

Plankton, a super food: Originating life and sustaining it.

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Introduction

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, fueling 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 transhydrogenated,) 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? Sea plankton. This is why plankton is so helpful in practically all medical conditions. It is likely the most important super food available to harness solar energy.

LIFE FROM THE OCEANS, PLANKTON, TO SUPPORT LIFE

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, wherefrom all life originated. Scientists at NASA theorize that about 3 ½ 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 superfood 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 rise 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 (Chlorophyta)
- blue-green algae (Cyanophyta)
- dinoflagellates (Pyrrophytophyta)
- cryptomonads (Cryptophyta)
- microflagellates (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 superfoods. Through years of research, the Sea Farms can now grow 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 produced at the 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.)

Planktons 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 ("The intelligent intestine," American J. Clinical Nutrition 2003;78:675.)

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 algae/Spirulina 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 hematopoiesis, 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 End-
products, which are toxic metabolites resulting from consuming refined sugars. Thus, Chlorella may
improve Alzheimer's disease (J. Medical Hypothesis 2005;65:953.)

In conclusion, 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 Costeau said that “the future of nutrition is found in the ocean.”