists used extracts of the blue-green algae *lyngbya*, *phormidium*, *oscillatoria* (a member of the *spirulina* family) and *anabaena*. *Spirulina* is known to contain glycolipids and sulfolipids.³⁴ It contains 5-8% lipids, and of that, about 40% are glycolipids, and 2-5% are sulfolipids.³⁵ Analysis by Earthrise Farms revealed it has about 1% sulfolipids. Blue-green algae can be cultivated in ways to significantly increase the lipids, and presumably, the sulfolipids. This means it could be grown on a large scale for extraction of this valuable anti-cancer and anti-AIDS substance.

In 1996, NCI scientists announced another extract from the blue-green algae *nostoc*, *cyanovirin-n*, could be a broad spectrum virucidal agent against HIV. This unique antiviral protein was selected for further high-priority preclinical development.³⁶

Reduces kidney and liver toxins from mercury, drugs and chemical pollutants

Kidneys play an essential role in cleansing the body of toxins. Heavy metals and many drugs are known to be toxic to the kidneys. Scientists are interested in substances that can help cleanse the kidneys of toxic side effects from heavy metal poisoning or from high intake of medicines or pharmaceutical drugs.

In Japan, *spirulina* reduced kidney nephrotoxicity from mercury and three pharmaceutical drugs in laboratory rats.³⁷ Scientists measured two indicators of kidney toxicity-blood urea nitrogen (BUN) and serum creatinine. When the rats were fed a diet with 30% *spirulina*, BUN and serum creatinine levels decreased dramatically.

Similar effects were observed when rats were given common drug medications: para-aminophenol (painkiller), Gentamicin (antibiotic) and cis-dichloro-diaminoplatinum (anti-cancer drug). In all cases, the *spirulina* diet greatly decreased BUN and serum creatinine levels, and in two cases, brought serum creatinine down to original levels.

In a follow-up study, urinary excretion of two enzymes were measured as further indicators of renal function. The activities of both were significantly reduced in the group fed 30% *spirulina*. The effective compound responsible for the suppression of renal toxicity was the water soluble extract, *phycocyanin*.³⁸

These studies suggest *spirulina* may have a beneficial effect for humans suffering from heavy metal poisoning. They also suggest kidney side effects from pharmaceutical drugs may decrease when it is eaten along with the administration of drugs. Side effects limit the dosage of many drugs, slowing the recovery period. With clinical use in hospitals or with outpatients, higher dosage of such drugs and shorter recovery times may be possible. In any event, study of the kidney cleansing effect offers an insight into the cleansing effects people have reported while fasting.

A 1997 study found liver detoxification of chemical dioxins (polychlorinated dibenzo-p-dioxins). The fecal excretion of dioxin was 7 to 11 times higher for rats on a treatment diet of chlorophyll rich foods (20% *chlorella*, 20% *spirulina* or 2% chlorophyllin). These findings suggest *chlorella*, *spirulina* and chlorophyllin are useful as a new approach in the treatments of patients exposed to lipophilic xenobiotics.^{38A}

Effects against diabetes and hypertension

Spirulina may have a positive effect against diabetes. A water soluble fraction was found to be effective in lowering the serum glucose level at fasting while the water-insoluble fraction suppressed glucose level at glucose loading.³⁹ It may also reduce blood pressure. In a recent study with rats, it was found to reduce high blood pressure.⁴⁰

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