Marine Phytoplankton Research Documents

Page 1

Marine Phytoplankton, a super food

Dr. provided research on the possible benefits of Marine Phytoplankton.

Not all plankton are created equal Page 10

Documentation of the value and exclusivity of Tom Harper's Marine Phytoplankton.

The truth about Marine Phytoplankton Page 15

Scientific research on Marine Phytoplankton and how it aids the body.

Health Indicators of Marine PhytoplanktonPage 21Use: A Pilot Study

Research from a pilot study conducted by the University of Utah to explore and document the possible effects of Marine Phytoplankton on the body.

"Marine Phytoplankton, a super food."

Before any discussion on any nutrient is undertaken, we need to review some very basic, and recent advances in Medicine and Nutrition.

The new science of Metabolomics (American J. Clinical Nutrition 2005;82:497) is revolutionizing the way we think about health and disease. Its simplicity is astounding, especially when we realize that we have always intuitively known the principles Metabolomics is founded upon: energy produced by our cells is indispensable for them to carry out their assigned duties. For this to occur, for our cells to Metabolize, they need air, food, and the ability to get rid of the "metabolites," or toxins, or by-products of combustion generated by our production of energy, or metabolism.

Just like any ordinary machine (which have been patterned after own cell metabolism) needs air, fuel, and a mechanism to dispose of fumes and waste products, our cells have the same energy needs. It does not matter that some cells work in the brain, and others are shaping our little toes. All cells work the same way. They have different outputs and function, but they basically work the same way. Some produce hair, and others sweat. Just like some factories, or machines produce books, and others soap bars. Essentially, they all require energy, and a way to take out the garbage.

Consequently, our cells depend in all respects from the energy derived from our Sun. Its energy is suffused throughout our planet, fuelling life at all levels. Plants absorb this energy (photosynthesis,) which is later consumed by animals and humans. In these modern days, we have no difficulties understanding the concept of energy sustaining our economies, and way of life. Truly, everything about our communities depends on the energy generated by our Sun. Energy may be secondarily obtained from atoms, wind, oil, etc, but its ultimate source is the Sun itself. Well, the energy from the Sun also constitutes and fuels everything about our anatomy and physiology.

Now, back to the simple science of Metabolomics: Most of the Nobel prizes in Medicine and Biology have been awarded to the concept of "cell communication," which is how our 100 trillion cells get their metabolic function coordinated (J. Science, November 26th, 2004.) They do this through a system of "messages," which are well-known molecules like hormones, neurotransmitters, enzymes, etc. They form a vast network of communication, which should have never been separated into different components. The Psycho-Neuro-Immune-Endocrine system of cell communication to coordinate our metabolism is now considered to be the cornerstone of health and function in cutting edge research ("The intricate interface between the immune system and metabolism," J. Trends in Immunology 2004;25:193.)

Cell communication takes place mostly at the level of the outer cell membrane, which is equipped with antennae, or radar-like glycoproteins. These "receptors" are literally shaped into "lock-like" structures, by the energy produced within the cells themselves. Messages turn out to be "key-like" glycoproteins,

or molecules that will need to match the lock, or receptors on the cell membranes for "listening " to occur. The mitochondria are specialized organelles in charge of producing the energy necessary to fuel all activity within the cell. Mitochondria function takes place mostly in their own cell membranes, too. While the nuclei are very important to all cells, they are only a blue print to guide the production of each cell. The messages therein produced, are sent from the cell membrane, and received by other cells' membranes throughout the body (J. Science, May 31st, 2002 & 2003;300:1461-1604.)

Naturally, the cell membrane becomes an extremely important part of cell communication and function. The cell membrane is the very interface between each cell and its environment. Cells are totally dependent on the environment in our bodies. Said environment is created by our very lifestyles. Poor foods, polluted air and water, poor relationships, etc, provide toxic environments, thereby compromising cell membrane function ("The Biology of Belief," Bruce Lipton, 2005 & "Quantum Cellular Biology," J. Medical Hypothesis 2001;57:358.)

So, the structure and function of our cell membranes is extremely important for our receptors to successfully receive the messages generated from other cells, thus coordinating our cells' metabolism and function. And, what are our cell membranes made up of? Sugars, proteins and fats! In other words, nutrition provides not only the fuel needed for our cells to function, but also the very molecules our cells need to be structured properly. A failure to eat properly will result in practically all manner of diseases. No wonder that "food is the best medicine!" ("Life's Complexity Pyramid," J. Science 2002;298:763.)

The wrong sugars (processed,) fats (saturated and tranhydrogenated,) and proteins (animals exposed to many toxins) will compromise cell membrane structure and function. As noted above, this compromises cell communication, AND thusly, the ability of each cell to produce energy. Simply put, all cell function will then be compromised, and practically all diseases will manifest themselves. This is why the right foods, those foods which contain the most healthy sugars, fats, and proteins will support body function and structure better than less gifted foods.

A classical example of a "failure to communicate" (think of "Cool Hand Luke") at the cellular level is Insulin resistance, the scourge of our modern days. Simply put, our cell membranes throughout the body are becoming rigid and inflexible, because of poor dietary intake, environmental pollution, and stressful lifestyles, thus compromising response to the most important metabolic messenger: insulin. Insulin finds the receptors and the cell membrane of our cells somewhat unresponsive, which can trigger practically all diseases ("Second world congress on the insulin resistance syndrome," J. Diabetes Care 2005;28:2073.)

We can say that consumption of refined sugars, which is rampant and addictive in our society, constitutes a source of toxicity to the cell membranes. With these types of foods, cell membranes also become inflamed, since they lack the micronutrients to quell the fire produced by our metabolic furnaces. These processed foods

lack antioxidants to neutralize all the oxidating free radicals produced by our metabolic furnaces, and by toxins in the environment. Thus, our cell membranes also become oxidized. Since the mitochondria (our cell furnaces) also depend on healthy cell membranes (composed of the right sugars, fats, and proteins) to produce energy, or metabolize, poor nutrition will cause mitochondrial dysfunction: These are the most basic mechanisms known in modern medicine (J. American Medical Association 2004;291:358.)

It is that simple: Our cell membranes become rigid, and unresponsive, thus compromising metabolism by interfering with cell communicating messages ("The puzzle of complex diseases," J. Science 2002;296:698.) Cell membranes are then oxidized, toxic, inflamed, and lacking in mitochondrial metabolism. This fulfills the prediction by a physicist, David Deutsch, who opined that the day would come when medicine would figure out that very simple concepts are at the root of all health issues, much the same as Physics is based on very simple and all-encompassing principles ("The Fabric of Reality," 1997.)

Physics, then, brings us back to the concept of energy: we need it to fuel all cell function. Food, then, is our main factor in harnessing the energy of the Sun. This is why...

It is essential that practicing physicians develop a working knowledge of herbs [and nutrition,] and stay abreast of these emerging findings in order to best advise their patients on the value of health promoting diets in disease and prevention... These are heady days for nutritional scientists as newer understandings of food and health promise to bring clinical nutrition to the forefront of clinical medicine. Practitioners must become nutritionally educated and oriented if they are to maintain their patients' confidence and stay abreast of this aspect of continuously evolving modern medicine ("Nutrition guidance of Family Doctors towards best practice," American J. Clinical Nutrition 2003;77:1001S.)

Again, the energy concepts underlying Metabolomics are very simple. "When East meets west: the relationship between yin-yang and antioxidation-oxidation" (J. FASEB 2003;17:127) compares the Yang (male forces) with Oxidation and the energy-producing Mitochondria. The Yin, or female force is compared to the processes of anti-oxidation, anti-inflammation, and detoxification. The Yang produces energy through metabolism by consuming food (fuel) to be burned by Oxygen in the Mitochondria. This process yields Free Radicals and oxidants, like any combustion engine. These products of combustion need to be neutralized by our cells anti-oxidating and anti-inflammatory processes, which are themselves fueled by micronutrients, as are our pathways of detoxification.

In other words, nutrition fuels the Yang/Energy of our cells and provides the means for the metabolism of the cells to be "cooled down," or neutralized by our Yin/antioxidating mechanisms. So, our bodies and minds require this simple process to occur unimpeded for optimal function. Again, Energy from our minds and spirit fuel the cell, as much as Energy from the Sun.

The article "Antioxidants in photosynthesis and human nutrition" (J. Science 2002;298:2149) reviews the

concept that photosynthesis is vital for the optimal metabolic function of the human cell. And, what foods are the best equipped to harness the energy of the Sun through photosynthesis? Those food that are highest in their contents of antioxidants.

LIFE FROM THE OCEANS, PLANKTON, TO SUPPORT LIFE

The main product is Sea plankton, and the other Sea products (Spirulina, Irish moss, and Kelp.) Consequently, let us review these products in depth:

Life on Earth is made possible because of its atmosphere, and its topsoil. People, and all living creatures, owe everything they enjoy to these elements. Earth's atmosphere and its topsoil were formed by microorganisms inhabiting our oceans, where from all life originated. Scientists at NASA theorize that about 3 ¹/₂ million years ago, tiny microorganisms with the ability to convert energy, or light from the Sun, water and minerals into essential nutrients (amino acids, carbohydrates, vitamins, etc) marked the beginning of life on Earth. These microorganisms, or "vegetation" from the oceans made it possible for all other life forms to originate.

We have an image in our minds of some amphibian crawling out of the ocean to begin life on firm land, forgetting that these creatures could not have survived on volcanic terrain, unless topsoil had first formed. They could not have adapted to life on Terra Firma, unless oxygen, or a suitable atmosphere had developed prior to their migrating out of the primordial Seas. These two elements, air and topsoil, were formed through rain and floods, in preparation for ocean amphibians to immigrate out of the water, where all life started in the form of microorganisms.

These microorganisms are commonly known as "algae" and "plankton." Besides producing enough gases to form our atmosphere, and enough micronutrients and minerals to form our topsoil, these tiny organisms are rich and nutritious enough to feed huge mammals, such as whales. Blue whales, bowhead whales, baleen whales, gray whales, humpbacks, and right whales all eat plankton. These mammals live between 80-150 years, and stay healthy and strong throughout their lives. The largest one, the whale shark, lives for over 150 years, grows up to 14 meters long, weighs up to 15 tons, and is sexually active until it dies.

A new science, Environmental Microbiology, is making these vital facts better known to the public. The Journal Science (arguably the most prestigious scientific journal in the world) featured Environmental Microbiology on its front cover in 2002;294:1055. Also, The Journal of Plankton Research provides monthly updates on the voluminous research taking place in this realm. Plankton are tiny open-water plants, animals or bacteria. The name, like the word planet, is derived from a Greek root that means, "wanderer," or "floating life." These organisms range in size from microscopic bacteria and plants to larger animals, such as jellyfish. Plankton generally have limited or no swimming ability and are transported through the water by currents and tides. In the Chesapeake Bay, plankton communities serve as a base for the food chain that supports the commercial fisheries. Most of the research into plankton has taken place in this area of the world, and in British Columbia, Canada. However, as noted below, the production of plankton in farms is making this super food readily available to all.

Plankton can be divided into three major size classes:

- phytoplankton-microscopic plants and bacteria
- zooplankton-microscopic animals
- macrozooplankton-larger fish eggs and larvae and pelagic invertebrates

Plankton are often used as indicators of environmental and aquatic health because of their high sensitivity to environmental change and short life span. Phytoplankton are useful indicators of high nutrient conditions due to their propensity to multiply rapidly in the right conditions. Zooplankton are useful indicators of future fisheries health because they are a food source for organisms at higher trophic levels, such as finfish. Currently, research is being conducted in the Chesapeake Bay concerning how plankton react to different environmental conditions. The best growth occurs in the so-called "spring bloom," when many species of phytoplankton take advantage of the enhanced conditions provided at that time of the year.

Phytoplankton

Like land plants, phytoplankton fix carbon through photosynthesis, making it available for higher trophic levels. The major environmental factors influencing phytoplankton growth are temperature, light and nutrient availability. Phytoplankton growth is usually limited to the photic zone, or the depth to which sunlight penetrates the water. Other limitations to growth are nutrients such as nitrogen and phosphorous, which are prevalent in the Chesapeake Bay.

Phytoplankton can undergo rapid population growth or "algal blooms" when water temperatures rises in the presence of excess nutrients, which typically occurs each spring in the Chesapeake Bay. While increased phytoplankton populations provide more food to organisms at higher trophic levels, too much phytoplankton can harm the overall health of the Chesapeake Bay. During these blooms, most of the phytoplankton die and sink to the bottom, where they decompose. This process depletes the bottom waters of dissolved oxygen, which is necessary for the survival of other organisms, including fish and crabs.

Major groups of phytoplankton in the Chesapeake Bay include:

- diatoms (phylum Bacillariophyta)
- golden-brown algae (Chrysophyta)
- green algae (Clorophyta)
- blue-green algae (Cyanophyta)

- dinoflagellates (Pyrrophycophyta)
- cryptomonads (Cryptophyta)
- microflaggelates (Prasinophyta, Euglenophycota, Protozoa)

Phytoplankton are being used as indicators of environmental conditions within the Bay because their populations are especially sensitive to changes in nutrient levels and other water quality conditions. A good picture of the current conditions in the Bay can be derived by looking at phytoplankton indicators such as chlorophyll, primary production rates, biomass and species composition. Satellite technology with color scanners detect high concentrations of chlorophyll in Chesapeake Bay, which are correlated with the presence of Plankton. One gallon of Chesapeake Bay water may contain one half million plankton organisms. One drop may contain thousands.

Algae are also known as Prokariotes, or, unicellular organisms without a nucleus. An example is Blue-Green algae, like Spirulina. Another type of algae is the Eukariotes, or unicellular organisms with a nucleus, such as Green and Red algae. Chlorella is a type of Green algae. Larger algae are known as seaweed. Kelp is perhaps the best known of them.

Modern technology

While it is true that some algae are toxic, or soak up toxins from polluted ocean water, this is not a significant problem, since commercial algae for human consumption is grown in safe farms in British Columbia. This is a remarkable achievement, because people may now profit from these nutrient-rich micro-organisms.

Spring bloom conditions are reproduced in a controlled environment year round in these farms. This increases the diversity and health of different species of phytoplankton, which make these products more powerful. The exclusive extraction process in these farms allows farmers to combine the benefits of phytonutrients with a natural and balanced composition of sea minerals.

Until now, people could not readily obtain such rich super foods. Through years of research, the Sea Farms can now growth these microorganisms in large quantities. These state of the art facilities allow the production of something very unique for you to maximize your health. The phytoplankton produce at Sea farms is not cyanobacteria, but true micro-algae, or plankton in its many forms and species. This, along with Sea Farm processing makes their product totally unique in the world.

The past and future of human nutrition is in the oceans

The micronutrients and electrolytes in plankton are exactly what human cell membranes need to carry out their metabolism. Not surprisingly, the composition of human plasma, or fluid surrounding cell membranes, is similar to that of sea water. Relying solely on land-based food sources may lead to deficiencies in these micronutrients and electrolytes. While transient sub-optimal nutrition may be forgiven, a constant diet lacking in these micronutrients will adversely affect every function, structure,

and detoxification functions of the human cell. As noted above, our metabolism will suffer, leading to practically all diseases.

Good nutrition will enhance the structure and function of all organs in our bodies. Our brains, muscles, hearts, arteries, joints, bones, skin, hair, hormones, immune system, vision, digestion, kidneys, liver will carry out their jobs much better. Metabolically, our lipids, and sugars can be optimized, thus providing more overall energy, minimize weight problems, and improve sleep. These nutrients improve mental function, and memory. They reduce depression, harmful effects of stress, and mood swings.

Specifically, Spirulina (cyanophyta,) has 62% amino acids, or 20 times more protein than Soy and 200 times more than beef. It is also the richest source of vitamin B12, and it contains high levels of minerals, like Zinc. Spirulina has 10 times more carotenoids than carrots, and it is rich in xanthophyl pigments, like chlorophyll. It is also rich in oils, containing more omega 3s than fish oil, such as GLA. Plankton is also rich in polymeric, and basic healthy sugars, such as polysaccharides (J. Plankton Research 2005;27:695.)

Plankton also have an alkaline pH, which is important, given the acidity of our diets high in refined sugars, soda pop, and farmed large animals.

The high density of nutrients found in algae is extremely important for many reasons.

Perhaps the most important (as noted above) is that these nutrients maintain human cell membranes in structure and function. This is vital for cell detoxification, and for the overall metabolism of human cells. In fact, the causes of diseases have been simplified to very specific mechanisms, all of which center on cell membrane function and structure.

Inflammation, Oxidation, Toxicity, and Mitochondrial dysfunction keep cell membranes from doing their job effectively.

Algae contain high levels of antioxidants, and anti-inflammatory micronutrients to fuel metabolism and detoxification. Also, they stoke the fires of the Mitochondria, where cells make energy required to carry out their function. Of course, photosynthesis is the mechanism whereby plants in general and algae in particular, harness life-sustaining solar energy.

So, it is not surprising to find very good evidence that algae is highly beneficial (J. Applied Phycology 1993;5:235.) In my opinion, the enrichment of our cell membrane function, through nutrients, and the prebiotic function of algae are the most important contributions to our health from these microorganisms. Prebiotics are rich fibers that feed our health intestinal flora (Chiba Hygiene College Bulletin, 1987:5#2, Japan.) It is precisely in the intestines where we find most of our immune, neurologic, and hormonal systems, the very systems our cells use to communicate through their cell membranes

One of the most researched items on nutrition is the role of Iodine in all aspects of cell function. Its relative absence in the diets of Mountain populations is generally felt to be at the root of many health problems, particularly when it comes to Thyroid function.

Thyroid hormone is indispensable for practically all cell functions, especially in the brain.

This is why populations living closer to oceans are generally healthier, and live longer

(J. Environmental Health Perspectives, September 2003:111#12:A628, A638, A642.) Of course, algae, and fish in general, and phytoplankton in particular, are very high in Iodine content. This is another compelling argument for turning to this super-food.

Here are some specific benefits of Sea plants documented in the medical literature:

- It is an Immune system enhancer, J. Nutritional Sciences and Vitaminology 1994;40:431
- It enhances macrophages, J. Nutritional Immunology 1995;3:35, J. Immunopharmacology, January 1996.
- It has anti HIV effects, Journal National Cancer Institute, August 1989, page 1254.
- Its phycocyanin stimulates hematopoesis, or building of blood cells, 2nd Asia-Pacific Conference on Algae technology, April 1994.
- It makes Iron more available, J. Nutrition Research 1986;6:85.
- It decreases nephrotoxicity, Annual Symposium Pharmaceutical Society, Japan, 1988
- It was approved in Russia to treat radiation sickness: 20 tablets for 45 days, Grodenski State Medical University, January 15th, 1994, J. Toxicology letters 1989;48:165
- It has anticancer activity by increasing endonuclease enzymes to fix DNA damage J. Nutrition and Cancer 1995;24:197, China J. Genetics 1988;15:374
- Its polysaccharides enhance immune system, 2nd Asia-Pacific Conference on Algae technology, April 1994
 - J. Agriculture Biol Chem 1983;47:2349
- It treats flu virus, J. Natural Products 1996;59:83.
- Its Calcium-spirulan, a polymerized sugar, treats Herpes Simplex, J. Phytotherapy Research 1993;7:76
- It strengthens immune system in chickens, after they are weakened by antibiotics, Proceedings 44th Western poultry Disease Conference, North Carolina, May 1995, J. Poultry Science 1994;73:46
- Chlorella, or unicellular green algae may reduce AGE, or Advanced Glycosylated Endproducts, which are toxic metabolites resulting from consuming refined sugars. Thus, Chlorella may improve Alzheimer's disease (J. Medical Hypothesis 2005;65:953.)

The new sciences of Metabolomics and Environmental Microbiology are pointing the way back to the origins of life: algae and plankton. The future is quite bright for these rich food sources, since they promise to better sustain life itself. This is why Jacques Cousteau said that "the future of nutrition is found in the ocean."



Not all phytoplankton are created equal.

Humans are made up of billions of cells: cells that started out as basic stem cells and transformed into each specific cell for each body part. Stem cells have three general properties: they are capable of dividing and renewing themselves for long periods; they are unspecialized; and they can give rise to specialized cell types. Scientists are now studying how to heal our bodies using proliferated stem cells, but there are huge ethical concerns.

But, what if we could heal our own cells with nutrients? A mere 3.3 billion years ago all life existed from single cell creatures from the sea: phytoplankton, the flora, and zooplankton, the fauna.

A rare and unique discovery has been made at an Aquaculture research facility on Vancouver Island in British Columbia. Alpha 3 CMP is a breakthrough product that has harnessed Earth's original food source and made it bio-available for the human digestive tract.

If most of the nutrients for our topsoil came from the sea, then the foods we eat get the same nutrients. Unfortunately our food is so processed, first by the plant itself, then by the manufacturers that the nutrient level is very low.

History in the making.

When Tom Harper, saw how shellfish that ate the Alpha 3 CMP phytoplankton grew and had a lower mortality rate, he realized that this might be a food that could encourage health in other species within the Aquaculture industry, or have potential for humans. For generations, wonderful species of algae such as Spirulina, Chlorella, and Astaxanthin have been helping individuals maintain good health, and now Mr. Harper has developed methods of bringing humans this extraordinary new highly concentrated blend of wild Phytoplankton for the first time in history.

Scientist and natural practitioners have known for years the nutritional potential within these microscopic plants, but due to the fact plankton maintain the foundation of all life in our oceans, we know we can't harvest them in sustainable quantities from the Sea without threatening the Earth's fragile eco-system. Mr. Harper's patent-pending technology allows him to grow massive quantities of this wild plankton blend in his eight one million litre tanks, and returning the original amounts of plankton nutrients back to the ocean within a five to 12-day period. Therefore the ocean's foundation remains balanced.

Mr. Harper tried it on himself as an experiment because he had been diagnosed with a rare and untreatable illness that would cut his life short within the next year. He started eating about 75 mg of the phytoplankton per day and noticed positive shifts in his overall physical/emotional state within a short time. While he cannot legally claim that the phytoplankton is responsible for the turnaround, he does believe that the benefits from the product helped increase his immune system for a stronger fight. Harper's friends, family and community began requesting personal samples of this new food source, which in turn led to the creation of FrequenSea with Marine Phytoplankton which can now be found through ForeverGreen.

Some consumers are concerned with eating ocean -derived plants and fish due to possible toxins. Each and every batch of Alpha 3 CMP is third-party tested at a licensed facility under the strict guidelines of Health Canada for yeast, mould, bacteria, e-coli, staphylococcus, salmonella, heavy metals and arsenic, and thus far, continue to meet those high standards each and every time.

Now, Mr. Harper can easily produce astonishing amounts of phytoplankton with the ability to expand to meet a global demand within all sectors of the food and ingredient markets. Production is done in outdoor tanks using natural seawater pumped from a depth of 100 meters off the shore of the Sea Farm. Any and all debris is completely filtered out leaving only pristine clear water containing naturally occurring phytoplankton. With natural sunlight, and patent-pending techniques, the farm recreates the spring bloom conditions, producing billions of tiny floras within the massive tanks in only five to 11 days.

Pristine Waters of British Columbia

Although National Geographic is unaware of Tom Harper's technology and the Sea Farm, we were delighted to see an article in the August 2006 issue celebrating the rich and diverse sea life that owes its abundance and diversity to the extraordinary and nutrient-rich marine phytoplankton that ONLY grows along the Eastern coast of Vancouver Island. Not surprisingly, that is the same wild phytoplankton being grown and harvested for ForeverGreen! These particular species of phytoplankton depend on very specific conditions to flourish and sustain life. This particular region of the world is abundant with rainforests, rivers flowing from the coastal and Rocky Mountain ranges, extreme currents, and varied levels of sunlight. These nutrients are making their way into the Straight of Georgia from the excess rain run-off of rainforest floors and rivers, providing the perfect balance of minerals to feed the phytoplankton. Should many of these species float to other regions without these nutrients and aquatic environment, they will eventually die. There is only ONE other area in the world where these blends of phytoplankton flourish other than in nature: Tom Harper's Sea Farm!

"The tides carry and mix nutrients from immense deepwater up-wellings at both the Northern and Southern entrances. What makes this an exceptional cauldron of life is the way ocean tides interact with fresh water...

This creates a vacuum of sorts that draws even more deep ocean water and more nutrients into the Straights"

There is no other region in the world with an ecosystem such as this that supports the growth of this diverse, pristine array of Phytoplankton species.

Excerpt from National Geographic Magazine August 2006

All phytoplankton products are the same...aren't they?



Due to the enormous success of Alpha 3 CMP over the past three years, other plankton products are making their way into the market. Many consumers believe that all phytoplankton products are grown and created equally, when in fact this is far from the truth. Alpha 3 CMP Marine Phytoplankton is the only product that contains WILD BLENDS of hundreds of plankton species, and whose silica cell wall has been naturally and gently ruptured without the us of any heat, freezing, or chemicals to allow the essence of the phytoplankton to become bio-available for human consumption.

Many other products on the market contain single strains of phytoplankton that are grown in a completely denatured, unnatural laboratory environment using bio-reactors and synthetic seawater, and then put into capsule or liquid form whole with the silica shell still in tact. That means that very little, if the body will absorb any, of the nutrients. Human beings, unlike animals, are lacking the digestive enzymes in their stomachs to break down the silica cell wall of phytoplankton and benefit from any potential nutrients inside. Therefore, you will find most plankton products blended with seaweeds and other greens to yield possible nutritional benefits for humans.

The wild plankton blends in Alpha 3 CMP are so incredibly concentrated and potent that only 75mg per day is needed per day, providing your cells with the astonishing essence of millions of cells in every serving!

The difference.

Open Cell vs. Closed Cell

Phytoplankton have a silica shell. Unlike sheep, cows, horses, and marine life, human beings do not have the digestive enzymes that allow us to break down silica to access the nutrients inside. Unless the cell wall of the phytoplankton is ruptured, we cannot benefit fully from the nutrients locked inside of these microscopic plants. Mr. Harper's technology involves gently rupturing the cell walls of each species of phytoplankton without the use of HEAT, FREEZING or CHEMICALS, while keeping the nutrient levels in tact. His technology allows for 100% bioavailability for our human cells. Upon contacting other companies promoting their blends of Plankton, we have yet to find one that offers OPEN CELL options. The general public does not understand the differences of open and closed cell phytoplankton, and many companies depend on this lack of knowledge to maintain sales. Even though many companies boast that they offer more per serving...is *More* really "*More*" if we can't absorb it in the closed cell form?

• WILD Phytoplankton vs. Laboratory Grown Phytoplankton

Mr. Harper's technology offers the ONLY source of these WILD blends of marine phytoplankton grown outdoors from NATURAL seawater (free of contaminants) and utilizing ONLY NATURAL SUNLIGHT as Mother Nature always has. Other products offer single species of closed cell plankton, grown using a de-natured laboratory environment employing bioreactors, artificial seawater and artificial sunlight. These particular laboratory-grown single species have been traditionally used to feed small finfish, and upon questioning other companies, they could not offer ANY human clinical trials pertaining to their SPECIFIC plankton species before or after their launch into the human markets.

Full Disclosure of Geographical Location and Use In The Industry

The Sea Farm not only provides full disclosure of our unique location for species identification, but also offers guided tours to the public. Upon questioning other companies about their

particular "Phytoplankton" products, or origin of species, they claim is safe and efficacious for human consumption, many were unwilling or unable to properly or scientifically identify species, name origins, or identify direct human benefit based on THEIR "proprietary blend" species. Instead, inquiries were met with diversions such as being told they are "Proprietary blends", "secret sources" etc. Why is that? Perhaps there is a reason they wish to keep the species, growing methods and LACK of human clinical trials a secret?

<u>ECO FRIENDLY..."Zero Carbon Footprint"</u>

The Sea farm GIVES BACK to *Mother Nature*. We provide huge amounts of Natural Carbon offsets and gives three to five times more of the Phytoplankton nutrients back out to the ocean. Full double blind HUMAN clinical trials: Alpha 3 CMP Phytoplankton is presently the subject of ongoing clinical studies at the University of Utah and other accredited facilities. To date, our first human study shows the increase of the CD3 complex. The studies indicate that in fact, the wild blends of marine phytoplankton actually help to increase the human immune system. Not only that, there are also indicators that there are psychological benefits as well.

A scientific breakthrough at a cellular level.

Since the distributors of the Alpha 3 CMP ingredient and ForeverGreen continue to be flooded with emails, letters and phone calls from people who have found new positive shifts with their health and wellbeing after consuming the product with Alpha 3 CMP for a period of time, many people started asking the question "why are these changes taking place?"

This prompted Dr. Glen Richardson, PhD, from the Department of Health Promotion and Education at the University of Utah to begin a double blind study at the University of Utah that has phenomenal primary results.

"We heard enough anecdotal evidence to prompt the University of Utah to accept the challenge to do a double blind study of the Alpha 3CMP," said Dr. Glen Richardson. "With the results we achieved such as increased CD3 complex cells (the immune booster cells in the body), an indicator of the presence of T-Lymphocytes, we could see definitive health benefits from this whole food."

Although Alpha 3 CMP has now been proven to help build and strengthen the immune system, the double blind study also revealed a positive "psycho-spiritual" effect. "The emotional items that showed significance were favourable responses to inquiries about how they felt in the previous four weeks," writes Dr. Richardson in an excerpt from his initial pilot study. Some examples are shown below:

- a. Feeling full of life
- b. Feeling lots of energy
- c. Feeling calm and peaceful

Dr. Richardson, along with group of graduate students who are supervised by PhD faculty members, will be commencing a new study that will measure the A1C levels in Type 2 diabetic professionals in a hospital. "As a population, we've become addicted to high energy fast foods," said Richardson. "We need to find a way to control this growing problem before it gets out of hand completely."

Here is the exciting component to the CD3 complex cell study. The fact that the University of Utah does not endorse Alpha 3 CMP makes the findings all the more significant. Dr. Richardson and his colleagues are simply testing for scientific evidence. The results they have found explain why such a vast and varied amount of positive feedback is coming in from consumers.

Alpha 3 CMP is the <u>only</u> phytoplankton available with these human studies, with these proven results, and it is important to understand that these results are not found with any other Phytoplankton products not containing Alpha 3 CMP to-date. Beware of imitations!

If it's good for Earth, it's good for you!

As mentioned above, the production of Alpha 3 CMP also offers the planet a "zero carbon footprint". Most products, even agricultural, leave a carbon footprint, whether it's methane gas from a herd of cows, or the cost to bring woodchips to a facility to make bio-fuels.

Alpha 3 CMP marine phytoplankton is grown in a facility in Canada on the pristine shores of Pacific Northwest and has only one by-product: oxygen. The tanks of blooming plankton consume massive amounts of CO2 out of the atmosphere: running eight tanks will fix approximately 1 ton of CO2 <u>everyday</u>!

Alpha 3 CMP...good for Earth, and good for your cellular system!



Pictured here; Arial view of Unique Sea farms with 5 tanks in full "bloom" with Wild species of Phytoplankton

Forevergreen

THE TRUTH ABOUT MARINE PHYTOPLANKTON

Jacques Cousteau once said, "The future of nutrition is found in the oceans." What did he mean? How could the nutrients found in the ocean possibly be more beneficial than those found on land? To better understand the value of marine nutrients, we first must understand a few key principals about marine phytoplankton.

For the first part of this discussion, an understanding of a few terms will help simplify what is an intricate process. For years scientists have studied various forms of ocean nutrients using terminology that to them is somewhat interchangeable; however, as these nutrients have found their way to our shelves companies have continued to use certain terms as though they were still in the lab.

Below is a list of common terms followed by a brief summary of how access to the nutrition from the ocean can greatly enhance our health and well being.

Definition of essential terms:

<u>Biome</u>: A **biome** is a major group of distinctive plant and animal communities. A biome is made up of ecosystems. There are two fundamental classifications of biomes:

- 1. Terrestrial (land) biomes and
- 2. Aquatic (water) biomes

<u>Aquatic biomes</u>: The organisms responsible for primary production in all aquatic ecosystems are known as "phytoplankton." These miraculous microscopic organisms not only form the base of life in our oceans, but also produce up to 90% of the oxygen in our atmosphere.

Notice we did not use the term "plankton" or "algae". This is where an interchanging of terms usually creates confusion among many consumers. "Algae" is one of the most misused terms in the consumer markets partly because in science, the term "algae" can refer to any plant in a wet environment without true roots or leaves. With such a broad definition as "wet environment" distinctions between marine, freshwater or even land based algal growths are often misrepresented. Often the terms "microalgae" and "macroalgae" are used in an attempt to distinguish between microscopic organisms such as phytoplankton and larger organisms such as seaweed or kelp. Although these terms have helped, much confusion still exists.

A good rule of thumb states that all phytoplankton are classified as microalgae, but not all microalgae occur in phytoplankton. As you will read below, there are roughly a dozen different classes of phytoplankton. Just as "algae" has a broad definition, so does phytoplankton. Among the various classes of phytoplankton you find marine, freshwater and terrestrial based species. So, just because someone labels a product microalgae or phytoplankton the reality of what they are using is usually different.

<u>Algae</u>: **Algae** (singular *alga*) encompass any aquatic organisms capable of photosynthesis. Algae range from single-cell organisms to multicellular organisms, some with fairly complex form and (if marine) called seaweeds. All lack leaves, roots, flowers, seeds and other organ structures that

characterize higher land based plants. The US Algal Collection is represented by almost 300,000 specimens. Most common forms of algae are known as:

<u>Green Algae:</u> Only about 10% of green algae are marine species, most live in freshwater. Green algae are more closely related to the green land plants than any other group of algae. They have the same photosynthetic system as land based plants. There are more species of green algae found in warm tropical oceans than in cooler temperate seas. The structure of green algae ranges from single-celled forms to multi-cellular sheets. The most common green alga is *Chlorella*.

<u>Red Algae:</u> The red algae are a large group, about 5000 - 6000 species of mostly multicellular, marine algae, including many notable commercial seaweeds.

<u>Blue-Green Algae:</u> **Cyanobacteria** (Greek: *kyanós* = blue + bacterium) is a division of Bacteria that obtain their energy through photosynthesis. They are often still referred to as blue-green algae, although they are in fact more like bacteria. The most common commercial blue-green alga is *Spirulina*.

<u>Yellow-Green Algae:</u> Yellow-green algae generally live in freshwater, but some are found in marine and soil habitats. They vary from single-celled organisms to simple colonial forms. Unlike other algae, their chloroplasts do not contain fucoxanthin, which accounts for their lighter color. Several species have shown to provide a very poor food source for immediate consumers because they were readily ingested but were very poorly digested.

<u>Brown Algae:</u> Brown algae are a large group of mostly marine multicellular algae, including many seaweeds of colder Northern Hemisphere waters. They play an important role in marine environments both as food, and for the habitats they can form. Worldwide there are about 1500 - 2000 brown seaweed species. Most brown algae contain the pigment fucoxanthin, which is responsible for the distinctive greenish-brown color that gives them their name.

<u>Sea Vegetables</u>: Sea vegetables are marine macroalgae, more commonly known as seaweeds. Macroalgae differ from microalgae primarily by their larger size, which is chiefly a function of a more complex cellular organization. These algae comprise three Classes – Brown (Phaeophyta), Red (Rhodophyta), and Green (Chlorophyta) based on their pigment composition. The general public is probably most familiar with kelps and other brown seaweeds that can form extensive forests along the coastline.

<u>Plankton</u>: The name **plankton** is derived from the Greek word "planktos", meaning "wanderer" or "drifter". While some forms of plankton are capable of independent movement and can swim up to several hundred meters in a single day, their position is primarily determined by currents in the body of water they inhabit. By definition, organisms classified as "plankton" are unable to resist ocean currents. Plankton is primarily divided into broad functional groups:

1. Phytoplankton 2. Zooplankton

This scheme divides the plankton community into broad producer and consumer groups.

<u>Phytoplankton</u>: The name comes from the Greek terms, *phyton* or "plant" and *planktos*, meaning "wanderer" or "drifter". Phytoplankton is microscopic plants that live in the ocean, freshwater and other terrestrial based water systems. There are many species of phytoplankton, each of which has a characteristic shape, size and function. Marine species of phytoplankton grow abundantly in oceans around the world and are the foundation of the marine food chain. Marine Phytoplankton is the producing (autotrophic) component in the ocean.

There are fourteen classes of phytoplankton. Each class of phytoplankton contains unique attributes in size, cell structure, nutrients and function. The following is a list of the classes with a brief description:

Classes of Phytoplankton

Bacillariophyceae (diatoms) – 100.000 species in 250 genera, passive floating, silicon cell walls, chain-forming **Chlorophyceae** (green algae) – 2,500 species in 350 genera, self-propelled, green pigmentation Chrysophyceae (chrysomonads) – 1,000 species in 120 genera, self-propelled, golden-brown pigmentation Cryptophyceae (cryptomonads) - 60 species in 20 genera, self-propelled, tear drop shape **Cyanophyceae** (blue-green algae) – predominantly tropical, either filamentous or coccoid, photosynthetic bacteria Dictyophyceae (silicoflagellates) - only a few species, self-propelled, silicon skeleton Dinophyceae (dinoflagellates) – 4,000 species in 550 genera, self-propelled, some species form "red tides" Euglenophyceae (euglenoids) – 800 species in 43 genera, self-propelled, pliable, green pigmentation Eustigmatophyceae (vellow-green algae) - very small, self-propelled, large "eyespot", high pigment concentration **Prasinophyceae** (prasinomonads) – 120 species in 13 genera, self-propelled, heart shape **Prymnesiophyceae** (prymnesiomonads) – 500 species in 50 genera, self-propelled, calcium carbonate scales **Raphidophyceae** (chloromonads) - < 20 species, self-propelled, yellow-brown pigmentation **Rhodophyceae** (red algae) – few microalgal species, usually benthic, red pigmentation Xanthophyceae (yellow-green algae) – 600 species in 90 genera, most are fresh-water or terrestrial

<u>Ecosystem</u>: An ecosystem is a naturally occurring collection of all living organisms in a biome; every plant, insect, aquatic animal, bird, or land species forming a complex web of interdependency. Within an ecosystem an action taken at any level in the food web has a potential domino effect on every other occupant of that system.

<u>Food Chain</u>: A food chain is a linear pathway from one organism to another. There is one organism per level. They usually start with a primary producer and end with a top consumer. Here is an example of a food chain:

$\textbf{phytoplankton} \rightarrow \textbf{copepod} \rightarrow \textbf{fish} \rightarrow \textbf{squid} \rightarrow \textbf{seal} \rightarrow \textbf{orca}$

In this example, phytoplankton—autotrophs by virtue of their ability to photosynthesize—are the base of the food chain. It is always the case that numbers and mass decrease from the base of the chain to the top. In other words, the number and mass of phytoplankton are much greater than the number and mass of copepod's being supported by the phytoplankton. Viewed another way, 90% of the organism's energy source is lost in each level of consumption.

<u>Photosynthesis</u>: Photosynthesis (photo=light, synthesis=putting together), generally, is the creation of energy from light, carbon dioxide and water, with oxygen as a waste product. It is arguably the most important process known; nearly all life depends on it. It is an extremely complex process, comprised of many coordinated biochemical reactions. It occurs in higher plants, algae, some bacteria, and many protists, organisms collectively referred to as photoautotrophs (photo=light, auto=self, trophe=nutrition).

<u>Primary Producers:</u> All life on earth is directly or indirectly reliant on primary production. Primary production is the production of organic compounds from atmospheric or aquatic carbon dioxide, principally through the process of photosynthesis. The organisms responsible for primary production are known as primary producers or autotrophs (auto=self, trophe=nutrition), and form the base of the food chain. In terrestrial biomes, these organisms are mainly plants, while in aquatic biomes phytoplankton are primarily responsible.

<u>Consumer</u>: A consumer is an organism that is incapable of making its own food from light or inorganic compounds, and feeds on organisms or the remains of other organisms to get the energy necessary for survival. A consumer is known as a heterotroph (heterone = (an)other and trophe = nutrition) in the food chain. All animals as well as humans are consumers (heterotrophic) and therefore must obtain their nutrition from another consumer (heterotroph) or a producer (autotroph).

SUMMARY

Eating closer to the base of the food web (primary producers), transfers more energy and nutrients to you. As we learned in our definitions, there are at least fourteen classes of phytoplankton. Some of the classes are commonly found in marine environments while others are freshwater based or terrestrial based. We also learned that a general classification of microalgae does not necessarily mean the same as phytoplankton; while all phytoplankton are microalgae, not all microalgae occur in phytoplankton.

The base of all marine food chains is marine phytoplankton. Diatoms (Bacillariophyceae) are especially important, as they are estimated to contribute up to 45% of the total oceanic primary production (Mann, D.G. 1999, The species concept in diatoms, Phycologia 38, 437-495). Many of the over 100,000 diatom species flourish in temperate ocean conditions, but generally three diatoms prevail – Skeletonema, Thalassiosira, and Chaetoceros. These prevailing diatoms utilize the nutrient-rich ocean water and in conjunction with photosynthesis their microscopic cells contain high concentrations of essential nutrients.

Access to these highly concentrated nutrients has been through the natural progression of the food chain. However, for humans a direct link to these nutrients is difficult because of several factors:

Growing: Many species can grow in artificial seawater, though their growth is not usually optimal because some micro-nutrient is missing or even too abundant. Natural seawater, on the other hand, contains a complete suite of buffered elements in suitable proportions forming the best possible base for growing marine phytoplankton. It is common practice in research laboratories to use artificial seawater for experiments. Scientists do this to control the environment when they want to measure the effects of specific parameters they might be studying (e.g., effects of light levels on growth). Controlling the growth environment using photobioreactors (enclosed growth chambers) provides limitations of expense and large scale production.

Harvesting: In order to shorten the food chain and allow humans direct access to the base oceanic nutrients found in marine phytoplankton, you need to extract microscopic organisms. Most commercial facilities and research laboratories harvest phytoplankton using centrifugation. Other extraction processes are sometimes used but are not as cost-effective. New facilities and technologies are required to efficiently break the

cellular structures of these microscopic organisms and deliver the highly concentrated nutrients with minimal loss.

Digesting: Many scientific studies have focused on the ability of consumers to not only ingest but digest primary producers. Most marine and freshwater phytoplankton have either a siliceous or cellulose outer membrane. While many products may be ingestible, many microalgae products simply can not be digested by humans. The ability to breakdown cellulose is not possessed by mammals. Typically, this ability is possessed only by certain bacteria which are often the flora on the gut walls of cows and sheep, or by fungi, which in nature are responsible for cycling of nutrients.

The group of phytoplankton known as the diatoms create their cell walls from silicic acid. Relative to the cellulose cell walls produced by other groups, silica cell walls require less energy to generate (approximately 8%), a major saving of overall cell energy (Raven, J. A. (1983). Biol. Rev. 58, 179-207), and an explanation for higher growth rates in diatoms (Furnas, M. J. (1990). J. Plankton Res. 12, 1117-1151). This difference in cellular membrane structure from all other alga forms enhances the importance of the diatom class of marine phytoplankton.

So what does this all mean for the ability to consume at the base of the marine food chain? First, we must realize that because of the over processed state of our foods, the closer we can eat to the primary producers the higher the quality of the nutrients we will receive. Access and digestibility of these tiny microorganisms are key factors in actually providing our systems with these highly potent and effective nutrients.

Second we must understand that "algae" and "phytoplankton" are broadly defined terms encompassing numerous species. Remember, all phytoplankton are classified as microalgae, but not all microalgae are found in phytoplankton. The richest source of primary production in the marine food chain is the marine phytoplankton class known as diatoms. These microscopic organisms account for 45% of the primary production in our oceans.

Third, in order for humans to gain access to the highly effective and potent nutrients, the issue of digestibility is crucial. If we can ingest but not digest, it does not matter how nutritious or how much we consume or systems will be left empty. Algae and phytoplankton with cellulose walls are not digestible by our systems. Unlike most algae and phytoplankton species, diatoms contain a silica cell wall which allows this specie to conserve its energy during growth preserving nutrients for its consumers.

Finally, there is a difference in the growth of any algae or phytoplankton in its natural ocean state verses a freshwater or manmade state. Freshwater and artificial seawater simply do not contain the amount or breadth of nutrients that are found in our oceans. Additionally, strains of algae cultured over many generations potentially suffer from mutations. Contamination in a natural environment can be controlled without robbing consumer of vital natural nutrients and growth patterns. The marine food chain has thrived for millions of years without bioreactors and manipulated growing processes.

Below we have listed some of the products that claim to use marine phytoplankton. Upon careful review you can see how some of the common misconceptions and misuses of terms lead to confusion.

COMPARISON OF PHYTOPLANKTON AND ALGAE PRODUCTS

Spirulina is blue-green algae and therefore is actually classified as Cyanobacteria. It is a simple, one-celled form of algae that grows in warm freshwater environments. Even though *Spirulina* is distantly related to the kelp algae, it is not a sea plant. The freshwater ponds and lakes it favors are notably more alkaline than ordinary lakes and cannot sustain any other forms of microorganisms. Spirulina is much like terrestrial plants except that it does not have a cellulose cell wall.

Chlorella is a form of unicellular green algae found in still, freshwater; soil, or bark of trees. Chlorella has a strong cell wall that prevents its native form from being adequately broken down and absorbed by the human digestive system and so special processing is required to break its cell wall.

Kelp are large macroalgae (seaweeds), belonging to the brown algae. Despite their appearance they are not grouped with the normal aquatic or land plants. Kelp grows in underwater forests (kelp forests) in clear, shallow, oceans, requiring water below about 20 °C; it offers a protection to some sea creatures, or food for others. Of the more common algae products currently on the market Kelp is correctly classified as a marine algae.

Alpha 3 CMP[™] (Condensed Marine Phytoplankton) is a unique nutrient-rich blend of marine phytoplankton harvested from the pristine temperate coastal waters of the Pacific Northwest. What makes these temperate waters an exceptional cauldron of life is the way in which ocean tides interact with fresh water, creating turbulence that draws even more deep water nutrients and supporting a diverse array of marine phytoplankton species. <u>National Geographic</u>, (Aug. 2006). The proprietary patent pending process harvests natural seawater, capturing the marine phytoplankton in million-liter tanks. This is the only known product to take natural marine phytoplankton communities containing a complete suite of marine trace elements in proportion to those found naturally in human tissue. Throughout this unique growing and harvesting process, quality control and testing is employed to ensure the highest quality product, providing assurance that no pathogens, toxins, heavy metals or contamination has occurred to the natural marine phytoplankton. The concentrated paste contains a variety of over 200 species (primarily from the larger, nutrient-rich Bacillariophyceae classification commonly known as diatoms). Through the harvesting process the Company's patent pending proprietary technology breaks down the cellular walls, separating the silicate walls and releasing the nutrients that are otherwise encapsulated. This process, unlike any other known to man today, makes the nutrients immediately bioavailable. The raw paste at this point contains approximately 85% water. It next goes to a state-of-the-art phytopharmaceutical production facility, licensed and certified GMP (Good Manufacturing Processes) by Health Canada, where it is further concentrated, passing through the highest standard quality assurance procedures (sanitized and stabilized) to certify Alpha 3 CMPTM safe for human consumption.

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Health Indicators of Alpha 3 Marine Phytoplankton Use Among Apparently Healthy Individuals: A Pilot Study

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Abstract:

A randomized placebo-control pilot study was conducted with 41 volunteers (26 females, 15 males; ages between 20 and 58, non-inclusive) in order to determine the effects of taking either a liquid or capsule marine phytoplankton food supplement on blood, body, and psychological measurements over a 90 day period. According to the One Way RMANOVA results, all the body measurements were statistically similar across both groups, but the %CD3 blood measurement in the phytoplankton group was significantly higher (F(1,31) = 22.86, p < .01), as well as the emotional wellbeing sub-scale of the SF36 psychometric (F(1,29) = 4.04, p = .05). Additional paired *t*-tests were performed to compare the values within each group across measurement sessions and revealed that the phytoplankton group's blood measurements changed. These findings seem to indicate that the consumption of a marine phytoplankton food supplement may explain some physiologic changes and have impacted both the immune system as well as the self-reported emotional state of the participants.

Note: The University of Utah does not endorse this product but are only reporting the results of this pilot study.

Introduction:

When Willis J. Abbot wrote: "There,' he said, 'is a green pasture where our children's grandchildren will go for bread.", he was referring to the whaling industry of Nantucket (Abbot, 1902). Today, instead of directly targeting whales for our sustenance, we are investigating whale food, i.e. marine phytoplankton as a source of human nutrition. Phytoplankton forms the base of the marine food web (Johnston et al., 1989). It is primarily consumed by zooplankton, which is then consumed by ever larger predators, until it is, in many cases ultimately consumed by humans. In short, we indirectly eat phytoplankton when we eat fish in the same way that we indirectly eat vegetables when we eat meat. The question of whether or not "there is a shortcut possible in the nutritional pyramid, i.e., whether plankton can be utilized directly for feeding of man" was posed by Geiger in 1958. Currently this question has been refined to ask if there are any health benefits to be realized by direct consumption of this "bread" from the "green pasture" of the sea. Perhaps supplementing the human diet with phytoplankton would be complimentary to health as suggested by Kay (1991).

The term "marine phytoplankton" actually describes hundreds of species of photosynthetic, unicellular organisms which live near the surface of the ocean; perhaps the best known of which is algae. A food supplement produced by Marine Life Sciences, Alpha 3 CMP™ (Condensed Marine Phytoplankton) contains over 200 species of marine phytoplankton, which in aggregate constitutes a nutritious "whole food" in that it is both unprocessed and naturally occurs as the foundation of the marine food-web. Although there is ample anecdote about the health benefits of this supplement which has been provided by consumers, to date it has not been systematically studied.

Other micro-algae and cyanobacteria have been shown with some frequency to have beneficial health effects; two organisms in particular are Spirulina (cyanobacteria) and Chlorella (green algae). Both have been shown to have impact on such serious conditions as AIDS (Gustafson et al, 1989), immune function (Khan et al, 2005), Diabetes (Parikh, 2001, Yamagishi et al, 2005), Cancer (Mishima et al, 1998, Mathew et al, 1995), Malnutrition (Simpore et al, 2006), allergic-rhinitis (Mao et al, 2005), and general health (Kay, 1991). The review titled "Microalgae as Food and Supplement" (Kay, 1991) further describes a variety of studies conducted on microalgae, and recommends, "More research into the probiotic characteristics is greatly needed. We may find that the most beneficial aspects of consuming microalgae are not due to nutrients that we are familiar with, but to compounds that we have only begun to investigate." For this reason, there appears to be sufficient justification in endeavoring to discover whether the consumption of the MLS phytoplankton food supplement provides measurable physical and/or psychological health benefits.

Methods:

The design employed a mixed-methods sequential explanatory approach combining quantitative and qualitative methods (Ivankova et al, 2006) in order to robustly answer the research questions in two phases. First, quantitative data were collected to determine if (and where) there was a relationship between phytoplankton supplement consumption and physiological, somatic, and/or psychological health measures. This was investigated using blood tests, physical, and psychological measurements in a double blind, randomized control/treatment/placebo group time series design (Phase One). Second, qualitative data were collected via private Instant Messaging (IM) session interviews allowing participants to articulate their thoughts and feelings about any changes they experienced during the experiment which they associated with the consumption of the phytoplankton supplement. (Phase Two).

Phase One:

There were two types of measurement sessions during this phase of the experiment: clinical + psychometric and psychometric only. On clinical + psychometric measurement days, participants were asked to submit to blood, somatic, and psychometric assessment. During the psychometric only sessions, participants were asked to complete questionnaires about their current psychological state. All test results were only identifiable by ID number until the end of the experiment. The somatic data collected included body measurements such as weight, percent body fat, blood pressure, etc. The blood data collection required subjects to travel to an ARUP Outpatient Collection Facility (i.e. University Hospital, Madsen Health Center, or ARUP Labs) and permit a single withdrawal of 26 ml of blood taken in 6 separate vials (one for each specific blood test, i.e. 4 x 4ml and 2 x 5ml) by a professionally trained ARUP phlebotomist. Table 1 describes the blood and somatic measurements that were taken on all subjects, with the notable exceptions being that only females were screened for pregnancy and only males had their Prostate Specific Antigen levels measured.

Attribute	Test	Туре	Description/Reference
Blood Lipids	0020421: Lipid Panel, CRISK	Clinical	Measures blood lipids related to cholesterol (29)
c-reactive protein	0050180: C- Reactive Protein, CRP	Clinical	Measures amount of protein in blood signaling acute inflammation (30)
insulin levels	0070107: Insulin, Random, INSULIN R	Clinical	Measures body sensitivity to insulin for evaluation of hypoglycemia (31)
immune system markers	0095950: Lymphocyte Subset Panel 4 - T-Cell Subsets Percent & Absolute, TSHORT	Clinical	Measures Lymphocyte counts to identify immunodeficiency (32)
glucose control	0080453: Hemoglobin A _{1C} , GLYHGB	Clinical	Measures glycosylated hemoglobin in blood for estimating diabetes control (33)

Table 1.

pregnancy	0020063 BHCG-	Clinical	Pregnancy screening blood test for identifying pregnant participants
3010011	0		
Prostate test	0070121 PSA	Clinical	Measures Prostate-Specific Antigen in blood
blood	Sphygmo-	Somatic	Force exerted on blood vessel walls and elevated
pressure	manometery		levels are associated with morbidity and mortality.
body weight	Scale	Somatic	Using a single scale calibrated for laboratory use.
body fat	Skin-fold	Somatic	Using laboratory skin-fold calipers and a single
percentage	thickness		measurer.
hip-waist ratio	Dimensions (girth)	Somatic	Using a flexible tape measure and a single
	(girtir)		medsurer.
resting heart	Timed Palpation	Somatic	30 second resting pulse as determined by a single
rate			measurer.
Beck	Beck Depression	Psychometric	A widely used 21 item self-report inventory of
Depression	Scale 2		symptoms of depression in clinical and non-clinical
Ocale			
SF-36	SF-36	Psychometric	A 36 item generic measure short-form health survey
			for comparing populations regarding disease burden
			(23)
Spirituality	Spirituality Scale	Psychometric	A ?? item measure of beliefs, intuitions, and lifestyle
			choices representative of human spirituality (36)
Happiness	Authentic	Psychometric	Measures overall happiness with 24 items taken
	Happiness		online (34)
	inventory		
Happiness	Psychological	Psychometric	A short 6 item form of the Depression-Happiness
			Scale (20)
	1	1	

*For the clinical, somatic, or psychometric measurements, it is important to remember that participants were allowed to decline participation in any single measurement or to withdraw from the study at any time without penalty per IRB regulations.

Experimental Agenda:

After participants were recruited and provided their informed consent, they were randomly assigned to one of four groups (capsule or liquid phytoplankton experimental groups, and two control groups: placebo and no-treatment). Following group assignment, participants completed the clinical and psychometric measurements scheduled for Day 1, and the non-control

participants were provided with supplies of supplements (or placebos) and instructed about their proper use during the experiment. When participants had ready email access, a daily automated reminder was sent to prompt their compliance with the recommended daily servings of the supplement, as well as periodic "test reminders" to encourage participants to arrange their schedules to accommodate the experimental measurements. The planned measurement schedule appears below in Table 2, with the final test marking the beginning of the qualitative portion of the experiment, Phase Two.

Treatment Groups	Day 1	Ind.	Day	Ind.	Day	Ind.	Day	Ind.	Day
		Var.	14	Var.	30	Var.	60	Var.	90
Liquid Phytoplankton	T1	PL	T2	PL	Т3	PL	T4	PL	T5
	CS1				CS2				CS3
Capsule	T1	PC	T2	PC	Т3	PC	T4	PC	T5
Phytopiankton	CS1				CS2				CS3
Placebo	T1	CP	T2	CP	Т3	CP	T4	CP	T5
	CS1				CS2				CS3
Control Group	T1		T2		Т3		T4		T5
	CS1				CS2				CS3

T= Times that the subjects will be tested with psychometric instruments.

CS= Times that the subjects will be tested with clinical/somatic measures.

PL= Subjects take Liquid Phytoplankton as per recommended servings

PC= Subjects take Phytoplankton Capsules as per recommended servings.

CP= Subjects take a placebo

Phase Two:

In this portion of the study, the participants completed online interviews intended to discover the details of any experienced changes that they associated with the consumption of the phytoplankton supplement. The three questions that constituted the basis of the interviews were:

- 1. During the experiment, how did you generally feel (e.g. energy or mood)?
- 2. What has changed (e.g. sleep, allergy, skin, bowel movements, hunger, pain, cold symptoms, libido, outlook, hair, fatigue, vision, dreams, concentration, wakefulness, balance, or food cravings)?
- 3. Do you plan to continue to take the supplement after the experiment? (How much did you actually take and when did you take it)?

The interviews were conducted using any of a number of IM applications (MSN Messenger, Google Chat, or private chat sessions on <u>www.chatzy.com</u>) and automatically transcribed for analysis.

Results:

Data were collected from 47 participants who all met the eligibility criteria to take part in this randomized clinical trial. Of these, 87% (n = 41) completed the project, and of this group, 63% were female and 37% were male. Using a computer algorithm, the participants were assigned randomly into one of four groups; 20% to liquid phytoplankton, 23% to capsule phytoplankton, 26% to placebo, and 31% to control. The collected data were analyzed using the Statistical Package for Social Sciences (SPSS), Windows Version 15.0 (SPSS, 2006). All analyses employed an alpha level of .05 when testing for significance.

In order to address the research questions regarding the progressive impact of taking a phytoplankton supplement on physiological, somatic, and psychological, a One Way Repeated Measures Analysis of Variance (RMANOVA) was conducted using each measured dependent variable for which a complete dataset was collected. These measurements are listed in Table 3 below.

	Psychologica		
Somatic		Physio	logical
Systolic	Beck	cholesterol	Estimated Plasma Glucose
Diastolic	SF-36a-h*	triglycerides	Abs CD4
Heart Rate	Spirit	HDL Cholesterol	%CD4
Weight	AHI*	LDL Calculated	CD4:CD8 Ratio
Bodyfat e	SDHS	VLDL	Abs CD8
TBW%		Non-HDL Cholesterol	%CD8
Skinfold		C-Reactive Protein	Abs CD3

Table 3.

Hips	Random Insulin	%CD3*
Waist	A1C	PSA

*The SF-36 includes 8 subscales.

The RMANOVA tests indicated that there was a significant increase in measurements of the immune function marker %CD3 (F(1,31) = 22.86, p < .01) among subjects in the phytoplankton group, and this is illustrated in Figure 1. Additional significant findings were found for the Emotional Well-being subscale of the SF-36 (F(1,29) = 4.04, p = .05). No other between-group results were found to be significant, although some were nearly so at the .05 alpha level. Figures 2 and 3 both show the general trends of the somatic and psychological data.

Figure 1.











Paired t-tests were conducted to compare the first and middle, as well as the first and last measured values for each variable in order to discover if there were any changes throughout the progression of the experiment. Participants in the control/placebo group did not experience any significant changes on any of the physiologic variables. However, the phytoplankton group was found to have some significantly different blood measurements across time as depicted in Table 4.

Table 4.

		Paired Samples Statistics					sig. (2-
Variable	Times Compared	М	SD	SEM	t	df	tailed)
cholesterol	First to Middle	10.85	15.61	3.49	3.11	19	<.01
non-HDL cholesterol	First to Middle	10.05	17.02	3.81	2.64	19	0.02
absolute CD4	First to Middle	92.3	184.21	41.19	2.24	19	0.04
triglycerides	First to Last	25.63	54.12	12.42	2.06	18	0.05
VLDL	First to Last	5.16	10.97	2.52	2.05	18	0.05

Similarly, significant somatic and psychological measurement changes appear in the following two tables. However, because both the control/placebo and phytoplankton groups experienced changes, Table 5 represents the control/placebo group and Table 6 represents the phytoplankton group. The paired t-tests indicated that both groups experienced a reduction in hip measurement both immediately and ultimately, as well as a slight increase in the Beck Depression Inventory score and a decrease in various subscales of the SF-36.

Tab	le	5.
	•••	•••

		Paired Sa	mples Sta	atistics			sig. (2-
Variable	Times Compared	М	SD	SEM	t	df	tailed)
Hips	First to Middle	-1.17	1.35	0.3	-3.89	19	<.01
SF-36b	First to Middle	-11.25	23.61	5.28	-2.13	19	0.05
SF-36d	First to Middle	-9.23	14.53	3.25	-2.85	19	0.01
SF-36f	First to middle	-10	17.95	4.01	-2.49	19	0.02
SF-36h	First to Middle	-4	6.61	1.48	-2.71	19	0.01
Hips	First to Last	-2.07	2.55	0.59	-3.53	18	<.01
Beck	First to Last	2.75	4.46	1	2.76	19	0.01
SF-36d	First to Last	-10.75	16.49	3.69	-2.92	19	0.01
SF-36e	First to Last	-4.2	7.05	1.57	-2.67	19	0.02
SF-36f	First to Last	-11.25	18.98	4.24	-2.65	19	0.02
SF-36h	First to Last	-5.25	8.19	1.83	-2.87	19	0.01

Table 6.

		Paired Samples Statistics					sig. (2-
Variable	Times Compared	М	SD	SEM	t	df	tailed)
Hips	First to Middle	-1.67	2.7	0.7	-2.39	14	0.03
Beck	First to Middle	3.37	4.76	1.19	2.84	15	0.01
SDHS	First to Middle	-1.5	2.68	0.67	-2.24	15	0.04
Hips	First to Last	-2.95	2.31	0.7	-4.23	10	<.01
Beck*	First to Last	5	4.99	1.33	3.75	13	<.01
SF-36a	First to Last	-5.36	9.09	2.43	-2.21	13	0.05
SF-36d	First to Last	-12.14	13.69	3.66	-3.32	13	0.01
AHI	First to Last	-0.48	0.33	0.15	-3.25	4	0.03
SDHS	First to Last	-2.57	2.5	0.67	-3.84	13	<.01

The qualitative data indicated that in general (69%), participants did not experience a change in mood or energy during the experiment. However, of those participants who actually had the phytoplankton supplement, only 25% reported no changes in mood and energy as opposed to 43% of the participants in the non-phytoplankton groups. This seems to indicate that taking a real phytoplankton supplement increased the likelihood of reporting a change in mood and

energy. Similarly, most of the participants who reported "no changes" during the experiment in relation to the anecdotally reported areas of interest (e.g. sleep, allergy, skin, bowel movements, libido, hunger, pain, cold symptoms, outlook, hair, fatigue, vision, dreams, concentration, wakefulness, balance, and food cravings) were more common from the control and placebo groups.

In general, it seems that for the participants consuming phytoplankton supplements, it was not uncommon to experience some improvement in mood and energy or sleeping patterns. Three participants reported that they were not as sick during the "flu season" and that if they did get sick, they were not as uncomfortable with the symptoms as usual. Of particular interest is that all of these reports came from individuals in the phytoplankton supplement groups, not the control groups. Other benefits that were reported had to do with changes in sleep (including better quality and a reduced need for it), changes in skin softness and appearance, and one report of reduced arthritis pain.

Discussion:

The purpose of this study was to identify and quantify any health benefits that could be gained by taking a marine phytoplankton supplement in either liquid or capsule form. Due to the relatively small sample size and the unequal gender representation among the participants, there are clearly legitimate concerns about the representativeness of the data. Although these concerns may taint the applicability of the results, they do not appear to be sufficient grounds to entirely dismiss the findings or the recommendation that more research is needed.

The initial IRB proposal permitted 80 subjects to enroll in the study, but the project was only able to recruit slightly more than half that number. According to the individuals who declined to participate (in spite of substantial compensation), two aspects of the experimental procedure were particularly unattractive. First, subjects reported that they did not want to give blood. Apparently trypanophobia ("needle-phobia") was a serious obstacle in the acquisition of subjects. Another difficulty had to do with the need for participants to transport themselves to one of 3 ARUP collection centers where the blood could actually be drawn. It was hypothesized that in future experiments, partial cash payments could be made upon completion of each blood collection in order to provide immediate incentive and not only improve recruitment rates, but follow through as well. In one case, a subject did not give a single blood sample; five other subjects (12%) missed one blood measurement during the experiment.

Another concern has to do with the subjects that did enroll. The random assignment to groups ultimately resulted in unequal group sizes because of random attrition and the fact that two subjects were reassigned to the control group from the capsule phytoplankton group. This reassignment was due to complications that the participants believed were associated with the supplement. One reported severe headaches which ceased upon discontinuance of the supplement, and the other reported a recurrence of symptoms that were due to a previous bladder surgery. In both cases, the subjects were reassigned to the control group and there were no further reports of these possible "side-effects".

Problems with recruitment and compliance are not new to research projects, and are notorious for influencing the quality of the results. This pilot has been impacted by a number of these types of issues and therefore the significance of the findings must be interpreted with care. Although the immune system marker %CD3 was highly significant, it was significantly different at all time measurements. Also, many of the investigated variables reflected changes over time, most notably the phytoplankton group's blood test results. These changes were not paralleled in the control/placebo group and may indicate a clinically significant effect from the phytoplankton (see Table 4). This is also true of the somatic and psychological variables (Tables 4 and 5), but the measured impact may contradict the qualitative reports, in that the participants claimed to have more energy and feel healthier even though the quantitative values seem to point to a net decrease in perceived health and energy. Perhaps the difference is that the phytoplankton group experienced *less* of a decrease during the busy holiday season when the experiment was conducted. Future research can be informed by this pilot and may be advised to build in more stringent controls for compliance in addition to more attractive data collection techniques and incentives.

The MLS Marine Phytoplankton product is new to the supplement market and there are no extant publications of it being tested clinically, although there are other research projects in progress. Notable areas of study include the effects of the supplement on diabetic patients, the effects of the supplement on the health and fitness of chickens, the impact of the product on grass as a fertilizer, and its effects in the bovine model. According to the manufacturer, there is no shortage of anecdote to be investigated. However, because the product has not been sufficiently researched, it has yet to be determined how much of this anecdote stands up to scientific scrutiny.

To date there are no published scientific studies on the benefits of eating this (or any) blended marine phytoplankton supplement. Potential benefits from the supplement may come from more balanced nutrition or from some synergy of the constituent nutrients, i.e. some interaction effect due to the natural (fluctuating) composition of the product. There are myriad studies on the benefits of eating the 60+ individual nutrients found in the product. In some ways, the supplement is similar to a naturally occurring "mega-multivitamin" from the sea, where a great variety of requisite nutrients are made easily available to the body. Accordingly, the reasoning behind taking a multivitamin (Barringer et al, 2003) appears to apply nicely to marine phytoplankton supplements.

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