ALGAE . . . A MODERN MANNA

Then the Lord said unto Moses, Behold, I will rain bread from heaven for you; and the people shall go out and gather a certain rate every day, that I may prove them, whether they will walk in my law, or no . . .

And when the dew that lay was gone up, behold, upon the face of the wilderness there lay a small round thing, as small as the hoar frost on the ground.

And when the children of Israel saw it, they said to one another, It is manna; for they wist not what it was. And Moses said unto them, This is the bread which the Lord hath given you to eat. – Exodus, Chapter 16

Since this dramatic episode, which may have occurred about 1200 B.C. and is believed to have been first recorded in writing some 300 years later, scholars have been intrigued by *manna*. Some believe manna might have been coriander seeds, others a type of lichen common in African and Arabian deserts.

However, what manna may have been is not so important as what the Pentateuchal account represents: man's age-old dream of a miraculously provided food so perfect that it would satisfy all human needs.

If the yearning for manna was strong three millenia ago, it is even stronger today. The spectre of starvation stalks millions of the world's mounting population. The high hopes placed on the Green Revolution, which seemed so promising in the 1960s, are fading as mounting costs of petroleum, the basis of modern fertilizers essential to the Green Revolution, threaten to make fertilizers unavailable to poorer nations.

Man needs a modern manna. The call for science to respond was aptly put by James Kendrick, Jr., University of California vice president for agricultural sciences, as he spoke during the 100th anniversary celebration of the University's Agricultural Experiment Station at Berkeley:

100 years ago, greater agricultural production was a pressing need for our rapidly growing society, and farmers needed the help of science to achieve it. Now, as we face the next 100 years, we have that same pressing need for production . . . and the help of science is needed more than it was before . . .

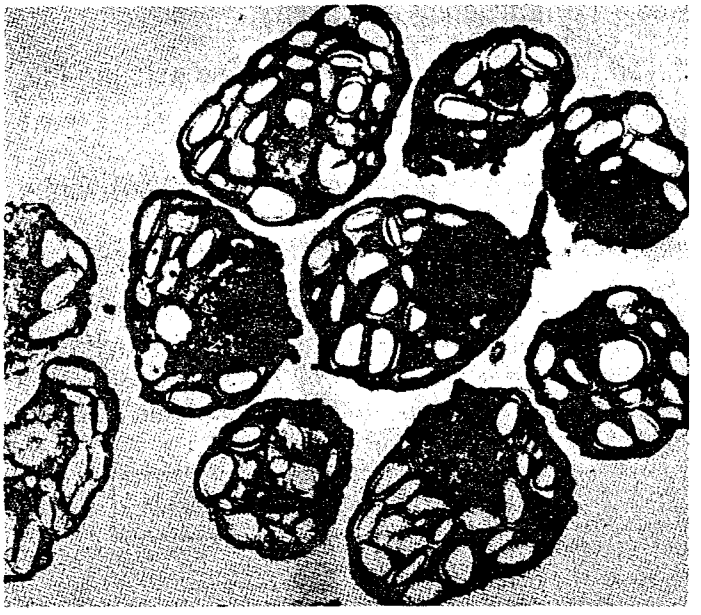
Major limits to production growth for the rest of this century will not be physical, but man's ability to discover new knowledge . . .

The time has come for more resources to go into nutrition research, new food technology, and ways to increase productivity per acre. We need to explore ways of capitalizing on photosynthesis and making better use of the sun's energy . . .

Answering this appeal in a variety of innovative ways is an interdisciplinary group of scientists, engineers, and technicians in the United States who have made significant advances in this area and are confident they have opened a new era in the fields of nutrition, health, and environmental quality. This group, working both independently and together, believe they have touched on modern manna. Interestingly, it would have its roots in one of the earth's oldest, most overlooked, yet most efficient high-energy life forms: algae, ubiquitous photosynthesizers.

ALGAE

Algae exist everywhere in thousands of varieties. While resembling bacteria, some of which can photosynthesize, algae have cell walls and are far more efficient photosynthesizing organisms. Some algae grow in colonies resembling plants. Best known of these are the sea kelps, some of which can attain lengths of several hundred feet. However, algae such as these differ from true plants, in not having root, circulatory, and other complex transport systems. Each cell is self-sufficient. Break a piece of sea kelp off and it will retain its viability.



This photograph, at about 4,000 magnification, shows daughter cells which have formed within the parent cell and are preparing to start individual existence. As many as 16 new cells may form in one "parent". Some varieties of algae split like this every 2 or 3 hours.

Algae are generally, if not entirely satisfactorily, classified by color: green, blue-green, red, and brown. However, regardless of camouflaging pigmentation, all contain green chlorophyl for photosynthesis. Some blue-green algae contain 4 to 6% of their weight as chlorophyl.

Algae may be found wherever there is water, or even moisture: in the ocean (where they are a major constituent of plankton), lakes, rivers, streams, hot springs with a high mineral content, ponds, and short-lived rain puddles. They may be found living on the ground or beneath the earth's surfaces, on the bark of trees, on rocks, and even within the bodies of higher plants and animals.

Primitive as algae may seem, and have been labeled as such by scientists, most are highly efficient photosynthesizers (more so than green plants), utilizing light energy (greater than 10% conversion efficiency), carbon dioxide from the air, and hydrogen and oxygen from the water to synthesize a high-energy form of proteins, carbohydrates (starches and sugars), lipids (fats), nucleic acids (DNA and RNA), vitamins and cofactors, and chlorophyls and pigments.

A few strains, of special interest to nutritional researchers, rapidly metabolize molecular nitrogen from the air to proteins and other nitrogen-containing biomolecules. In addition to a nitrogen source, algae require phosphorus (usually from phosphates) and micro quantities of certain metals to grow. The trace metals appear in the algae along with essential vitamins necessary for balanced human nutrition and sustained energy.

And algae grow rapidly. A few cells in a pond, under optimum conditions, can reproduce to cover the pond with thick scum in but a few hours. Exceptionally fast growing varieties have cell generation times of from 2 to 3 hours; a single cell splitting at this rate could produce algae covering the earth within a very short time. Obviously there are limiting factors and these limiting conditions are responsible for the high cost of algae and algae products.

Some types of algae have been used as a food source for centuries. A few primitive tribes have gathered algae for food. In the Orient, sea kelps are today used in some areas, and in the Western world, dried and powdered sea kelp is sometimes used as a dietary supplement. One form of algae, when mixed and seasoned with other foods, is considered an exotic delicacy in isolated Asian areas.

An excellent type of blue-green algae, freeze-dried and powdered, is available now in some health food stores in the U.S. Green algae are available in Japan at high prices. Some survival manuals contain instructions for making "pond scum" into an edible broth.

But except in these minor ways, the immense nutritional and energy-health potential of algae has not been utilized or even recognized by most humans since the destruction of the Aztec empire. Algae are simply not in the cultural nutritional patterns or in the organic energy identity patterns of most of the human race.

This being so, there has been no incentive for farmers to grow algae, especially during a fast receding era when high-technology/low-energy containing foods were abundant and inexpensive.

But with the impending world "food energy" shortage, all this may change as the need for energy-positive food supplements mounts. The crescendo of change will become deafening when the health giving and sustaining qualities of a few varieties of fresh-water algae become known and people rush to enjoy its life-sustaining energy.

PROPERTIES AND CHEMICAL COMPOSITION

Blue-green fresh-water algae, when grown, harvested, and processed for human consumption, have a dark green color and are a fine grained or fluffy powder depending on the processing methods used. They have no odor and are described by many as having a mild natural flavor—unlike that associated with the sea algae (kelp). They are packaged in bulk powder, tablets, capsules, and as soft drinks for use. The average chemical composition of the blue-green algae which are harvested from Upper Klamath Lake is:

AVERAGE CHEMICAL ANALYSIS (% DRY WEIGHT)

Constituent	*Blue-Green Algae*
Protein	60
Chlorophyl	6
Lipid (Fats)	4
Carbohydrate	14
Minerals	13
Moisture	3

Spectrographic analysis by atomic absorption spectroscopy shows that the complexed-chelated minerals present are boron, calcium, chromium, cobalt, copper, iron, magnesium, manganese, potassium, phosphorus, selenium, sodium, sulfur, titanium, vanadium, and zinc.

And, analysis shows that blue-green algae are rich in the necessary known vitamins. The vitamins present in the average daily adult intake of 2 grams of algae are presented in the next column.

While blue-green algae, on the whole, are good sources of vitamins, they contain no vitamin D and have a highly variable ascorbic acid content which is dependent on the environment in which they grow. Lesser amounts of ascorbic acid have been reported for yeast, and no reports were found for the ascorbic acid content of bacteria. Even when compared with eggs and milk, which are known to be rich food sources, algae are an excellent nutritional supplement.

Dulse is a popular red algae which grows naturally in the ocean; that which is sold in the U.S. is generally harvested from the North Atlantic Ocean, sun dried, and

Vitamin Content	*Avg. daily intake 2 grams Blue-Green Algae*
Provitamin A (B-carotene)	1400 USP Units
Thiamine B1	0.04 mg
Riboflavin B2	0.10 mg
Pyridoxine B6	0.08 mg
Cyanocobalamin B12	4.00 mcg
Ascorbic Acid C	6.65 mg
Niacin	0.73 mg
Choline	9.31 mg
Pantothenic Acid	0.07 mg
Inositol	0.70 mg
Folic Acid	1.00 mcg
d-Ca-Pantothenate	22.00 mcg
Biotin	0.80 mcg
a-Tocopherol E	0.40 mg
Vitamin K*	

mg = milligrams; mcg = micrograms
**Vitamins E and K are synthesized in the mammalian body from the phytol moiety of the chlorophyl molecule.*

AVERAGE COMPOSITION OF MILK, EGGS, AND BLUE-GREEN ALGAE

Average Composition	Cows (a) Milk (% Dry Weight)	Chicken (a) Eggs (% Dry Weight)	Blue-Green Algae (% Dry Weight)
Protein	28	49	60
Carbohydrate	32-38	3-4	14
Lipid (Fat)	28	44	4
Minerals	6	4	13
Fiber	0	0	-
Chlorophyl	0	0	6
KCal/g	5	6	6b

(a) Composition of Foods, Agr. Handbook, No. 8, USDA
(b) Food from Sunlight, C. Hills and H. Nakamura, University of the Trees Press, Boulder Creek, California, 1978 (pp 310-321).

processed for human consumption. The kelp grow in a high salt environment which contains almost no nitrogen for use in making proteins, nucleic acids, and other nitrogen-containing molecules; therefore, the protein content is low and the salt content is high, as shown in the table of comparisons.

Fresh-water blue-green algae, which are not to be confused with other algae or higher green plants, synthesize large amounts of proteins and chlorophyl; they contain more protein and chlorophyl than any other organism (plant or animal). And the amino acid profile is essentially the same as for humans and domestic animals.

The sugars contained in Dulse (kelp) and alfalfa are, for the most part, not digested by humans because we lack the necessary enzymes to break them into smaller useful components. The sugars contained in blue-green algae are identical to glycogen, the major storage product of the liver in man.

Both Dulse and blue-green algae contain large amounts of potassium and iron. However, Dulse also contains high levels of sodium, an element whose deleterious effects on the vascular system in man are well known. The complexed-chelated minerals in blue-green algae have been shown to provide the necessary amounts for a normal healthy life. Assimilation of and utilization by the consumer are much more important than the consumption of mega amounts.

The vitamin-cofactor profile, with the exception of vitamin D, is more uniform and complete in the blue-green algae than for either Dulse or alfalfa. Eating blue-green algae, with all its natural factors remaining intact, and getting younger is no myth—*it is reality*. Vitamins E and K are manufactured in the body from the phytol moiety of chlorophyl which is contained in abundance in blue-green algae. Thus, eating blue-green algae supplies the body with large amounts of raw materials for the synthesis of necessary molecules. Eating blue-green algae every day means you will have lasting sustained energy.

CONTROLLED GROWTH FACTOR

Although fresh-water algae, "The Energy and Health Givers," have been eaten by man for centuries, only recently have they been touted by scientists and anthropologists as the group of high-protein containing organisms the most likely to provide man with sufficient amounts of nutriments for the future. All of these writers, however, have not themselves been consumers of algae and apparently did not know anyone who was; thus, an entirely accurate account of the present uses of algae has not appeared in most of the world's literature. The real benefits which fresh-water microalgae can provide to modern man, when eaten on a daily basis in 1 to 3 gram amounts, is not in its protein food value, but instead is in its controlled growth factor (CGF) designated as such by Japanese biochemists to describe the combination of molecules that provide the large increase in sustaining energy when certain types of algae are eaten by man in the freeze-dried form (1 to 3 gram daily). Yet, the chemical composition of blue-green algae is adequate to sustain life.

ALGAE FOR MAN: THE KEY

The processing of algae is just as important as the product itself. Considering the health and energy-giving qualities of algae, it must be recognized that the method used to dry the algae after it has been grown and harvested is critical if the beneficial factors (CGF) are to be retained.

The Kanembu natives of the Lake Chad region of Africa have traditionally harvested and eaten algae. They use a processing method similar to that used by the Aztec civilization to remove the blue-green alga, Spirulina, from Lake Taxcoco. The algae are gathered from the lake in porous cloth bags and allowed to drain. It is then formed into large flat cakes on the sand and dried in the sun. As the blue-green algae gels, it is smoothed by hand and marked off into squares. When most of the water has evaporated or seeped into the sand, the squares are pulled up, dried further on mats, and cut into brittle cakes. The Kanembu then eat the algae which is called "dihe," after it is cooked in a sauce of tomatoes, chili peppers, and various spices. The algae sauce is then poured over millet. Unfortunately, much of the chlorophyl and other factors are lost by the hot sun/sand drying.

Two drying methods for processing algae are currently in use; they are spray-drying, which involves the use of high temperatures (500 to 600 F.), and freeze-drying, which employs low temperatures (32 F.) and reduced pressure (absence of air). Due to the much higher costs of freeze-drying, this process was largely abandoned for processing algae until our efforts to provide a product with all the "beneficial factors" intact dictated its use. As far back as 1921, Robert McCarrison, M.D., F.M. Pottenger, M.D., D.G. Simonsen, Ph.D., and W.A. Price, D.D.S., demonstrated the destructive processes involved when foods are processed at high temperatures. They also showed the degeneration of primitive peoples that adopted "civilized" diets and demonstrated a correlation between societal decay and diet. The experimental information obtained by these early nutritional investigators continues to be substantiated as useless diet fads sweep the U.S. like a plague. And, almost everyone is overfed, yet undernourished. Eating algae can change man's insatiable appetite for self destruction.

With such factors as poor soils producing low quality, low energy crops, heat processed and refined food, and even the lack of food, algae, which have been grown in sunlight and natural water, is perhaps the most significant and feasible way to dramatically improve the diet form on earth.

WHAT ARE ALGAE USED FOR?

While photosynthesis takes place in algae, a complex of chemical compounds is synthesized simultaneously along with the carbohydrates, lipids, proteins, nucleic acids, and vitamins. The exact compounds which make up this complex have not yet been determined by scientists but – because of its growth-promoting factors – it is called controlled growth factor (CGF). The CGF found in certain types of fresh-water microalgae is water soluble and is easily extracted from blue-green algae. CGF is separated into four fractions, each having specific effects on enhancing the growth of certain microorganisms. CGF has the following chemical properties: it has maximum optical absorption in the ultraviolet region (260 nm) of the electromagnetic spectrum; it is a mixture of sulfur-containing nucleotides (nucleic acids are larger units of nucleotides), and peptides (small proteins) which are chemically complexed into units. The nucleotide portion of the CGF consists mainly of the important nucleic acid bases adenosine and cytidine. The molecular weight of the nucleotide protein complex, which we believe provides some of the long term energy stimulation when eaten by man and animals, is less than 15,000. The most nutritionally effective ingredient of the blue-green algae Anabaena (the type harvested from Upper Klamath Lake) is the CGF; and it has been shown to insure the proper vital cellular metabolism and functions in man.

PROTEINS, LIPIDS, AND CARBOHYDRATES

Fresh-water blue-green algae, when grown under closely controlled conditions of sunlight, water, carbon dioxide, and some elements, contain a balanced human nutritional profile and contain as high as 65% pure consumable protein. Since blue-green algae contain high amounts of lysine and arginine and other basic amino acids, they improve the nutritive value of rice and wheat flour and other grains when they are mixed together or included together in the diet. Algae have been shown to be helpful in increasing the assimilation and utilization of proteins when on a vegetarian, micronbiotic, and/or strictly raw food diet. A 30 year old man, who has been on a vegetarian diet for three years, describes his energy enhancement when eating blue-green algae:

"For the past three years, I have been a vegetarian raw-fooder. About six months ago, I decided to modify my diet to include eggs and grains, as my weight had dropped from 135 pounds to 118 pounds and I was getting weak. About two weeks after including the eggs and grains in my diet. I began eating algae. Almost immediately my strength started coming back and it continued to increase. I gained about eight pounds. Of course, the eggs and grains I was eating helped, too. About two weeks ago, I depleted my supply of algae and have noticed two changes: my overall strength is reduced from what it was, and my body doesn't feel as clean as when eating algae. My body odor has returned. I am looking forward to picking up more algae from you and to feeling the results of eating it again."

The lipid-chlorophyl-carotene content of algae is about 10% (by weight). The fatty acids consist primarily of unsaturated moieties having 16 and 18 carbon atom chain lengths. Therefore, they act in the capacity of vitamin F to enhance lipid metabolism by lowering the blood level of cholesterol, preventing obesity, and optimizing the functions of the adrenal and thyroid glands. Algae provide for strengthening, invigorating, and activating human bodies in old age. A 74 year old overweight woman describes her energy reactions to algae:

"I simply can't describe in adequate terms the effect algae has had on me. My metabolism is up tremendously, giving me energy I haven't experienced for years! I can't remember when I have felt this good! My sleeping habits, which have been so restless for many years, have taken a complete turn-around, and I am sleeping deeply and soundly for the first time as far back as I can remember. Something else truly amazing is that I have lost six pounds in one week and haven't been dieting – I'm just losing liquid like crazy. The bladder operation I had 25 years ago was never entirely satisfactory in that the bladder never fully emptied. But the algae seem to be helping the situation, and I urinate only half as much now. The algae are doing wonders for me, and I would like to be assured a continuing supply for I don't want to be without it."

PHYTOL, STEROLS, ANTIBIOTICS

The phytol molecule is produced in the human body by the hydrolytic removal of the phytol moiety from chlorophyl. Phytol is a metabolic precursor component necessary for the synthesis of vitamins E and K and is about 1% of the dry cell weight. A major cell component sterol is identified as chondrillasterol, a synthetic precursor of cortisone, which is naturally secreted by the adrenal gland. Cortisone is used in the treatment of arthritic ailments and other disorders. Sterols make up about 2% of the dry cell weight of some algae. And, some algae contain the natural antibiotics *chlorellin* and *chlorophyllide.*

GROWTH-PROMOTING EFFECTS

When algae, or a water soluble extract of it, are added to a suspension of Lactobacillus, lactic acid production is accelerated. Using an extract of algae, a soft drink containing Lactobacillus has been manufactured. The growth of the so called "friendly bacteria" is accelerated in the gut of humans when algae are eaten daily.

Animals which are fed a diet of whole-dried algae have shown accelerated growth rates when compared to those raised on normal laboratory rations. Yamagushi and his coworkers observed greater weight increases and a higher percentage of viable offspring in mice, rats, swine, chickens, and silkworms. One study from a sample of Japanese school children who had been given 2 grams of algae every day for 112 days, indicated that this dietary supplement provided weight and height increases greater than in the control individuals.

A young Los Angeles mother describes her 3 year old's reaction to algae:

"My 3 year old son who had visited the doctor on the average of every other week because of colds and tonsilitis, started using algae along with me. Before using the algae, he was on antibiotics at least once each month. Since starting the algae, his colds been less severe and less numerous, and he is off antibiotics. To date, he has not had a cold or tonsilitis in over 11 months. He likes the taste so well he asks me for it if I forget to give it to him."

CHEMICAL COMPOSITION AND VITAMIN AND MINERAL COMPARISON OF BLUE-GREEN ALGAE, DULSE, AND ALFALFA

Approximate Composition	Blue-Green Algae Freeze-Dried	Dulse (a) (Kelp) Sun Dried	Alfalfa (b) Dehydrated
g/100 g (e)			
Protein	60	25	23
Carbohydrate (Sugars)	14	44	39
Lipid (Fats)	4	4	3
Minerals (Ash)	13	27	12
Fiber	Trace	Trace	16
Chlorophyl	6	<0.1 (c)	<0.1 (c)
Moisture	3	-d	7
Vitamins, mg/100 g			
Thiamine B1	2.0	0.6	0.8
Riboflavin B2	5.0	0.5	1.8
Pyridoxine B6	4.0	0.01	1.0
Cyanobalamin B12	200 mcg	3 mcg	0.3 mcg
Provitamin A (B-carotene), IU	70,000	-	44,000
Ascorbic Acid C	333.0	-	176.0
Vitamin D	0	-	1040.0
Niacin	37	-	5.0
Choline	466	-	-
Pantothenic Acid	3.5	0.4	3.3
d-CA Pantothenate	1.1	-	-
Inositol	35	-	210
Folic Acid	50 mcg	-	0.8
Biotin	40 mcg	1.8 mcg	33 mcg
a-Tocopherol E, IU	20 (f)	-	50
Vitamin K, IU	f	-	15
Minerals, g/100 g (e)			
Boron	9 p.p.m.	Trace	47 p.p.m.
Calcium	3.5	0.5	1.8
Chlorine	4.0	6.4	0.3
Cobalt	1.3 p.p.m.	0.46 p.p.m.	24 p.p.m.
Copper	33 p.p.m.	26 p.p.m.	20 p.p.m.
Iodine	Trace	0.02	Trace
Iron	1300 p.p.m.	1500 p.p.m.	350 p.p.m.
Magnesium	0.14 p.p.m.	0.22	0.3
Manganese	25 p.p.m.	10 p.p.m.	50 p.p.m.
Molybdenum	Trace	0.4 p.p.m.	2.6 p.p.m.
Nickel	Trace	2 p.p.m.	Trace
Phosphorus	0.53	0.32	0.25
Potassium	5.0	7.1	2.0
Sodium	0.2	2.5	0.15
Titanium	140 p.p.m.	Trace	Trace
Zinc	140 p.p.m.	100	Trace

Symbol identification: g = grams; mg = milligrams; mcg = micrograms; p.p.m. = parts per million; Trace = identified as present but not quantified; IU = International Units.
(a) Composition of Dulse supplied by Atlantic Mariculture, Ltd., Dartmouth, Nova Scotia, Canada.
(b) Composition of alfalfa taken from National Academy of Sciences National Research Council, Pub. 585 & USDA Agricultural Research, T3 No. 1235.
(c) Symbol < means less than the number shown.
(d) No data available.
(e) g/100 g same as percent (%).
(f) Vitamins E and K are synthesized in the human body from the phytol moiety of the cholorophyl molecule.

And reports from Japan indicate babies love algae as a food supplement when consumed as a liquid.

MEDICAL EFFECTS

Published reports involving the clinical and biomedical use of algae are few; however, those that have been completed in controlled situations show encouraging results. Most of the clinical studies performed to date have been done in Japan and have appeared in Japanese journals; thus, the results of their work have gone virtually unnoticed by Western physicians. However, several U.S. medical practitioners presently use algae in their practice. All have had excellent results with the administered cases. The algae are given to the patient as a dietary food supplement in the form of capsules, tablets, powder, or liquid. And, no claims can be made in the U.S. regarding the efficacy of algae although medical people in other countries are using algae as a preventive and cure for disease and metabolic dysfunction.

VASCULAR TREATMENT

Algae have been used to eliminate arterial blockage when by-pass surgery has been indicated. Recently, a 68 year old woman went to her family physician complaining of severe pain in the left leg and an inability of the limb to support her weight for longer than a few minutes. Her physician reported after thorough testing that she had no arterial pressure in the left femoral artery and that a blockage had occurred in an iliac artery. He suggested an arterial by-pass to alleviate the problem. But, due to her reluctance to have surgery, he agreed to place her on a suggested diet of algae (2 grams daily), tomato juice, specific meat protein, natural blue Indian corn, and specified amounts of distilled water for a period of three weeks. If, however, at the end of the three-week period no improvement in arterial pressure was detected, she would have surgery as suggested. Much to the physician's amazement, within the experimental time frame, the arterial pressure in the femoral artery returned to normal and the patient's blood pressure dropped substantially. The patient, after three months of continued algae supplementation to her usual diet, has normal use of the leg and there is no indication that surgery will be needed in the future.

All physicians and chiropractors who have used algae on their elderly patients report a rejuvenation of the circulatory system such that the contained enzymes, gases, and blood pressure are similar to those of young adults.

GASTROINTESTINAL ULCERS

Yamagushi, et al *(Japan Medical News,* 1997, 25 [1965]), administered 2 grams of algae daily to patients with gastric ulcers, duodenal ulcers, and chronic gastritis. Symptoms such as stomach pain, suppressive feelings in the stomach, pyrosis, and belching were eliminated. *All gastric ulcers* and cases of *chronic gastritis* were cured; seven of nine cases of duodenal ulcer were cured completely, and the other two cases showed marked improvement. Saito and his associates *(Medication and New Drugs,* 3, 3 [1966]), have used microalgae, applied atopically, in the treatment of refractory cuts to promote healing and stop bleeding. They report fast healing and almost immediate cessation of bleeding. A Los Angeles woman describes her relief from tooth extraction in the following manner:

"I am writing this letter to share with you my excitement with the algae. It started when a close friend suggested that it might help the healing process after having my four wisdom teeth extracted. The night after oral surgery, I applied the algae to the surface of the gums and almost immediately the bleeding stopped. A week later, I returned to the oral surgeon to have my stitches removed. He was truly amazed at the rapid healing of the gums. The algae not only healed my gums incredibly fast but it also increase my energy."

The successful control of Vincents Angina (trench mouth) and advance pyorrhea using chlorophyl extracts has been reported.

LEUKOCYTE LOSS PREVENTION

X-ray radiation or mitomycin injection in the treatment of cancers or prevention of its post surgery recurrence normally brings with it a decrease in the normal leukocyte levels. Saito, et al *(Medication and New Drugs,* 3, 61 [1966]), have reported that the oral administration of algae decelerates this loss and serves for a quicker return to normal blood levels. Blue-green algae (2 to 3 grams daily) when administered to several U.S. patients recovering from cancer surgery and while receiving x-ray treatment, have reduced symptoms of nausea and have given increased levels of body energy for a quick return to normal activities.

TREATMENT OF ALLERGIES

Takuma, et al (*Pediatric Clinics,* 15, 10 [1962]), decolorized green algae and used it to treat milk allergic infants. The allergenic symptoms were eliminated. Takuma and co-workers also used the algae to treat eczema resulting from allergic reactions to soybean milk.

We have used blue-green algae successfully to reduce chronic hypersensitivity to foods. A young lady reports her progress this way:

"I have been eating algae for about six months now and have noticed several physical changes – all for the better. Having suffered from hypoglycemia for many years, I now have a normal, stabilized blood sugar level. The algae seem to have increased my metabolism and given me renewed energy; with the proper diet, I have lost 25 pounds in six months.

"The algae have markedly decreased my sensitivity to food. I used to be quite allergic to dairy products, but now I can tolerate them quite well.

"I really think the algae is great and it has done a lot for me. Thanks for telling me about it."

Algae powder has been used in the U.S. to cure seasonal allergies due to pollens. The algae is pulverized into a fine dust and placed in solution and sprayed into the lungs through the nostrils using a nasal atomizer. The congestive symptoms have disappeared after a few days of treatment. The symptoms, in all cases, did not return after discontinued use. However, these patients continued on a course of 1 to 3 grams oral ingestion of the same algal material.

EXCRETION OF HEAVY METALS IN THE HUMAN BODY

Professors S. Ichimaru and N. Ogino (discoverers of "Itai-itai" disease in Toyama Prefecture) report the effectiveness of algae in excreting cadmium accumulated in the bodies of "Itai-itai" patients. They comment that microalgae is the only substance available that discharges heavy metals such as cadmium, lead, and mercury without adverse side effects of chelation therapy. Treatment of U.S. patients has shown that use of algae tends to normalize excessive and deficient conditions regarding all the minerals necessary for a healthy body.

Algae are being used in the U.S. to correct or eliminate the effects of metabolic dysfunctions such as those associated with cirrhosis of the liver, thyroid gland, arthritis, nervousness, and so on, where impairment of normal body metabolism is associated with abnormal carbohydrate metabolism. A 30 year old male diabetic has described a substantial reduction in the use of insulin while eating algae:

"Let me take this opportunity to thank you for the introduction to your type of algae. It has markedly reduced my requirement for both regular type and NPH type insulin by a total of 20% to date. Further, it has regulated some of my body functions that were affected by the strain of work pressures and has generally made me feel better."

This person is continuing to reduce his insulin requirements under the care of his physician; such reductions in life sustaining medicines should always be done while under a physician's care.

Many informal reports by physicians who have used microalgae to treat obesity, hypertension, muscle tone, fatigue, hemorrhoids, viral infections, and alcoholism point to the efficacy of its use as a pharmacological agent.

All of the human and some animal patients with whom we have been associated and who have been suffering with a severe biological dysfunction have been placed on a controlled daily diet consisting of 1 to 3 grams of algae, fish and/or poultry (about 20 to 40 grams protein), blue Indian corn (which has been baked as cornbread), two boiled eggs per day; two baked potatoes, and three 8 ounce glasses of tomato juice. Since the algae "normalizes" the carbohydrate metabolism almost immediately, it is important that adequate amounts of carbohydrate, lipids, and protein be made available to provide the sustained energy that is made available through increased assimilation and availability of stored and ingested foods. Normally healthy individuals need not alter their diet in order to experience the benefits of this tremendous energy and health giver.

Today, about five million pounds of various algae types are produced and consumed outside the U.S. However, nowhere in the world, except in the U.S., is there a massive unpolluted pristine body of water like Upper Klamath Lake, where the much sought after blue-green algae grow in such abundance they can be scooped from the glistening water by the handfuls. And, they have been there for years waiting to be recognized as the super nutritional product which they are. The carefully harvested, pure blue-green algae from Upper Klamath Lake are commercially available for the first time anywhere in the world. And they are the only unpolluted, naturally grown source of blue-green algae available, so rich in life-giving essence – controlled growth factor, chlorophyl, vitamins, minerals, proteins, and active enzymes. Some health food stores carry the forms of algae described here.

Authors of the above article are Dr. V.H. Kollman and D. Raymond Schmidt. Details of their qualifications and experience appear overleaf.

Dawn. During the night, photosynthesis and growth stopped. The cell survived by consuming food it had produced and stored during the day. Note the paucity and small size of white carbohydrate globules compared to those shown in photos taken later in the day.

Midmorning. After several hours of photosynthesizing, the cell becomes "ripe" with the food it has generated. Note the abundance and larger size of white carbohydrate globules. The cell itself has also considerably increased in volume.

D. Raymond Schmidt is a recognized authority in the application of raw foods to dietary intake and has played an active role in shaping the present-day health food and nutrition movement. Schmidt has done extensive field research on the diets of primitive and modern societies. He is affiliated with the Price-Pottenger Nutrition Foundation at San Diego, California, and has collated the works of the late Weston A. Price, D.D.S. Schmidt is also a field research member with the Kaiser Permanente Medical Group, Los Angeles, California.

Dr. Victor H. Kollman is affiliated with the University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico. He has been working with the applications of algae to man, animals, and the environment for 15 years and is a recognized expert in the use of algae and green plants for biochemical synthesis of compounds labeled with stable isotopes for clinical, biological, and biochemical applications. Dr. Kollman is the scientific consultant to the Four Corners Regional Commission, Office of the Governors of New Mexico, Colorado, Utah, Nevada, and Arizona, for the development of algae-related industries in the southwestern United States. He has served as the director of several projects for applications of algae to nutritional supplementation, treatment of polluted culinary water, and treatment of wastewater. Presently, he is supervising two algae growth, harvesting, and processing activities.

Both authors are avid eaters of algae and recommend it to all people who want to be – or want to stay – healthy.

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