How to Improve Topsoil

Sea Energy in Agriculture

an almost lost legacy

Dr. Maynard Murray

on trace elements in plant health and animal nutrition

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We are the Whirled

Life on Earth began in the ocean. Of Earth's millions of species, 90% of all life is found in the seas.

Water dissolved minerals from the planet's crystal bedrock, to wash into early Earth's vast ocean. Rain and ice scoured the infant orb's dense granites, gathered in streams and rivers, which all ran together into a sea. Minerals in endless flowing solution accumulated in the ocean over many millennia—concentrated. Gaia's gently gestating belly gradually became seven salty seas.

At evolution's eve, Earth's early ocean was a womb within which were born bacteria—the first living organisms—to begin to build a planetary biosphere. In this saline soup of minerals and amino acids, life learned to condense and crystallize molecular order inside a thin film oil membrane. Biological life appeared and cells were born. Simple, primitive bacteria lived by feeding on energy stored as mineral ions and heat.

The earliest bacteria ate elemental iron, with a strong, dense charge of electrons. Certain cells fixed iron into crystals, which precipitated out of solution. In many millennia, these bacteria removed enough iron to form thick sea floor sediments. In thousands of millennia, these beds hardened into iron-rich rock.

Iron was exhausted in seawater, so new bacteria flourished to feed on calcium and magnesium. Cells began to build tiny crystal capsules. Life learned house each blob of protoplasm in awesome architectures of atomic arrays. Microscopic mineralized structures grew into hard, dense, bony shells. Over millennia, life evolved into complex cellular communities—colonies of coral and crustaceans. In death, they formed fossil beds of limestone.

More minerals removed from Earth's early ocean to store in seafloor sediments becoming bedrock. Endlessly, water washed ever more minerals into the ocean, as ever more salty grew the seas.

Sea in Seasoning

New solar-powered bacteria appeared to capture sunshine with magnesium, and spin photons into carbon rings called *sugar*. Photosynthesis allows life to unlock water's hydrogen energy, and store sunlight dewdrops as carbohydrates. *Cyanobacteri*a, the first bluegreen algae, were first in the Plant Family of Earth's evolutionary path.

More minerals melted into Earth's waters; seas grew saltier. All the while, the new photon-fixing fuel cells breathe in carbon dioxide, breathe out oxygen. Ions, oxygen and carbohydrates accumulated in Gaia's living liquid brew.

New organisms appeared to exploit this energy-rich environment. Breathing oxygen, new cells burned sugar to unleash the stored sunshine. These early evolution innovators were progenitors of the Animal Family: fish, reptile, amphibian, bird, mammal, and man.

Sea salt has all the elements needed for life. Over two billion years, land was worn down by wind and water, and elements washed out to sea. Thus, the sea received the enormous chemical richness and balance that once supported life on land.

So, when we savor the flavor of food, our fundamental seasoning is salt from the sea. The sea is the original source of seasoning. In similar respect for survival wisdom, we call a veteran "seasoned."

Natural sea salt is a faint gray-green, with soft, complex crystal structures.

But today's table salt is only sodium—pure white cubic crystals of chloride.

All other seawater elements are refined—removed and taken out. Gone is the iron. Lost are potassium, calcium and magnesium. And many more minor minerals and trace elements that we can barely measure.

Mid-century Science Bioneer

Dr. Maynard Murray was a pioneer in biology, health and agriculture. His lifelong quest taught him the key to health is a secret in soil, whose source is the sea. A medical scientist, he recognized evidence of an all-encompassing unity for life on Earth. His inspiration came from his study of the ocean.

Along his 45 year journey, Murray was actively engaged with farmers to learn agriculture. Later, he operated a successful hydroponic vegetable farm. His research led him to a key to the cause, treatment and prevention of cancer.

Murray got his B.S. in 1934, an M.D. from University of Cincinnati College of Medicine in 1936. Two postgraduate years in internal medicine, then three-and-a-half in ear, nose and throat surgery. From 1937 to 1947, he taught physiology and directed experiments at Cincinnati College of Medicine, studied law at night school and learned in medical hypnosis.

In 1947, Murray moved to Chicago to begin a 25-year medical career in ear, nose and throat. Experiences with patients aroused his concern for the quality of life. While Americans lived longer, medical practice revealed they weren't living better. Chronic illness and degenerative disease slowly steadily increased.

"A large portion of our lifetime and resources is spent to combat illness and withstand aging," Murray wrote. "Paradoxical that despite the great variety of foods developed to nourish our bodies, we still suffer degenerative diseases, and fall prey to aging long before optimum lifespan is reached."

Pointedly, he wrote, "Americans hold the dubious distinction of being among the sickest of populations in modern society."

Astutely, he added, "A nation with a drug industry flourishing as well as ours certainly cannot claim good health!"

First Clue

"Life in the sea, animal and vegetable, is far healthier than similar life on land. Why?" Murray asks to begin his book.

Murray's passion to answer such questions led him to devote himself to search for solutions. Even with a family and medical practice, Murray was never too busy for field and lab experiments.

As a university student, Murray tried to induce cancer in a toad. He was astonished; the amphibian had natural immunity. He sought answers in ocean animals rather than freshwater and land animals. Time and money was spent traveling to study and dissect sea life from South America to Pribilof Islands.

"A cubic foot of seawater sustains many times more living organisms," he noted, "than an equivalent of soil. Seawater is literally alive, especially if its temperature is warm.

Murray sliced open whales to see an animal that lives in salt water is largely blubber—that fatal fat—yet no sign of arteriosclerosis from clogged arteries. He autopsied dolphins and marine mammals searching for organic degeneration.

And saw little sickness in the sea. In dissecting sea animals, whales and seals, no malignant disease was found. Ocean animals never develop degenerative diseases that plague man. Cancer, arteriosclerosis, diabetes did not exist in sea animals.

"Looking at ocean life, one is immediately impressed that in this 71% of earth's surface, there is no cancer, hardening of arteries, or arthritis. Disease resistance in sea plants and animals differs remarkably from land animals. Ocean trout don't develop cancer, while freshwater trout over five years have liver cancer. It's difficult to find any land species without cancer. All land animals develop arteriosclerosis, yet sea animals are never diagnosed with this."

Murray noted that aging hardly occurs in the sea. Comparing cells from adult versus newborn whales showed no evidence of chemical changes observed in land mammal cells. Some sea denizens seem to never cease growing. Size of land versus sea turtles reveals the tremendous difference.

Seasoning Reasoning

Murray pondered what imparts this apparent immunity to sea animals. Was this a nutritional factor? Was it mineralsr? Or some more complex chemical factor?

Simple reasoning sees that minerals in soil leach out with rain and snow to flow by streams and rivers into oceans. The land's mineral fertility winds up washing into the seas. Minerals lost from land accumulated in the sea for millennia. This logic suggests seawater minerals are key

nutrients responsible for the heath of sea life.

"Seawater is Earth's most ancient natural solution," Murray said, "and, in my opinion, most ideal, physiologically. In the sea, as liquid crystalloid, all Atomic Table elements are in a solution of consistent balance and proportion, available to all sea life.

Murray noticed the elements in seawater are essentially the same as in blood, and very close to the same quantities. This seemed no chance, but a true clue to the role of minerals in health. Might mineral deficiency be a significant cause of degenerative disease? If humans get a full menu of minerals, will our physiologic disorders decline?

How to supply humans these necessary nutrients? Drinking seawater isn't possible. Humans aren't designed to ingest minerals as salts—or rocks, for that matter. Our guts can't assimilate elements in raw, naked, ionic forms. Rather, human intestines need minerals packaged with sugars, amino acids, fats, oils.

The doctor observed. "Biology knows humans and other animals can't obtain elements unless they're hooked to carbon. Plants convert inorganic elements to organic compounds that can be used by animals."

"Table salt is the only food we eat that's inorganic," Murray noted, "and frankly, it isn't good for us."

"ocean Waters hold a perfect balance of essential elements required as food for the complex cell groups that make up our bodies," Murray postulated. "This is my thesis—now for proofs."

Seawater into Soil

As a first step to learning how to supply minerals to humans, Dr. Murray realized we get our minerals mostly from food, secondly in water. He decided to use seawater as a soil amendment, and observe if this provided any benefit. Perhaps if soil is supplied all essential minerals, plants will absorb them as nutrients, and pass them to animals that eat them.

In Murray's first trials, the U.S. Navy supplied seawater from oceans all over the world. Railroad tank cars delivered seawater to Cincinnati, which was sprayed at various controlled rates onto test plots.

In 1940, four 12-foot peach trees 20 feet apart began his experiments. Two trees were designated experimental and, in March, treated with 600 cc. of seawater per square foot, before the buds break. Two controls got no application.

Murray recalled: "May first, all four trees were sprayed with *Curly Leaf* virus. The test lasted three years. Virus spraying took place only the first year. Control trees contracted *Curly Leaf* each year, and finally died. Experimentals retained resistance throughout, and provided normal yields each year."

Turnips were planted the same year, the experimental half fertilized with 600 cc. of seawater per sq. foot of soil. *Staphylococcus* bacteria associated with "center rot" was mixed in soil of the entire plot. When turnips sprouted and leaves appeared, [they] were sprayed with the bacteria. All experimentals grew normal, healthy, no evidence of center rot. Controls contracted center rot and died.

This sort of result occurred with every crop Murray tested. Tolerance tests indicated the sea can be recycled back to the land.

Seawater is cheap. But water is heavy, so seawater is costly to transport. Nearly all the cost is shipping.

Sea Solids

All the solids in one railroad tank car of seawater hardly fill a steel drum. By weight, 3.5% of seawater is solids. Chemical analysis shows all the elements in the Atomic Table, with possible exception of some gases.

So Murray began using *sea solids*: salts and other chemicals left after water is removed from seawater. Removing the water made transport economical, and solids were easier to apply to soils.

He wrote, "We looked worldwide for natural locations where seawater becomes landlocked, and total evaporation takes place. The largest deposits were in Mexico, with others in South America and Africa. This complete spectrum of elements from the sea we designated *sea solids*."

In over 20 years, Dr. Murray tested sea solids on various crops in seven states and different climates. Experiments indicated land plants tolerate 400 to 1000 cc. of seawater to 1/3 cubic foot of soil. Sea solids were administered to soil at 500 to as much as 3000 lbs. per acre. Excepting serious rainwater runoff, one application would last five years.

He recorded, "We began using sea solids to grow large quantities of cereal grains to feed animals. Sea solids were applied at 1000 to 2,200 pounds per acre to half the fields. Controls received only customary fertilizer."

Corn, wheat, oats, barley, hay, fruit trees, vegetable crops, and other plants were raised on seawater, or sea solids. Fields were planted so an experimental plot using sea solids was by a control plot using the best commercial method. Sea solids-fertilized crops grew faster, healthier and produced far greater growth. Resulting color, disease resistance, taste, and yield were outstanding.

According to Murray: "At harvest, corn smut, rust, and other cereal diseases were significantly reduced in experimental fields. Disease resistance had been fixed in plants by this complete elemental diet. The next step was to see if the resistance could be transferred from plants to

animals."

Animals, wild and domestic, had no trouble determining which was better to eat. A walk through a field showed a glimpse of animal heaven. Rabbits and mice scurried everywhere, yet a control area with standard fertilizers was almost lifeless.

In 50's, Murray began assaying crops for nutrients. Consistently, sea solids grown foods had significantly more minerals (ash content), vitamins (+25% C in tomatoes, +40% A in carrots), and sugars. So sea solid grown food is tastier, and more nourishing.

Principle of Proportion

"From the start," Murray recorded, "my sea solids experiments produced excellent results. It conclusively proves the proportions of trace minerals and elements present in sea water are optimum for growth and health of both land and sea life."

Growers quickly criticize Murray, insisting salt will kill plants as quick as any pesticide or poison. True, if it's table salt. However, the doctor found if sodium is blended with all the other elements in the same ratios as in seawater, plants aren't injured, but thrive.

Wrote Murray, "Sodium chloride, the major component of seawater, is normally toxic to plants. However, my method prevents salinity from affecting plants' root structure.

"The scientific community knows excess table salt—four or five teaspoons—ingested at one time is lethal to human life. Salt was a recognized method of suicide practiced by Chinese in ancient times.

"Present with other elements in seawater, sodium and chlorine aren't toxic to plants. Actually may be necessary for absorption of heavier elements. It's known that saline solution picks up a greater quantity and variety of elements than ordinary water."

DR. Murray LEARNed a key principle: each essential element must be present in certain precise proportions relative to the others.

"Tomatoes serve as example of this need for balance. Tomato growers know potassium has a major function in plant growth. Potassium is added to soil in quantity by growers. Yet the tomato itself has only a minor amount of potassium.

"My experiments proved conclusively a small amount of potassium, as in its proper balance in seawater, grows unusually healthy, outstanding tomatoes. It's unnecessary to fertilize heavily with one element if an adequate balance of elements is available."

To evaluate qualitative effects, the total amount of minerals is less critical than proper ratios among them. Individually, one mineral in excess can be toxic, and make other elements seem in deficit. Blended in balance with all the elements in seawater, they enhance and enliven each other.

Trace Elements: Least as Most

In Murray's time, trace element knowledge was minimal—a new area of knowledge. He cited medical journals on the dramatic ten year change of interest by the scientific community in trace elements and health. One article stated "only a dozen trace element laboratories existed in the U.S. in 1966. Now [1976] over fifty in the U.S. are devoted to trace elements. Research of their role in physiology is also underway in Europe, Soviet Union, Egypt, Iran, and Australia."

Only twenty elements were known to have a specific role in human physiology. Several more were known to benefiT plants and animals. Heavy metals were suspected of positive roles. Even poisonous elements (eg, arsenic) were beneficial if ingested in organic form, and in trace amount.

Specialists agreed more trace elements await discovery as essential for animals and man. Yet, only nine trace elements were listed in "Recommended Dietary Allowances," and few enzymes had their trace elements identified. Yet, thousands of enzymes were identified. Undoubtedly, many more enzyme-trace element functions remain to be described.

So, while Murray could write little on trace elements, he grasped how the least can exert the most influence. An element needed in micrograms or less can have dramatic biologic effects by activating enzymes and hormones. The doctor knew we need all the elements available, not a few in excess amounts.

Seaponics

Rain falling on sea salts drying in open air beds dissolves heavier metals and trace elements first. Minerals that go in solution quickest wash away faster than light minerals. After a few rainwater washings, sea salt has far more sodium, far fewer trace elements.

Murray searched for sources of sea sediments that were subject to minimal rainfall and leaching. Southwest Africa, Arabia, Baja California, and northern Chile are all arid areas where rain is rare. Here, ocean waters swell up at high tides into beachside lagoons. These pools dry out, leaving behind the minerals.

These unwashed sediments worked best in Murray's soil experiments. Murray believed these desert deposits retained all of seawater's original elements in nearly the same ratios.

Murray realized farmland is a limited resource. Some areas of Earth are losing farmland as our food production base shrinks. He came to

believe hydroponics is humanity's best bet to expand food production, and began experiments with seas solids in hydroponics. This also gave him better control over plants' diets.

Murray started hydroponics in his cellar to supply his family year round fresh produce. Later, his research collaborated with commercial scale growers. In 1958, he bought a Florida farm and became a commercial grower, with 178 beds, each 100x4 feet.

About 112 pounds of dried, natural sea solids were dissolved in up to 10,000 gallons of water. The only fertilizer experimental crops received was this sea solids solution, and sometimes nitrogen, which bathed their roots a few times each day.

In a typical test, tomatoes were planted a foot apart in 100x3 foot hydroponic beds. Nutrient solution flooded the beds, was drawn out and returned to a tank three times a day. Experimental beds received 112-pounds of sea solids to 5000 gallons of water; controls got conventional hydroponic solution.

Tobacco Mosaic Virus, lethal to tomatoes, was sprayed on all plants. Experimentals didn't contract the disease, while all the controls died of the virus. In trial after trial, sea solids seemed to confer greatly enhanced disease resistance—nearly immunity.

Recycle the Sea

"Plants flourished as none have in this modern day of fertilized soil," enthused Murray. "The contrast of experimental with controls was truly exciting. Taste difference was very significant, especially in tomatoes and carrots. Production rate was considerably higher, disease resistance apparent."

Murray concluded, "The most effective nourishment for hydroponic-grown plants is to supply all needed elements in predetermined ratio as inorganic minerals dissolved in water. Surprisingly, this nutrient solution is in substantially the same ratios as seawater.

"All essential nutrients can be supplied in proper proportions by a single dilute solution of seawater, plus nitrogen. Dissolving complete sea solids in fresh water formed dilute solutions of 1000 to 8000 parts per million."

Eventually, Murray operated a successful five acre hyroponic farm in south Florida, growing tomatoes, lettuce, cucumbers, celery, and other produce in intensive beds. Because he grew superior yielding crops of healthy, tasty, disease free plants, market demand for his crops was high, and his farm very profitable.

"My experiments proved adequate supplies of food can be developed if man recycles the sea," insisted Murray.

Animal Testing

Murray's most remarkable tests were trials feeding animals foods grown in sea solid-fertilized soil. Cattle feeding behavior provoked his excitement. Corn grown on sea solids fertilized soil was marked by wrapping tape around a stalk, mixed with conventional cornstalks, and dumped in a pasture.

Astonished, Murray recalled, "As animals munched away, immediately they preferred sea-solid stalks. After once sampling an experimental stalk, animals would nuzzle and burrow the pile to find another, ignoring control stalks until they had no other choice."

In further proof animal instinct knows best, Murray treated a 100 square foot section of clover with sea solids. When clover was six inches, sheep were allowed to graze. They walked and grazed until they came to the treated spot, then ate until the clover within the treated area was nubbed to the ground.

Results urged larger, elaborate study of animal feeding. Murray designed a series of trials with various feed grains and types of animals. Working with several farmers, he devoted years to studying the benefits of sea-solid fertilized feeds.

He reported, "In 1954, three staple feeds—corn, oats and soybeans—were grown, and subsequently fed to animals under controlled conditions: four parts corn, two oats, one soy. Not only were experimental crops superior, but effects on animal physiology and pathology were delightfully amazing."

Feeding experiments with cattle showed greater weight gain eating less experimental feed. Chickens were particularly partial to sea solid grown feeds; they grew more quickly, hens produced more, larger eggs sooner, and at slaughter, their meat better quality.

Murray wrote, "Chickens, pigs and cattle fed sea solids produce reached maturity sooner than controls, and resisted diseases common to their species better. Experimental pigs carried benefits into a second generation; there were no runts in litters."

Cancer: Nutrition or Genetics?

Murray's most astonishing tests were with lab mice—a C3H strain genetically selected by inbreeding to develop spontaneous cancer. Murray wanted to see what effect, if any, his sea solid-fertilized feeds might have on these DNA-doomed mice.

He wrote "A first animal experiment was on C3H mice, which get spontaneous cancer of the breast. We hoped sea solids-grown food could build resistance to the virus or cancer.

"C3H mice weredivided in two groups. Controls were fed regular cereal grain, while experimentals were fed cereal grain raised on sea solids-

treated soil.

"Instead of cancer IN 90% OF CONTROLS, experimental animals' rate dropped to 55%. Second generations born to parents fed sea solids food had cancer in only 2% of the population!"

This single experiment caused Murray to reconsider conventional causes attributed to this dread disease. He repeated his experiment in variations. Each time, sea solids fertilized feed seemed to impart resistance, perhaps immunity, to cancer.

In his time, organic farming was obscure, perpetuated by very few dedicated souls. Natural food stores and coops didn't exist. Ecological whole system thinking was unknown, amid total reliance on reductionist analysis, synthetic remedies, petrochemicals, and machinery.

And cancer was just beginning a rapid rise to overshadow human health—modern medicine's biggest boogieman.

Nutritional Deficiency Diseases

Murray faced facts compiled in experiment after experiment, and realized nutrient deficiencies are a key element contributing to degenerative diseases.

"Our frightening increase in chronic disease can be attributed to the absence of complete, balanced physiological chemistry," believed Murray. "If necessary elements aren't in our food, where are they? Certainly nature provided them.

"My research clearly indicates Americans lack complete physiological chemistry because balanced, essential elements of soil have eroded to the sea; consequently, crops are nutritionally poor, and animals eating these plants are, therefore, nutritionally poor.

"minerals have departed from our soils due to continuous taking of crops and erosion. Most crops require forty elements from the soil. In no case do fertilizers add more than twelve, most add six."

Unlike technicians who see only their own small problem, Murray's lifelong work with oceans, farmers, hydroponics, and medicine gave him a broad view. He recognized a new pill won't resolve the real problem. Only addressing the root source can relieve disease. Murray correctly saw topsoil and farming is the real root cause, and called for changes, not in medicine, but farming and food processing.

Sea Energy Agriculture

In 1976, Murray published a small book titled **Sea Energy Agriculture**—a remarkable testimony to a natural approach to soil fertility, and a nutrition approach to medicine. Murray wrote hopefully, believing he had important news to report.

"This is my lifelong search to open doors to a provocative new arena of science and technology called *sea energy agriculture*..... quite possibly this could lead to the end of disease and famine."

Dr. Murray lucidly described his 45 years investigating sea minerals in farming, food and medicine. Knowing his message was sure to provoke astonishment, disbelief and controversy among his medical and scientific peers, he began by quoting G.P. Hardy in **A Mathematician's Apology.**

"Sometimes one has to say difficult things,
but one has to say them as simply as possible."

In his **Preface**, Murray assures us, "As a scientist, I have great respect for what our technology has accomplished, but it is imperative that we accept a junior partnership with nature. To join this, we must alter the way we grow our food, protect our plants from pests and disease, and process our food."

Organic Farming

Murray's one chapter on organic farming reveals weak insight into ecology—a prevalent shortcoming in his day. He believed plants feed directly on inorganic ions in watery soil solution. No matter if a nutrient was natural (organic) or man-made (synthetic).

The physician knew little of how bacteria, fungi and microbes affect plant feeding—that roots and soil organisms form intimate communities, wedded together in tight symbiotic dependencies. Actually, the medical doctor saw microbes mostly as unfriendly and dangerous.

Nonetheless, his **Conclusion** said: "Today's organic farmers realize a giant commercial farmer, specializing in one crop, using only chemical fertilizer, is destroying soil's ability to produce food. If this continues, soil will be ruined and lost through erosion. To prevent this, and reclaim soil already destroyed, organic farming must be used."

Thus, Murray cast his lot with the tiny minority to challenge the chemical orthodoxy of his times. Like every other small voice of reason, he was ignored in the petrochemical rush to pump up yield with synthetics.

Lifetime Research

Murray's **Conclusion** states, "Research reported is in the nature of pilot projects. Tremendous further research needs to be done to render conclusive the appealing results and provocative trends indicated to date."

The book ends by Murray musing on his findings' human implications. He cautioned against extrapolating his observations into human nutrition and health, yet recognizes this is an issue of our time—a key to renewing America's soil, food and health.

"For man to continue to live on earth, he must make fundamental changes. He must look to oceans as a source of needed elements. These elements must be returned to soil so better quality, more healthful foods can be produced.

"Man must stop destroying soil. This requires basic changes in our agricultural system. Large commercial farms probably must be broken up and small regional farms using organic methods take their place.

"We have the means and ability to make these changes. We need now only the desire."

Yet, Murray's voice fell on deaf ears. His time's closed chemical mindset couldn't embrace views differing from dominant paradigms. His data on nutrition and disease, soil minerals and food quality, trace elements and health was lost. His warning to renew all the minerals needed in topsoil was ignored.

Dr. Maynard Murray was fond of saying, "Nature can teach us so much, if we would only listen." He died in 1984, not sure his own message was heard or understood.

A quarter century has passed since **Sea Energy Agriculture** was published. Maybe now insights of this 20th century bioneer will be recognized and put to proper use. Certainly the need has never been greater.

For more information about Dr. Maynard Murray, including excerpts from his 1976 book *Sea Energy Agriculture*, visit:

Sea Energy Agriculture

After Maynard Murray's death in 1984, his work was carried on by Don Jansen, a Nebraska wheat and buffalo farmer who bought Murray's south Florida hydroponics farm and spent many long hours talking to the doctor. For a short, unfinished article about Don Jansen, visit:

Ocean-Grown Foods of South Florida