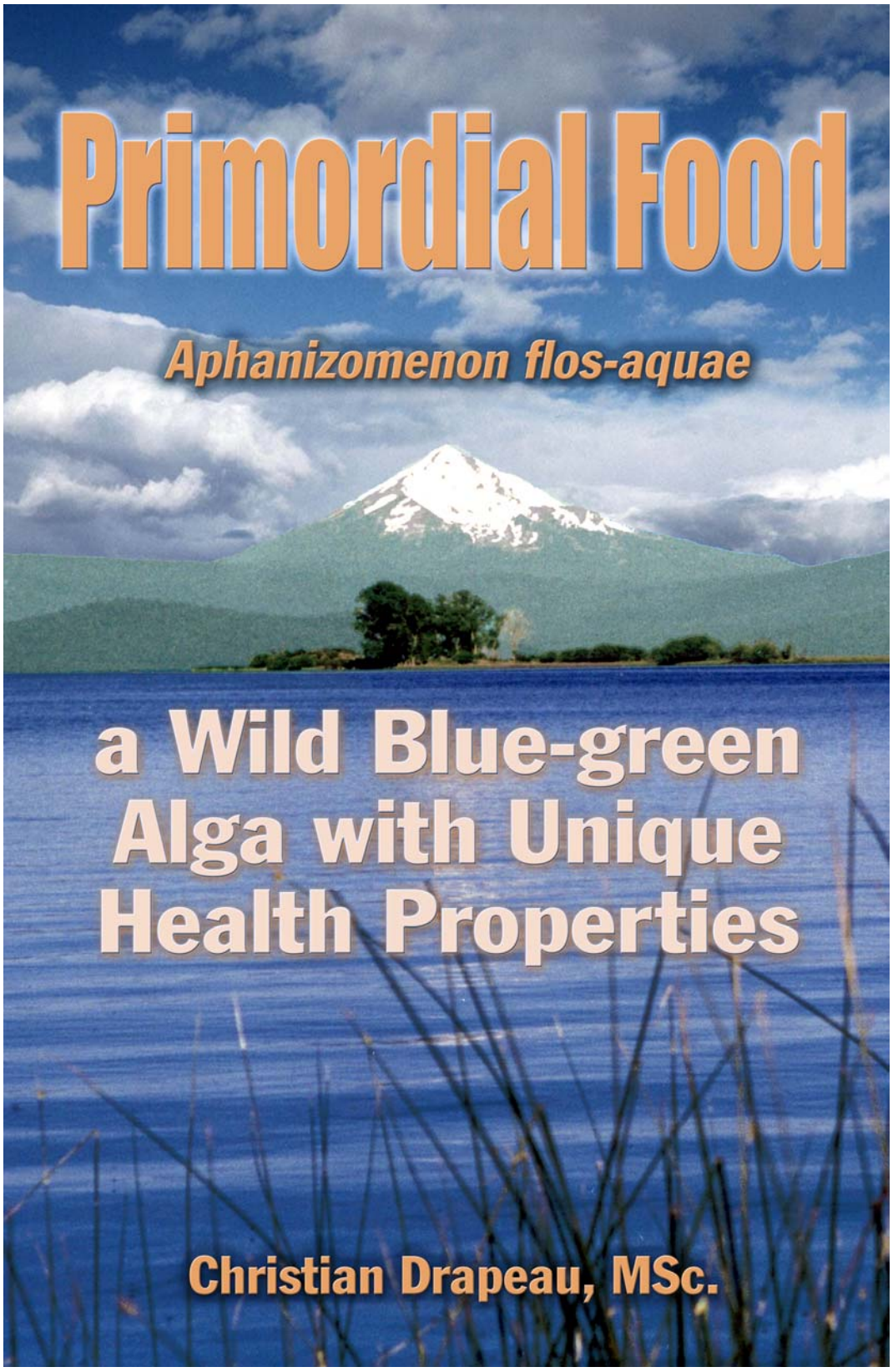


Prodigious Klamath Lake

Ecology of Klamath Lake

Klamath Lake is the largest freshwater lake in Oregon (125 miles^2; 325 km^2) with a watershed drainage exceeding 3,800 miles^2 (9850 km^2). This shallow lake with an average depth of eight feet is flanked by the Cascade Mountains to the west and the Winema Nattional Forest to the east. It is 4,139 feet above sea level and has two major tributaries, the Williamson and Wood Rivers, as well as many smaller springs and stream inflows, providing Klamath Lake with waters of exceptional purity.

Klamath Lake, along with Tulelake, are the shrunken remnants of ancient Modoc Lake. There have been many opinions regarding the age of the Klamath Basin, but the most recent work estimates the formation of the Klamath bed sediments at the Pliocene epoch, more than two million years ago. At that time, Modoc Lake is estimated to have covered over a thousand square miles. At the end of the Pleistocene epoch (about 12,000 years ago), Klamath River began to form, slowly draining Modoc Lake and lowering its surface altitude. Sites of higher elevation began to show and to divide Modoc

Eruption of Mt. Mazama—Painting by Paul Rockwood

At 7,100 feet altitude, Crater Lake is located in the caldera of former Mount Mazama. Crater Lake is 2,000 feet deep, and for decades its water has been used as a standard for water purity.

Lake into several smaller bodies of water, leading to today's Klamath Lake and Tulelake.

North of Klamath Lake is located the remnant of Mount Mazama, originally estimated to stand at 12,500 feet. Nearly 7,000 years ago, Mount Mazama erupted, pulverizing the top 5,000 feet of the mountain and throwing millions of tons of ashes into the atmosphere. The magnitude of Mount Mazama's eruption is estimated at 300 times that of Mount St. Helens. The ashes covered most of the state of Oregon and reached as far as seven other states. After the explosion, Mount Mazama collapsed, forming a caldera that is today's Crater Lake.

At a depth of more than 2,000 feet, Crater Lake is the deepest lake in the United States. Its extremely low temperature and purity create physical characteristics that reflect light in a manner that gives the water a unique and vibrant deep-blue color. While standing at the rim of Crater Lake, it is easy to understand the spiritual fascination that the lake has held for the native people and the early settlers.

Crater Lake to Klamath Lake

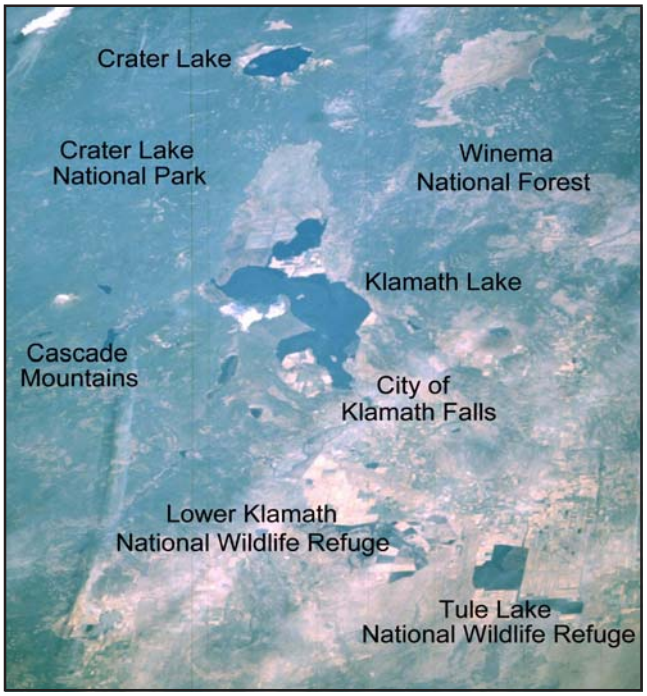
Nearly 90 percent of the water flowing into Klamath Lake comes from springs and rivers of exceptional beauty, bringing nearly 5,400 acre-feet of water every day, 650 billion gallons annually. Although the question remains officially unanswered, most estimates indicate that the spring waters flowing into Klamath Lake come from Crater Lake, after a journey of approximately 15 miles through mineral-rich underground aquifers.

Clear waters of a Williamson River spring

Generally, algae are found in bodies of water that are stagnant or deteriorating. Klamath Lake is an exception; it has always been and is still extremely robust and supports not only a tremendous biomass of AFA but also fish, waterfowl, and predatory bird species.

When ice was first collected from the lake in 1906, it was reported to be green with algae. Lake sucker fish were so common that people used pitchforks to harvest them. Ospreys were reported in densities of up to 10 nests per square mile. Today, the Klamath Basin is still home to the largest wintering congregation of bald eagles in the lower 48 states and is the largest stopover for waterfowl in the Pacific flyway.

Klamath Lake is located in a relatively undeveloped area, surrounded by publicly owned land such as the Crater Lake National Park, the Winema National Forest, the Lower Klamath National Wildlife Refuge and the Tule Lake National Wildlife Bird Refuge. With the Cascade Mountains to the west, thousands of square miles of National Park to the north and east, and the city of Klamath Falls located downstream at the southern end of the lake, Klamath Lake is virtually untouched by industrial activity and pollution.



Stories that Klamath Lake is polluted come from the fact that at certain seasons, fish die from oxygen deprivation due to the changes brought on by massive algal growth. During AFA blooms, the water of Klamath Lake can reach a pH of 11, and dissolved oxygen can go under 3 ppm. This can be deadly for fish.

Klamath Lake is actually rather pristine. It is devoid of industrial activities and surrounded by national parks: Crater Lake National Park to the north, Winema National Forest to the east, and the Cascade Mountains to the west. The city of Klamath Falls is downstream to the south.

Why AFA Flourishes

AFA is unique in its ability to fix atmospheric nitrogen. This very characteristic gives it a rare advantage over other types of algae existing in Klamath Lake. In the harvest season, it grows by consuming atmospheric nitrogen and the lake's available nutrition, creating an enormous bloom that is virtually 100 percent pure AFA.

Many of the lake's characteristics are responsible for this unusual ecosystem, allowing for such abundant bloom of AFA:

- FIRST, the lake is so old that it contains 30 feet of mineral-rich sediment at its bottom, much of it donated by the explosion of Mount Mazama. In their 1967 study of the lake, Miller and Tash estimated that the top one inch of the lake's sediment alone contains enough nutrients to sustain a full algal bloom.

- SECOND, the average depth is less than tenfeet with a median depth of about five feet. In more than 50 percent of the lake, you can stand on the bottom.

- THIRD, the lake is nearly 25 miles long and five miles wide, providing a longitudinal shape that fosters strong winds and turbulence. When the wind blows, it applies pressure to the shallow lake's surface, forcing the water to turn over. The turbulence grabs the mineral-rich sediment, bringing up into suspension a wealth of nutrients that further promote algae blooms. This cycle explains the exceptionally abundant growth of AFA in Klamath Lake.

View of Mount McLoughlin from the east side of Klamath Lake, where harvested AFA is brought to shore. Klamath Lake is a wonderful natural ecosystem filled with abundant wildlife.

Nontoxicity of AFA

In the 1960s and '70s, concerns were raised regarding the possible neurotoxicity of AFA. At that time, a few samples of what was thought to be AFA were taken from lakes in New Hampshire and Europe and were shown to contain neurotoxins.

Classic AFA grows in filamentous colonies about the size of a small blade of grass. In the original scientific literature, the toxic samples of AFA were described as "atypical non-colony forming AFA." In other words, the toxic strains that were originally identified and classified as AFA were not typical of AFA.

These few reports created the perception that AFA was a toxic algae species. However, virtually all samples of AFA taken throughout the world have failed to contain any neurotoxins. Indeed, toxicity in AFA was the exception rather than the norm. In Klamath Lake, nearly ten years of intense testing has failed to reveal the presence of any neurotoxins in its AFA. In 1998, the opinion among scientists was that AFA did not contain neurotoxins and that the original samples that had been identified as AFA were likely another species. Indeed, the boundary between AFA and some *Anabaena* species can at times be unclear, mostly pertaining to strains isolated and cultivated in laboratory. *Anabaena* spp. is known to produce various kinds of neurotoxins.

In Klamath Lake, nearly ten years of intense testing has failed to reveal the presence of any neurotoxins in its AFA.

Recently, a team of scientists at Wright State University used recent advances in genetics to establish if the original toxic samples of AFA were genetically identical to the common strains of AFA shown to be nontoxic. Li et al.[7] established that all the toxic strains of AFA were genetically dissimilar to the nontoxic strains and most likely belonged to the Anabaena genera. Further work is in progress in order to clearly identify these original samples and properly rename them. The Wright State University study confirms that AFA growing in Klamath Lake is nontoxic.

The Water of Klamath Lake[1]

The most fascinating and unique characteristics of the water flowing into Klamath Lake is its color and temperature. Crater Lake is known for its emerald blue water. This condition is due to its clarity, temperature, and chemical matrix, allowing light to reflect the spectrum of blue to the viewer. It is generally known that mineral concentrations are the predominant factor creating this anomaly. Water testing has confirmed that high mineral content creates this "blue color" condition and is most often seen in unpolluted high mountain lakes and streams.

Certain minerals have specific color spectrums due to the electrical or ionic activity created by increasing amounts of ions present in the water. In most cases, minerals are the prime energy conductors in water.

It was assumed that the spring sources supplying Klamath Lake were naturally high in mineral concentrations due to the blue color of the springs. Oddly enough, advanced testing has revealed the opposite. Several of the main springs have very little entrained minerals, yet they still have the blue color.

Ninety percent of the water flowing into Klamath Lake comes from springs of rare beauty. The water springs from the ground at a temperature of less than 38°F. The characteristics of the water suggest that it originates from Crater Lake.

There is no general consensus of how the "blue water" condition exists without the required mineral matrix. One obvious explanation is that the effect is not solely derived from minerals alone.

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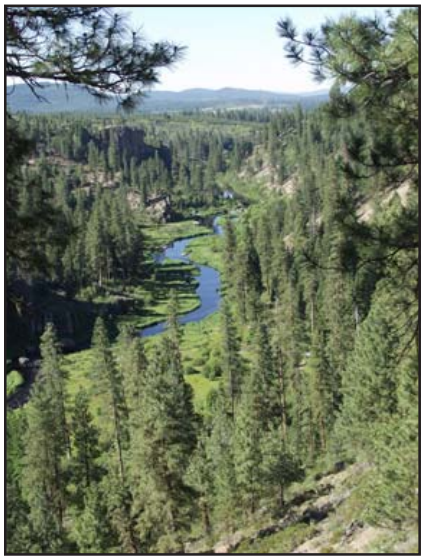
[1]This section has been graciously written by Mike Holecek, water expert.

Conductivity, pH, and specific gravity typically reveal information assuming the presence of minerals. We must look at the importance of electrical potential as a possible contributing factor. Looking at millivolt values (mV) of the source water, we can determine what the potential for electrical activity is. The mV values are scaled from positive to negative. The higher the negative number, the more electron activity is possible. A value of +75 mV has very little potential for electron activity, whereas a value of -75 mV has a tremendous amount of electron potential. Testing the springs at their source reveals values of -60 to -80 mV without the presence of minerals, indicating the source water is highly electrical.



Aerial view of the Williamson River

It is widely known that natural electrical charge does create a color phenomenon, known as the "piezo effect." This is caused by the compression of crystalline structures like quartz releasing a static or electrical charge. The resulting silica-quartz piezo spark is blue-white in color.

The surrounding watershed happens to be rich in quartz sands, allowing the source water to percolate through it, possibly creating the piezo effect. This could be a major contributing factor the to electric-blue color of the spring water.

In addition, water with temperatures of 4ºC (or 39ºF) creates conditions for maximum density and energetics. Cold water is more vital and able to distribute minerals, electrical ions, and nutrients than warm water. The spring sources suppling Klamath Lake range from 5 to 5.7ºC and are some of the coldest ground water temperatures in the United States.

In summary, chemical testing confirms the spring source water to be very low in mineral concentrations but extremely high in electrical potential. This allows the water coming into the lake to have greater capacity to collect nutrients and minerals, and an increased ability to respond to sunlight. These unique characteristics help to create the unusual water environment of Klamath Lake.

Pure spring water in the Williamson River

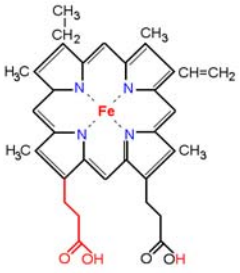
The Biochemistry of AFA

Over the years, people consuming AFA have reported benefits related to conditions such as hypoglycemia, poor memory, Attention Deficit Disorder, chronic fatigue, high cholesterol, high blood pressure, poor immunity, skin problems, allergies, asthma, rheumatoid diseases and depression. Cases have also been reported of significant improvements in conditions such as epilepsy, multiple sclerosis, diabetes and myasthenia.

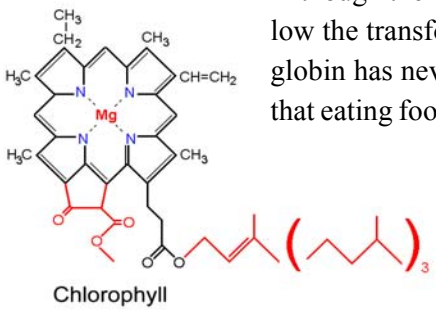
In this section, we will discuss the results of studies showing the various mechanisms of action of AFA in the body. We will also discuss the nutritional content of AFA and the role of unique nutrients on human health. We will limit this discussion to nutrients that are specific to AFA or present in exceptional quantities.

Chlorophyll

A green pigment found in plants, chlorophyll is responsible for the transformation of light energy into chemical energy. Although chlorophyll is present in all green vegetables, it is exceptionally abundant in AFA (about one percent of dry weight). Structurally, chlorophyll is almost identical to heme (also called hematin), which is the core of hemoglobin, the molecule responsible for carrying oxygen in the blood.



Heme



Chlorophyll

Although the biochemical pathway that would allow the transformation of chlorophyll into hemoglobin has never been investigated, data suggests that eating foods containing high chlorophyll content could stimulate the synthesis of hemoglobin in the body. In 1936 Hughes and Latner[8] carried an experiment in which they triggered

severe hemorrhage in dogs. The dog is often used in cardiovascular studies because of the similarity of its cardiovascular system with that of man. The control group was allowed to recover without any treatment whereas the experimental group received daily dose of chlorophyll. The group that consumed chlorophyll daily recovered much faster and showed much higher blood hemoglobin content.

Scientific research has revealed the anti-cancer properties of chlorophyll. For example, recent studies have reported that chlorophyllin, a water-soluble form of chlorophyll, protects against certain forms of liver cancer at a concentration similar to what is found in green leafy vegetables.[9-12] More specifically, chlorophyll was shown to prevent toxicity to aflatoxin, a toxin produced by fungi common to corn, peanuts and other crops. Aflatoxin is one of the most potent liver carcinogens known. Chlorophyll may also protect against other environmental toxins. This finding may have important implications in intervention and dietary management of cancer risks in humans.

Finally, popular medicine has also produced evidence of the healing properties of chlorophyll. Topical application as well as oral intake of chlorophyll was shown to prevent and help eliminate infections.[13,14] Topical application of chlorophyll was noted to promote healing of the skin as well as stomach ulcers.[15]

Beta-Carotene and Other Carotenoids

AFA is an exceptional source of carotenoids (more than 240 retinol equivalents per gram). Beta-carotene, as well as other carotenoids, has been shown to be a powerful antioxidant, helpful in the prevention of cardiovascular diseases.[16,17] For example, oxidative damage of low-density lipoproteins (LDLs) is believed to be of central importance in the development of atherosclerosis. Epidemiological studies suggest that high dietary intake of naturally occurring beta-carotene decreases the risk for atherosclerotic vascular disease by protecting LDLs from oxidation.[18]

Blood levels of carotenoids were measured in 1,899 men and

Beta-carotene is proven to stimulate the immune system and prevent skin, oral, and breast cancer. It has also been shown to be a powerful antioxidant, helpful in the prevention of cardiovascular diseases.

their cardiovascular health was followed for 13 years. During this time, the men with the highest blood levels of carotenoids had 36 percent fewer heart attacks and deaths than those with the lowest levels of carotenoids.[19]

Beta-carotene has also been proven to stimulate the immune system[20-22] and prevent skin,[23] oral,[24-26] and breast cancer.[27,28] AFA also contains lutein and lycopene, two carotenoids that are known to protect against certain forms of cancer.[29,30]

Polyunsaturated Fatty Acids

Dietary essential fatty acids, especially Omega-3 essential fatty acids, have been shown to be beneficial to the immune, cardiovascular, and nervous systems. Nearly 50 percent of the lipid content of dried AFA is composed of Omega-3 essential fatty acids (mostly alpha-linolenic acid).

The average North American diet is known to be lacking in Omega-3 fatty acids. Such deficiency is increasingly linked to cardiovascular diseases,[31-36] immunosuppression,[37] arthritis,[38] mental problems,[39-42] and skin problems.[43]

In addition, Omega-3 fatty acids were shown to prevent platelet aggregation[44-46] and to lower cholesterol.[33,47] Consumption of essential fatty acids, mostly Omega-3, was also shown to inhibit many forms of cancer, namely breast, prostate, pancreatic and colon.[48,49] There is also evidence that Omega-3 fatty acids may help in neuropathic conditions associated with diabetes.[50,51]

Significant interest has been raised by the relationship between essential fatty acids and nervous system functions. Epidemiological studies in various countries and in the United States suggest that

decreased Omega-3 fatty acid consumption correlates with increasing rates of depression.[39] Consumption of foods containing Omega-3 fatty acids may constitute an alternative treatment for depression. Furthermore, decreased concentrations of certain essential fatty acids in the plasma have been found in children diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD).[40]

Though the cause of ADHD is multifactorial, eating foods containing essential fatty acids may be helpful. Based on various unpublished studies, consumption of AFA was demonstrated to be beneficial in the treatment of ADHD.

Consumption of AFA has been demonstrated to be beneficial in the treatment of ADHD.

Omega-3 fatty acids are important for health, mainly because they are the precursors to a whole family of compounds (prostaglandins) responsible for modulating the functioning of the immune system and preventing or eliminating inflammation. This topic will be addressed in further detail in the section on phycocyanin (p. 38). The next section will also describe data that demonstrates the exceptional bioavailability of AFA's Omega-3 fatty acids.

Chemoprotection and Polysaccharides

A substance is "chemoprotective" when it protects against the toxic effects of chemicals or compounds present in our food or environment. Heavy metals and pesticides are examples of such compounds extremely deleterious to health. Various species of microalgae have been demonstrated to absorb heavy metals, and their consumption may promote the elimination of heavy metals.[52-54]

Scientific studies have shown that cyanophyta offer significant protection against heavy metal toxicity to the kidneys.[55] A sugar present on the cell membrane of microalgae has also been confirmed to bind and eliminate pesticides in the intestine.[56] Phycocyanin, the blue pigment present in AFA, has also been shown to have chemopro-tective properties.[57]

Summary of Scientific Research on AFA

Since the mid-90s, studies performed in collaboration with various universities and research centers have provided a significant amount of data supporting and explaining the benefits experienced by millions of AFA consumers. The scientific research done on AFA was organized into a comprehensive program that studied many aspects of its effects on human health.

A thorough review of AFA's empirically reported benefits was performed by a team of scientists affiliated with the University of Illinois. The team was composed of one board-certified forensic examiner and microbiologist, one surgeon and three physicians.[58] The criteria for inclusion in this study were:

- having a disease diagnosed by a medical doctor using traditional means of diagnosis
- documentation in the medical file of the failure of traditional treatments
- mention in the medical file of when the patient began consuming AFA
- documentation of improvement of condition with AFA

More than 200 cases that met the stringent criteria were included in this retrospective study. The study concluded that AFA seems effective in the treatment of various viral infections, chronic fatigue, Attention Deficit Disorder, depression, inflammatory diseases and fibromyalgia. The study strongly suggested that AFA acts on the immune and nervous systems and prevents the process of inflammation.

This review constituted the starting point of a series of studies aimed at researching the effects of AFA on human health. Since then, various studies have shown that AFA stimulates the mobilization and migration of immune cells, stimulates the activity of macrophages, prevents inflammation and pain by inhibiting

cyclooxygenase (COX-2) activity, stimulates brain function and elevates mood, enhances the body's own mechanism of regeneration, and is an exceptional source of Omega-3 fatty acids.

The Stimulating Effects of AFA on Natural Killer Cells

Natural killer (NK) cells, a type of lymphocyte, are a part of the immune system. NK cells are mainly responsible for the detection and destruction of cancerous and virally infected cells in the body. They destroy cells that are altered either due to viral infection or malignant transformation. They work by inducing the affected cell to undergo programmed cell death.

Two aspects must be considered when talking about NK cells: their killing activity and their ability to migrate. Although NK cells are present in the blood, where they are normally measured, it is in the tissues that they perform immune surveillance and eliminate virally infected or cancerous cells. Therefore they must be able to migrate and once they reached the affected tissue, they must have a good killing activity.

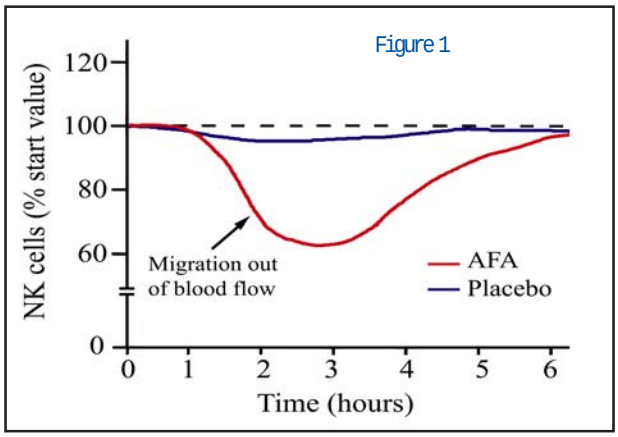
Stimulating Migration

Many substances are known to improve the activity of NK cells, such as green tea and ginkgo biloba, but until recently no natural substance was known to stimulate natural killer cells to migrate into tissues to search and destroy "sick" cells.

Until recent findings on AFA, no natural substance has been known to stimulate natural killer cells to migrate into the tissues to search and destroy "sick" cells.

In a double-blind crossover study, the immediate effect of AFA on natural killer (NK) cells was evaluated on 21 normal, healthy volunteers. Within two hours, the ingestion of AFA resulted in a significant decrease (40%) of NK cells in the blood (Figure 1).

This data was interpreted as the migration of NK cells from the



Graph showing the variations in circulating NK cells in the blood. The dotted line (100%) indicates the starting level of NK cells in the blood. Moving below this line indicates a movement of NK cells out of the blood into tissues. Consumption of AFA in humans triggered within two hours the migration of nearly 40% of the circulating NK cells (red) from the blood to the tissues. On the day participants consumed the placebo, no significant changes were observed. This daily effect was stronger in long-term consumers.

blood to the tissue, promoting immune patrolling in the tissues.[59] Close analysis of the data revealed that this effect was barely detectable the first time individuals consumed AFA. However, after a few weeks of daily consumption of AFA, migration increased and reached its maximum effect. The study shows that the benefits on the immune system are not cumulative, but come with regular daily consumption.

Stimulating Activity

NK cell activity is defined as the ability to kill virally-infected cells and cancer cells. Typically, NK cells identify the site of an infection or the site where cancerous cells are growing by moving toward chemicals produced by such cells. As they get closer, chemicals released by infected or affected cells activate NK cells. NK cells then move in close proximity of the affected cell and trigger a phenomenon called apoptosis, or programmed cell death.

Many substances are known to stimulate NK cell activity, though

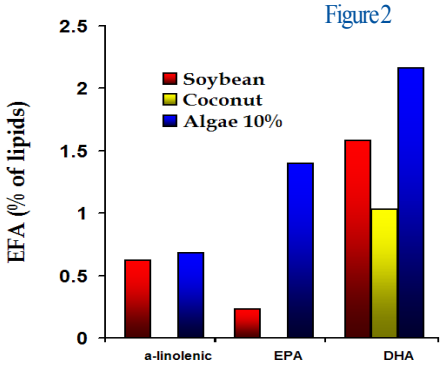
the most potent are polysaccharides extracted from rice and mushrooms. In a recent study, the polysaccharide fraction of AFA was tested against polysaccharides extracted from rice, known as arabinoxylan, one of the most potent NK cell activator available. The polysaccharide from AFA was found to be many times more potent than arabinoxylan.

This research suggests that eating AFA daily may stimulate the immune system to help prevent cancer as well as illnesses associated with viral infections. The anticancer properties of AFA have already been established by its ability to prevent cancer in the Ames test.[60]

AFA, an Exceptional Source of Polyunsaturated Fatty Acids, Especially Omega-3

A recent study revealed that AFA was many times more effective than soybean oil in providing dietary polyunsaturated fatty acids (PUFA).[61] In brief, rats fed a PUFA-deficient diet (coconut oil) supplemented with AFA (which contains mostly alpha-linolenic acid) showed blood levels of alpha-linolenic acid (LNA; 18:3w3) eicosapentaenoic acid (EPA; 20:5w3) and docosahexaenoic acid (DHA; 22:6w3) greater than levels found in rats fed the control diet containing soybean oil, in spite of the fact that the amount of PUFA in the experimental diet was one fourth the amount present in the control diet (Figure 2).

Figure2



Adding AFA (an exceptional source of Omega-3 PUFA) to the diet was shown to significantly increase the level of blood PUFA.

Increased plasma levels of EPA and DHA have been associated with nervous membrane stability and cardiovascular health, while decreased levels have been associated with Attention Deficit Disorder, depression and cardiovascular diseases.

Close analysis of the blood lipid profile in this study further revealed that the concentration of the inflammatory lipid arachidonic acid (AA) was decreased by AFA in a dose-dependent manner, which may in part explain the anti-inflammatory properties of AFA.

Eating AFA was shown to significantly decrease blood cholesterol and triglyceride levels.

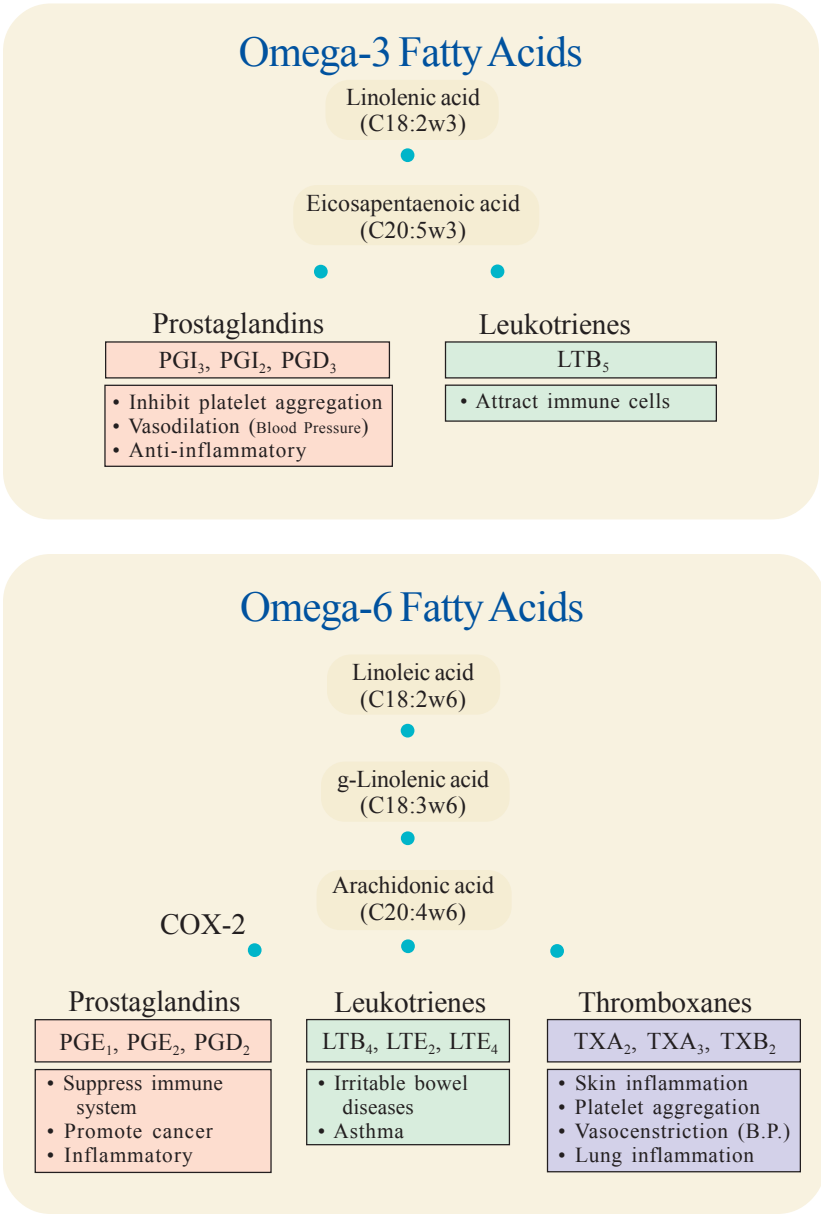
In the same study, eating AFA was shown to significantly decrease blood cholesterol and triglyceride levels. Other types of algae were also shown to affect cholesterol levels.[62] This effect could be explained by AFA's content of linolenic acid, which has been shown to decrease cholesterol,[47,63,64] though the effect seemed to be caused by AFA's high chlorophyll content.[61]

Anti-inflammatory Properties of Phycocyanin

Phycocyanin is the blue pigment present in all cyanophyta. In the living algal cell, phycocyanin serves as a protein storage unit and as an antioxidant, protecting the cell from certain wavelengths.

Phycocyanin has been shown to have strong antioxidant and anti-inflammatory properties. In various animal models of inflammation, phycocyanin was shown to reduce or prevent inflammation.[65,66] Phycocyanin has been shown to prevent certain forms of colitis.[67] The mechanism of action was identified as the ability to block the production of the inflammatory eicosanoid leukotriene B4.[66] Recently, phycocyanin has also been shown to be one of the strongest natural COX-2 (cyclo-oxigenase) inhibitors.[68]

Figure 3



Although this is an oversimplification, Omega-3 fatty acids are generally metabolized into health-promoting anti-inflammatory compounds, whereas Omega-6 fatty acids are precursors to inflammatory compounds in the body. COX-2 is involved in the transformation of arachidonic acid into inflammatory prostaglandins.

The Eicosanoid Pathway

Eicosanoids are a group of oxygenated fatty acids containing 20 (eicosa) carbon atoms, produced by the body to support many body functions.

Eicosanoids are ubiquitous substances considered local hormones because their activity is limited to the site where they are released. Short-lived and synthesized on demand, they are not stored in tissues. Their role in the body's homeostasis (equilibrium) is such that their two main precursors, Omega-6 (w6) linoleic acid (LA; 18:2w6) and Omega-3 (w3) linolenic acid (LNA; 18:2w3), are called essential fatty acids and were even considered vitamins a few decades ago (vitamin F).

The action of specific enzymes leads to the transformation of both LA and LNA into whole families of eicosanoids having various roles in the support of immune and cellular functions (see Figure 3 on page 39). Generally speaking, LA metabolites (w6) are responsible for the support of immune responses by inducing inflammation, fever and platelet aggregation. On the other hand, LNA metabolites (w3) are responsible for the support of immune responses by attracting immune cells on the site of injury and then suppressing inflammation when the immune response is over.

The American diet, now high in the Omega-6/Omega-3 ratio, has stirred a comprehensive effort to promote eating more foods rich in Omega-3, but the results have been marginal. Inflammatory diseases are still rising in western countries.

Over the past decades, the American diet has evolved by increasing the w6:w3 ratio, thereby promoting inflammation in the body. A higher w6:w3 ratio has been associated with cardiovascular diseases,[30-35] immunosuppression,[36] arthritis,[37] mental problems,[38-41] and skin problems.[42] To remedy this situation a comprehensive effort was made by various health organizations to promote increased consumption of w3 fatty acids (flaxseed oil, fish, etc.). Though this effort has had some positive impact, it is marginal. Inflammatory diseases are still rising in western countries.

A parallel effort has been the search for compounds that would modulate or inhibit the transformation of w6 fatty acids into inflammatory compounds. This research effort has led to the discovery of two main classes of compounds: COX-2 inhibitors and lipoxygenase inhibitors. Both COX-2 and lipoxygenase are considered inflammatory enzymes, and their inhibition reduces inflammation. Recent discoveries reveal that phycocyanin, the unique blue pigment in AFA, inhibits both enzymes.

Phycocyanin has been shown to have strong antioxidant and anti-inflammatory properties.

Phycocyanin has been shown in various animal models to significantly reduce inflammation.[65-67] This anti-inflammatory property is due to phycocyanin's ability to inhibit COX-2. It also inhibits the formation of leukotriene B_4, a compound involved in the pathophysiology of asthma. Recent drugs developed for the treatment of asthma are inhibitors of leukotriene B_4 action.

AFA is a Unique Source of PEA (Phenylethylamine)

Individuals have reported discontinuing their antidepressant medications after a few months of AFA consumption. More generally, people have been reporting an elevation of mood, an enhancement of mental energy and mental clarity, and an increase in quality of life.

The type of effect reported by consumers was consistent with the presence in AFA of a neuroactive amino acid or a biogenic amine. An effort was then made to search for such compounds, and recent scientific analysis has revealed the presence of the biogenic amine phenylethylamine (PEA) in AFA. PEA is well known to alleviate depression and elevate mood, and it plays an important role in the pathogenesis of learning disabilities and Attention Deficit Disorder.

PEA, a compound naturally produced by the brain, is responsible for the feeling of experiences associated with pleasure and mental awareness. For example, when one is absorbed by an activity

like painting, sculpting, or reading a fascinating book, when the world around seems suspended and nothing can disturb us, when worries vanish and hunger goes away, in such moments PEA is being produced by the brain. Likewise, PEA is released in the brain when one experiences the feelings of love and joy. For this reason, PEA has been coined "the molecule of love." When taken orally, PEA is known to readily cross the blood-brain barrier and become immediately available in the brain.

In the brain, PEA acts by increasing the concentration of dopamine in the synaptic cleft, thereby enhancing dopamine transmission. Dopamine is a neurotransmitter associated with the sensation of pleasure. It is not clear whether PEA acts by reducing uptake or enhancing release of dopamine, but the outcome has been established as an enhandemcent of dopamine transmission.

PEA has also been shown to enhance norepinephrine transmission in the brain. Norepinephrine is also involved in the experience of joy. Enhancing norepinephrine transmission in the brain increases the experience of joy and reduces appetite. For example, if an animal is implanted with an electrode in an area of the brain concentrated in norepinephrine, and this electrode is activated by a pedal that the animal has access to, the animal will disregard food and water and will press the pedal relentlessly until exhaustion to elicit an electrical impulse in this area of the brain.

Daily consumption of one gram a day of AFA extract could constitute an effective therapeutic approach in the treatment of depression.

This ability to modulate dopamine and norepinephrine transmission provides PEA with interesting properties in alleviating depression and Attention Deficit Disorder, while increasing concentration and elevating mood.

Depression

It was discovered nearly two decades ago that the amount of PEA in the brains of depressed patients was less than that of normal individuals[71,72] and that PEA given orally to individuals suffering from depression was able to reverse the depressive condition.[73] A de-

crease in the brain levels and/or turnover of endogenous PEA may therefore play a major role in the etiology of certain forms of depression. In fact, it has been observed that many antidepressant drug treatments act by increasing the level of PEA in the brain.[74-77]

In one study, when taken orally (10 mg/day), PEA was shown to decrease the symptoms of depression in 60 percent of the patients tested. The patients did not develop tolerance, and PEA remained effective over time. None of the side effects associated with conventional antidepressant therapy was experienced (i.e., nausea, fatigue, decreased libido, cardiovascular problems). On average, patients did not gain weight, in fact many actually lost the weight they had gained on the previous conventional antidepressant therapy.[73]

Oral intake of PEA may increase PEA levels in the brain and may alleviate subclinical symptoms of depression.

AFA contains on average 2 mg/g of PEA, and an AFA extract has been developed that contains up to 10 mg/g of PEA.[78] Daily consumption of one gram a day of AFA extract could constitute an effective therapeutic approach in the treatment of depression and other affective disorders.

Attention Deficit Disorder

PEA is synthesized in the brain from the two amino acids phenylalanine and tyrosine. It is degraded by the enzyme monoamine oxidase (MAO) into phenylacetic acid (PAA), which is eliminated in the urine. Both PEA and PAA were found to be decreased in the urine of patients suffering from depression and ADD. The PEA precursors phenylalanine and tyrosine were also both decreased in the plasma of children suffering from ADD.[79]

The Phenylethylamine hypothesis of affective behavior [77] states that PEA is an endogenous neuromodulator responsible for triggering or sustaining wakefulness, alertness, and excitement. Structurally, PEA is closely related to amphetamine and to a lesser extent to catecholamines. PEA induces behavioral and electrophysiological effects similar to those of some amphetamine derivatives, which are already sold under the name Adderall® for the treatment of ADD.[80] However, unlike amphetamines, PEA is endogenous to the brain and

PEA may prove to be a safe and effective alternative for the treatment of ADD.

does not develop tolerance or dependency, nor does it produce any side effects. Likewise, methylphenidate (Ritalin®), the most prescribed drug for the management of ADD, is believed to act by stimulating the release of endogenous norepinephrine and PEA.

PEA may therefore prove to be a safe and effective alternative for the treatment of ADD. In fact, preliminary data indicates that AFA has been effective at significantly improving concentration and mental performance shortly after consumption.[78]

Mood elevation

The Phenylethylamine hypothesis of affective behavior also states that PEA is a neuromodulator that modulates mood, attention, pleasure-seeking behavior, and libido. A deficit in the brain's level of PEA and/or a decrease in the turnover of endogenous PEA may therefore be a causal factor in certain forms of subclinical depressive conditions. Oral intake of PEA may increase PEA levels in the brain and may alleviate subclinical symptoms of depression. Individuals would then experience an increased quality of life and elevation of mood.[81]

Phenylalanine (PA), the precursor of PEA, has been shown to increase brain PEA content in animals. In one study, phenylalanine was shown to be effective at alleviating depression in patients with low PAA urinary excretion. Furthermore, phenylalanine led to an increase in urinary PAA excretion that was concomitant with its anti- depressant therapeutic effects. This suggests that the antidepressant and mood-elevating effects of phenylalanine may be related to its ability to increase brain levels of PEA.

All this data clearly explains the physiological mechanism behind the well-known effects of AFA on attention, mental energy, and general quality of life.

Weight Loss

Finally, PEA also carries another interesting benefit. As mentioned before, PEA is produced by the brain when one is fully absorbed into an activity like painting, sculpting or reading a fascinating book. At such a time, the world seems to disappear around us, and we are no longer hungry. This phenomenon is not an anorectic effect in which hunger completely disappears; appetite is reduced as attention is taken away from the feeling of hunger. In this manner, PEA acts as an appetite suppressant. Therefore, through its ability to reduce appetite, AFA is an effective supplement to be taken as part of a comprehensive weight-loss program.

AFA Stimulates Stem Cell Mobilization

Spurred by political considerations, much attention has recently been brought to the issue of using embryonic stem cells for research purposes and for the development of treatments for various diseases.

Embryonic stem cells (ESC) are cells harvested from embryos that have nearly unlimited capacity to regenerate and become any kind of cell in the body. In the embryo, they are the initial precursors of all the cells destined to become the brain, heart, muscles, skin, bones, etc. When transplanted into an adult, embryonic stem cells have the ability to heal and repair any organ in which they are transplanted, providing an extremely useful tool for the treatment of various degenerative diseases. Treatment with embryonic stem cells has either been shown or is suspected to improve various degenerative diseases such as Parkinson's diseases, diabetes, heart disease, as well as degeneration of the nervous system.

Knowledge of the potential of embryonic stem cells in treating various health conditions emerged in the 1960s and gained significant momentum in the 1980s. However, research involving ESC received significant opposition over the years because of the obvious ethical nature of harvesting cells from live human embryos and

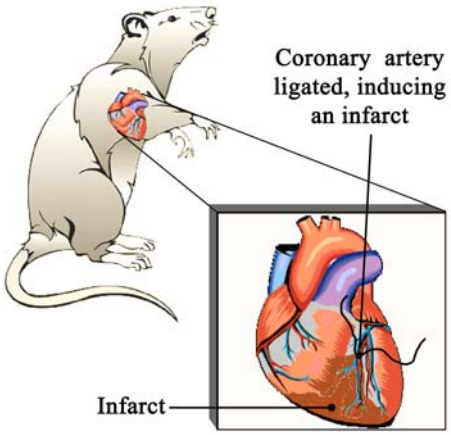


Figure 4

Stem cells carrying a gene encoded for a fluorescent protein were trans-planted into irradiated mice. Cardiac arrest was triggered by ligating the coronary artery. Three weeks after the cardiac arrest, up to 68 percent of the necrotic area was filled with func-tional fluorescent cardiomyocytes.

because of the door it opens to research involving genetic manipulation of humans. However, as an alternative to this ethical dilemma, much evidence has accumulated over the past few years indicating that adult bone marrow stem cells (ASC) might have pluripotent properties similar to ESC, leading to the hypothesis that stimulation of *in situ* release of bone marrow stem cells could constitute an effective treatment for various degenerative diseases.[82]

For example, Goodell et al.[83] recently described how ASC can migrate from the bone marrow to the heart and contribute to cardiac muscle repair and the formation of new blood vessels after ischemic injury (cardiac infarct).

In brief, highly purified bone marrow stem cells were genetically modified to produce a fluorescent protein. The mice's innate stem cells were killed through irradiation. Then the genetically modified stem cells were transplanted into their bone marrow, leaving the fluorescent bone marrow stem cells as the sole source of available stem cells. Cardiac arrest was subsequently triggered in the mice by coronary artery occlusion.

A few weeks later, the engrafted fluorescent stem cells had differentiated into cardiac muscle and endothelial cells, which contributed to the formation of functional cardiac tissue, as well as new blood vessels.

Orlic et al.[84] carried an experiment that clearly demonstrated that the simple fact of enhancing the release and circulation of adult bone marrow stem cells could lead to significant healing. The re-

searchers induced cardiac infarct in two groups of rats. The control group was left to recover on its own, while the experimental group received injections of ASC-releasing cytokines during 5 days after the infarct. After one month the survival rate in the control group was 17% and upon functional and histogical analysis the animals showed severe signs of cardiomyopathy. In the experimental group in which circulation of ASC was stimulated during 5 days post-infarct, the survival rate was 73%. Upon functional and histological analysis it was determined that newly formed cardiac tissue had developed, along with full functional blood vascularization, and that the cardiac functions were virtually normal. The simple fact of stimulating ASC release during 5 days post-infarct was sufficient to bring near complete recovery.

It is hypothesized that stimulation of in situ release of bone-marrow stem cells could constitute an effective treatment for various degenerative diseases.

Similar migration of bone marrow stem cells and subsequent regeneration of tissue was also suspected to take place in the brain. In a double-blind study including 40 patients suffering from Parkinson's disease, injection of stem cells derived from seven- to eight-week-old embryos slowed the progression of the diseases in all of the 20 patients.[85] Likewise, there is evidence indicating that stem cells could reverse symptoms of Alzheimer's disease.[86]

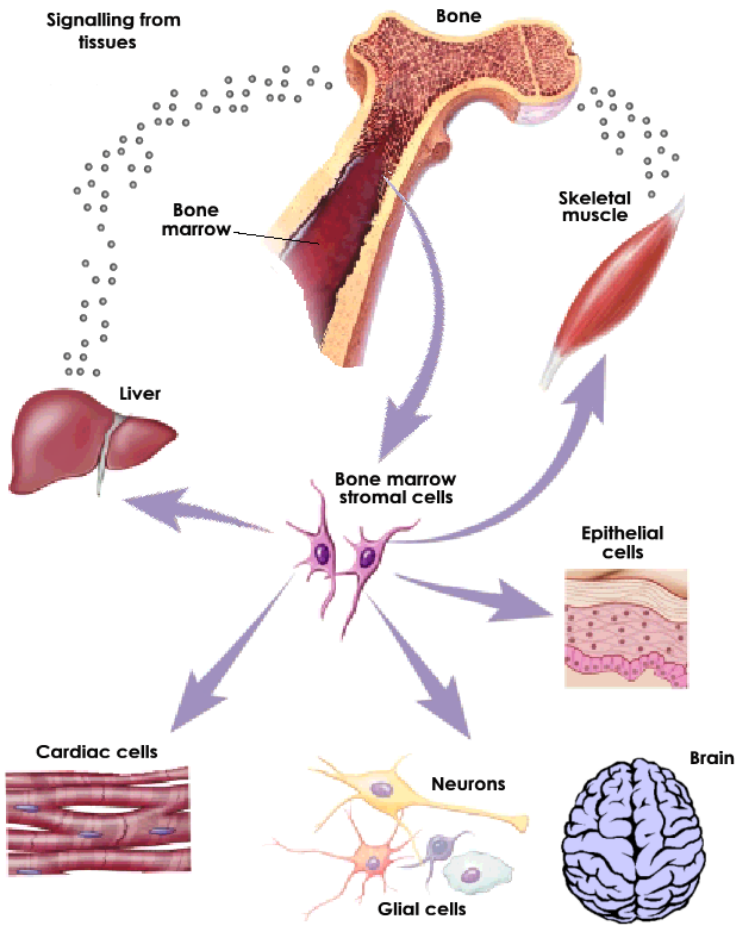
Studies were therefore conducted to investigate whether stem cells injected intravascularly or endogenously released from the bone marrow could cross the blood-brain barrier, migrate, then differentiate into brain cells. Bone marrow stem cells, along with monocytes and macrophages, were shown to have the ability to cross the blood-brain barrier and reach the brain.[87-90]

Intravascular delivery of genetically marked adult mouse bone marrow stem cells into lethally irradiated normal adult mice led to the development in the central nervous system of donor-derived cells having neuronal properties (neuronal phenotypes).[91] After eight to twelve weeks, it was estimated that about 0.2 to 0.3 percent of the total number of neurons in the brain were derived from the bone marrow. The authors wrote, "Our results clearly show that adult

cells from the marrow can gain access to the adult brain and assume characteristics of central nervous system neurons."[91]

Similarly, Mezey et al.[89] showed that in a strain of mice incapable of developing cells of the myeloid and lymphoid lineages, transplanted adult bone marrow stem cells migrated into the brain and differentiated into cells that expressed neuron-specific antigens. Between 2.3 and 4.6 percent of all neurons were donor-derived. Some neurons were observed with axonic projections and apparent den-

Figure 5



dritic trees. The authors suggested that bone marrow stem cells might naturally migrate into certain regions of the brain and give rise to a variety of neural cell types, thus implying a greater potential for regeneration of the central nervous system than had been traditionally expected.[89]

Based on information produced by various scientific teams, Jensen et al.[83] recently proposed the Stem Cell Theory of Healing, Regeneration and Repair (Figure 5 on previous page). This breakthrough theory suggests that bone marrow stem cells would leave the bone marrow and travel throughout the body, providing for healing and regeneration of damaged organs during the entire lifetime of an individual. In other words, adult bone marrow stem cells may be the natural mechanism that the human body utilizes to heal, regenerate and repair.

According to this theory, there is no need to harvest embryonic stem cells, manipulate them, then reinject them into individuals. Regeneration can take place simply by stimulating the release of stem cells from the bone marrow and stimulating their migration into tissues. The task is therefore simply to find natural compounds able to stimulate stem cell release and migration. Such compounds could be used for the daily enhancement of the body's natural mechanism of healing and regeneration.

The only such natural compound known to date is AFA, which has been recently shown to stimulate stem cell release and migration. A dose of 5 grams of AFA was shown to increase the number of circulating stem cells. Based on this information, a patent has been filed and recently obtained regarding the use of AFA for the treatment of Parkinson's disease, Alzheimer's disease, diabetes, multiple sclerosis, cardiac arrest recovery, and regeneration.





Conclusion

AFA is an interesting natural dietary supplement to study. First, it is one of few dietary products that grow naturally in the wild without man's intervention. It shares this characteristic with wild mushrooms harvested in small quantities by mushroom hunters, and herbs harvested in the virgin rainforests of South America, China, and Africa. Virtually everything else found in the marketplace is the product of human activity.

The significance of this is paramount. There is an undeniable law of nature under which everything evolves according to the pressure from the environment. In other words, the strongest of the species are selected for survival while the weaker do not survive. With time, this means that what is produced by nature carries the signature of strength, durability, resistance, and longevity.

AFA is the oldest living organism on planet Earth, and it has survived the pressure applied by billions of years. Today, wild-growing AFA is the only food able to bring to the body this multimillennial strength and vitality. The science is compelling, but beyond the scientific information, the characteristic of growing naturally in the wild, carrying the benefits of eons of vitalization, may very well be one of the deepest energetic mechanisms of action yet to be described.

Second, there is now a large body of scientific information documenting the efficacy of AFA in improving various health conditions. The identification of the active components of AFA and the description of the mechanisms of action is compelling, and though AFA is an important component of today's dietary supplement industry, the only thing that really matters is one's own experience. What can AFA do for you? In this regard, AFA is fascinating because it was not discovered in a laboratory, followed by scientific description of efficacy in test tubes; it started by the very experience of people consuming it and experiencing the exceptional benefits. And it is the close observation and analysis of these reported benefits that led to the discoveries of its numerous bioactive components. Interestingly, as scientists we knew that when an experiment did not uncover

what we were looking for, it was not because AFA was not effective but rather because we were not looking in the right place. The benefits were there; that we knew. For scientists involved in scientific investigation, this is a rather unique and interesting position to be in.

Third, studying AFA has led us to the discovery of a fabulous natural phenomenon: the use of endogenous stem cells for healing, regeneration, and repair. The release of stem cells from the bone marrow and the migration of these stem cells to tissues is the mechanism that the human body has developed over thousands of years to heal and regenerate. The mythical fountain of youth may have been discovered. All we have to do is to enhance this phenomenon, and AFA is the first known natural product to do so.

There are many dietary supplements and vitamins available today, and their number and diversity often confuse consumers. "What should I take?" is a question on the mind of many. While numerous dietary supplements and vitamins are effective and carry real benefits, there is one that will unavoidably bring benefits to most people: AFA.

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About Christian Drapeau

A wild-food expert, author, research scientist and neurophysiologist, Christian Drapeau, M.Sc. has lectured on nutrition to over 30,000 people internationally since 1994. He presents profound health information and insights with clarity and humor. His studies have included ADD/ADHD, accelerated learning, and the impact of wild superfoods on mental function, just to name a few.

Credentials

Christian Drapeau is a neurophysiologist with over thirteen years of research experience in the fields of natural foods and nutrition.

Mr. Drapeau received a B.Sc. in Neurophysiology from McGill University, Montreal, in 1987 and an M.Sc. from the Department of Neurology and Neurosurgery from the Montreal Neurological Institute, McGill University, Montreal, in 1991.

After his academic formation, Mr. Drapeau studied herbal medicine and naturopathy which led him to the position of Chief Scientist at Cell Tech (1995-1999), where he directed research on *Aphanizomenon flos-aquae* (AFA).

Mr. Drapeau is currently Chief Scientist for Desert Lake Technologies, LLC. He has been a member of International Who's Who of Professionals since 1996.

Since 1995, Mr. Drapeau has been pursuing scientific research in collaboration with various universities and research centers on the health benefits of the cyanophyta Aphanizomenon flos-aquae. He has coauthored many articles published in scientific literature on this topic.



The health benefits of Aphanizomenon flos-aquae (AFA) have been reported for more than two decades, yet it is only recently that science has revealed the mechanisms by which AFA acts on the body, and the astonishing health benefits of AFA. AFA contains a wide variety of phytonutrients that promote health, such as chlorophyll, carotenoids and polyunsaturated fatty acids. AFA contains unique molecules that modulate various aspects of human health, such as:

- Phenylethylamine (PEA) known as the "molecule of love." Beside enhancing concentration and attention, PEA is a natural mood elevator and anti-depressant.
- Phycocyanin, the blue pigment in AFA, which is a natural selective COX-2 inhibitor with strong anti-inflammatory properties.
- A polysaccharide that stimulates the migration of immune cells in the body; the only natural compound known to stimulate immune cell migration.

But the most extraordinary discovery is the ability of AFA to stimulate stem cell release and migration, making of AFA the first natural compound known to stimulate the natural innate phenomenon of healing, regeneration and repair in the human body.

"I was diagnosed with Multiple Sclerosis and was bedridden for one year and housebound for 5 years. I began consuming AFA in the spring of 1988, and consider the algae to be one of the "shining stars of my overall program." At this point in time, I function on a very high level and am virtually symptom-free, as long as I adhere to certain healthful principles."

— Bonnie S., New York

"Life saving! I have lived for long time with low energy, no stamina, and with painful joints. After taking AFA the pain went away and I experienced a new level of life energy. It had such an effect on me that I included AFA in my breeding and training program. My horses are never sick, they perform better, and when I push them hard they recover much faster."

— Eve-Marie L., Florida

"I was introduced to AFA in 1995 and I haven't missed a day ever since. Both of my children and many of our friends have done the same! What is it about this unique wild superfood that would elicit such extraordinary consistency? The answers to that question lie within the pages of this beautifully and thoroughly written booklet. Read it carefully and you will begin to understand and appreciate the truly extraordinary powers of AFA, known popularly as Klamath Lake Blue-Green Algae."

— Clive A., North Carolina


The information contained in this booklet is for educational purposes only and has not been reviewed by the FDA. This information is not intended to diagnose, cure, alleviate, mitigate or prevent any disease. If you have any health problem, you should seek the advice of a certified health care provider.

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Primordial Food

Aphanizomenon flos-aquae

Latin for:

"Invisible Living
Flower of the Water"

A Wild Blue-Green Alga with Unique Health Properties

by

Christian Drapeau, MSc.

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Klamath Lake Blue-Green Algae

- STIMULATES the migration of natural killer cells, a type of lymphocyte involved in eliminating cancerous and virally infected cells
- CONTAINS a substance known as "the molecule of joy," which enhances mental focus and mental energy, elevates mood, and alleviates depression
- IS AN EXCEPTIONAL source of omega-3 fatty acids, carotenoids and chlorophyll
- ENHANCES the release of stem cells from the bone marrow and therefore stands as an unequaled natural product for regeneration
- CONTAINS a unique and potent anti-inflammatory compound

- DEFINITIONS:

  Cyanophyta—The current scientific classification for the blue-green algae family

  Aphanizomenon flos-aquae—the scientific name of the freshwater cyanophyta found in Upper Klamath Lake

  AFA—The abbreviation for *Aphanizomenon flos-aquae*

  Microalgae—A common term to describe single-cell blue-green algae (Cyanophyta)

  Blue-green algae— A class of microorganisms containing the blue pigment phycocyanin . This term is used frequently in the health care field to describe edible microalgae like AFA

  Phycocyanin—The blue pigment in AFA



INTRODUCTION

A hundred years ago, when medicinal herbs and natural remedies were the most common means of regaining and maintaining health, the blue-green alga *Aphanizomenon flos-aquae* (AFA) growing abundantly in Klamath Lake might have been a household name. It would have had a reputation for being a food which gave a person added energy and mental clarity, boosted the immune system, and had a remarkable regenerative effect, even when consumed in small quantities.

Today, AFA enjoys a growing popularity among hundreds of thousands of people who report a wide range of benefits. Nearly two decades ago, it was discovered growing in wild abundance in a pristine lake in Southern Oregon. It has recently come to the attention of medical researchers, who are now conducting studies on this unique food to understand and uncover its secrets. Some call it nature's most complete food. Some scoff at its reported benefits. I invite you to read its remarkable story and decide for yourself.

The History of Medicine

Rethinking Health

Medicine has never been so sophisticated. Although there are more medications available today for the treatment of diseases than ever before, health is declining at an alarming rate. Our nation's spending for health is now second only to defense. How did we get to this state?

The development of modern medicine is certainly fascinating. One assumes that the current mainstream medical view is the culmination of centuries of experimentation and knowledge, yielding the best possible understanding of health. Unfortunately, this is not so.

Historically, medicine has been the story of opposition between conflicting views regarding health and disease. The sad truth is that the path medicine has taken has been determined primarily by events and circumstances rather than the rigorous evolution of knowledge. It has been deeply influenced by both politics and humanness.

One such event that drastically shaped today's medicine was the acceptance of Pasteur's work over Bernard's—one of the pioneers in the theory that the whole body, or the terrain, is the determinant factor in health.

The antibacterial model has skewed our vision of health by making us think in terms of eliminating disease rather than regaining and maintaining health.

Bernard held that if the terrain is well maintained by proper nutrition and strong immunity, disease will not develop. On the other hand, Pasteur, who provided evidence of a ubiquitous bacterial world, suggested that the root cause of all disease is the introduction of bacteria into the body, regardless of the terrain.

The discovery of antibiotics, which virtually eliminated tuberculosis and many epidemics of infectious diseases, consecrated the supremacy of Pasteur's bacterial approach over Bernard's more realistic but less popular terrain approach.

While antibiotics have been a good answer to numerous threatening diseases, experience has shown that they are far from the answer to all problems. The antibacterial model has skewed our vision of health by making us think in terms of eliminating disease rather than regaining and maintaining health.

We have been taught to think of health as something that is there until the day a doctor finds otherwise and pronounces a diagnosis of a disease. Then we become ill. A more appropriate way of looking at health is to think in terms of wellness, unwellness, and disease.

Sometimes we can live for years in a state of unwellness, going about our days well enough to be fully functional, but the quality of life is less than optimal—underlying back pain, fatigue, recurrent migraines, poor sleep, joint pain, allergies, and so on. We learn to live with it. Then one day, when it becomes a little more uncomfortable, we pay a visit to the doctor, and suddenly we are labeled with a disease. This is another consequence of the "disease model" where we only pay attention when a diagnosis is made.

Looking at health as a wellness model puts the responsibility back into the hands of each of us and takes it away from the doctor.

Health is gained and maintained by proper nutrition, attitude, sleep, exercise and the judicious use of dietary supplements. As soon as we fall into unwellness, we should pay attention and make the appropriate changes in our lives to regain radiant health. Looking at health in this manner puts the responsibility back in the hands of each of us, wherein the doctor becomes what he should be, a resourceful and essential guide in regaining wellness.

The Economics of Health

We often think of drugs and pharmaceuticals as an effective way of regaining and maintaining health, and we may see it as the only real option. But what about dietary supplements? In the drug model, dietary supplements are most often assumed to be ineffective or coincidental to recovery. Yet, the effectiveness of certain dietary supplements is undeniable, though the "economics of health" may at times prevent full objectivity.

When plants or other natural organisms are found to contain bioactive compounds capable of promoting health, it is not possible to patent them. Further, if the plant has been known in indigenous or folk medicine to exhibit specific health benefits, the fact that this knowledge is already in the public domain prevents anyone from filing a use patent. You can see it would be foolhardy for a pharmaceutical company to invest millions of dollars in scientific research to demonstrate the efficacy of a given plant and then millions of dollars to promote the product if this investment can not be protected by a patent. Consequently, a decision to research a substance is not based on its known effectiveness, but first and foremost on whether it can be protected by patent and will bring substantial financial gain.

A decision to research a substance is not based on its known effectiveness, but first and foremost on whether it can be protected by patent and will bring substantial financial gain.

When one desires to go from a state of unwellness to a state of wellness, it is important to know that plants with clearly demonstrated health benefits are available, but not necessarily offered in the medical model because there is no economical advantage to do so.

And this brings a corollary. Dietary supplements are nonetheless –and fortunately- available on the market place, but without the

protection of a patent few companies feel comfortable or able to invest funds into scientific research that will prove the health benefits of dietary supplements. In other words, most dietary supplement companies do not have the money to perform the scientific studies that would provide the data needed to meet the demands shaped by the pharmaceutical model.

Influenced by the pharmaceutical model, the market requests proof of efficacy, toxicity studies, studies on pharmacokinetics, determination of active components and dose studies. But the financial resources within the dietray supplement industry are not sufficient to carry such extensive research work. So dietary supplements cannot be proven to the extent that pharmaceutical compounds can, in spite of the obvious health benefits brought by numerous dietary supplements, without side effects.

Influenced by the pharmaceutical model, people seek dietary supplements that will rapidly eradicate symptoms; that is not how dietary supplements work. They work by helping the body regain normal healthy metabolism, they bring support to various organs so they can function well, they assist the body in the essential processes of elimination, nourishment and regeneration; and this is not easily demonstrated. Gaining greater health often means a myriad of small transformations –greater energy, better mood, better sleep, elimination of little aches-, which altogether lead to a greater quality of life. It is not like measuring reduction in cholesterol level or decrease in blood pressure. It is much more complex, it goes much deeper into the meaning of health, and is by consequence often more difficult to quantify. It is nonetheless very real.

When dietary supplement are studied for what they are, building blocks of health and not more or less temporary remedy to eliminate discomforts or reverse a diagnosis, the approach is then completely different, though not less powerful in revealing the health promoting properties of specific herbs or plants.

One such plant is the cyanophyta *Aphanizomenon flos-aquae* (AFA), which has clearly been shown in scientific studies to warrant a

great deal of attention. Among its most notable features, it has been shown to:

1. Stimulate the mobilization and migration of immune cells, as well as their activity.
2. Contain a substantial concentration of highly bioavailable omega-3 fatty acids.
3. Contain phycocyanin, the blue pigment in AFA that has been shown to inhibit the enzyme cyclooxygenase (COX-2), which is responsible for the synthesis in the body of pain- and inflammation-mediating substances. Phycocyanin is also a strong natural antioxidant.
4. Contain a significant concentration of phenylethylamine (PEA), a compound endogenous to the brain. PEA is known to increase concentration and mental energy, to elevate mood, and to alleviate depression and attention deficit disorder.
5. Stimulate the release of bone marrow stem cells and their migration into tissues, supporting the body's own mechanism of regeneration and healing.
6. Contain a selective ligand for the adhesion molecules L- and P-selectin. These molecules play a crucial role in inflammation and cardiovascular health.

Thousands of testimonials support the health benefits of AFA. Many scientific studies carried on AFA reveal its unique health-promoting properties, perfectly suited to promote radiant health and to help one regain and maintain a state of optimal wellness.

AFA—Unique Wildcrafted Food

An Ancient Food

For thousands of years, algae have been used worldwide as a food source or as a remedy for a wide variety of physical ailments and diseases.[1,2] In coastal regions of the Far East, notably in Japan, there is evidence that algae were used as a food source around 6000 BC, and there are records of many species of seaweed used as food around 900 AD.[3]

Many reports during the time of the Spanish conquest reveal that the natives of Lake Texcoco, near the city of Tenochtitlan (Mexico City today), collected blue-green algae from the waters of the lake to make sun-dried cakes called tecuitlatl.[4,5]

Native of Lake Chad preparing Dihé cakes

Prescott reported in his book Conquest of Mexico that a "slime" was gathered from the lake by the inhabitants of Tenochtitlan and eaten as a nutritious cake. They collected this green substance floating at the surface of the water and dried it in the sun. They gave it the name tecuitlatl, or excrement of stone, as they believed it came from the stones.[4]

They consumed the algae as cheese, which it resembled in aroma and taste, and they sold it in the marketplace. Even today, local African tribes harvest blue-green algae growing in Lake Chad. It is used to make hard cakes called Dihé.[5] Like the inhabitants of Tenochtitlan, these natives collect patches of floating microalgae and sun-dry them in shallow holes dug in the sand along the shores of the lake. Once

dried, the sand is cleaned from the algal cakes. They are broken into pieces and are then ready to be eaten or sold at local markets.

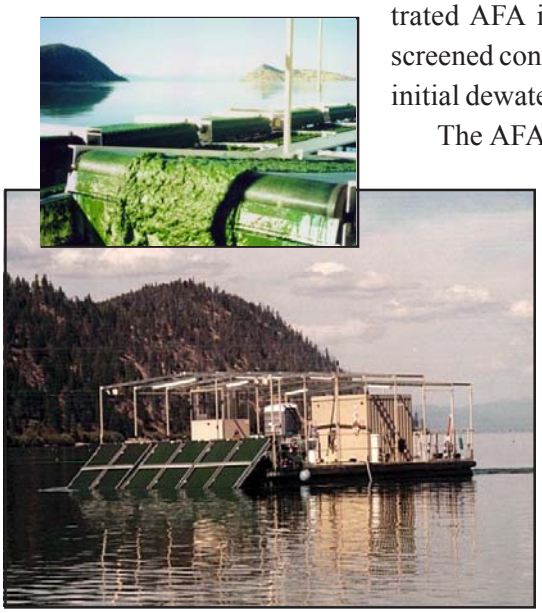
Reports by the United Nations have documented the superior overall health condition of people living around lake Chad who eat these Dihé cakes.

Harvesting Today

For more than two decades, the naturally occurring AFA growing in Klamath Lake, Oregon, has also been harvested and sold as a unique dietary supplement filled with health-promoting compounds. Although AFA grows in many other areas of the world, the biomass that accumulates every year in Klamath Lake is unique in its abundance as well as its purity.

High-quality AFA is currently being harvested in Klamath Lake, at the site of rich algal blooms. Small harvesting platforms pass through the algal blooms that gather in large, thick patches at the surface. These harvesters are equipped with rotating screens that lift the algae from the water surface or a pumping system that pumps lake water onto screens, and the concentrated AFA is then transfered on a screened conveyor system, where the initial dewatering step is performed.

The AFA is then slowly pumped through a refrigeration system that brings the concentrated AFA down to a temperature of 5°C (38°F). The

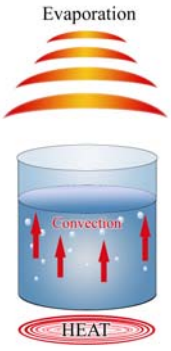


AFA is collected using a platform equipped with rotary screens. Once collected, it is then carried along a con-veyer belt to maximize dewatering.

AFA is then filtered through a centrifugal sieve to remove debris and undesirable species of algae. Purified and concentrated AFA is finally transported to the drying facility to be dried or stored deeply frozen.

A Superior Drying Method

Various drying methods have been utilized to dry AFA. A three-year study comparing the performance of these different drying methods established the superiority of Refractance Window™ technology over other methods, including freeze-drying and spray-drying.[6]



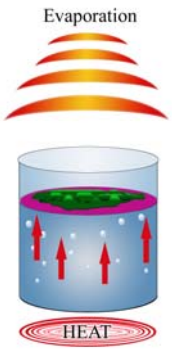
(fig.1)

In brief, when water is placed over a heating source, infrared energy is transferred throughout the water by convection. The heat energy then radiates from the water, primarily through evaporation. (fig.1)

If the water is covered by a transparent membrane, evaporation and its associated heat loss are blocked or "refracted." The membrane acts like a mirror reflecting the infrared energy back into the water. (fig.2)

(fig.2)

When a moist, raw material such as algae is placed on the membrane's surface, the water in the material creates a "window"



(fig.3)

that allows for the passage of infrared energy through the membrane and also through the material. Heat is directly transferred to the water present in the material. (fig.3)

In a matter of a few moments, the water in the material on the membrane's surface evaporates, and the "window" of infrared energy closes and "refracts" back into the heated water source, no longer exposing the material to heat. (fig.4)

(fig.4)

When comparing various drying technologies, the degree of preservation of a material's original color and flavor indicates the quality of the drying process utilized. Studies performed at Washington State University's Department of Biological Systems Engineering and Department of Food Science and Human Nutrition established the preservation superiority of the Refractance Window™ drying technology over all other methods of drying, including spray-drying and freeze-drying.[6]