Nature Farming in the Ancient Past, Present and Future

A guide by Peter Jackson

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Origins in Traditional Farming

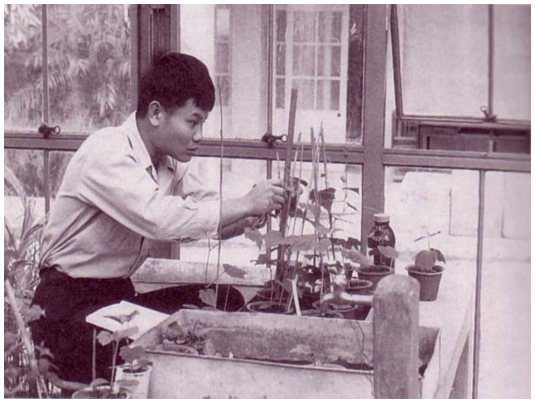
The earliest description of integrated farming systems for aquaculture and vegetables go back to almost 2200 BCE to a document called *You Hou Bin*. Fish culture in rice paddies was written about within 300 years from then. Terraces and ponds helped with flood control for thousands of years. Around 544 CE there was written the *Qimin Yaoshu* by Jia Sixie, the most completely preserved of the ancient Chinese Agricultural texts, with mentions of books and techniques going back another 1500 years. A translation of the title is *"techniques by which common people make their livelihood"* including details of agronomy, horticulture, sericulture, afforestation, aquaculture, animal husbandry and veterinary medicine, breeding, brewing, cooking, storage and remedies for barren land. Sixie quoted nearly 200 sources, many of which have been lost to the ages. Successful farming he says includes paying attention to the seasons, weather, and quality of soil to adapt work to save labor and increase yields. Further advances in technology led to the illustrated *Nong Shu* by Wang Zhen in 1313 CE and the *Nong Zheng Quan Shu* by Xu Quangyi in 1637 CE. The former had a detailed astrological agricultural calendar among other things. The latter contains detailed descriptions of Mulberry/Rice/Fish production as well as grain being cropped in the early stages of timber planting. The Duck/Rice production of Takao Furuno(where he collapsed space as Bill Mollison put it) to the rice to barley crop cycles of Fukuoka(where time was collapsed) have their genesis in these traditions.

History

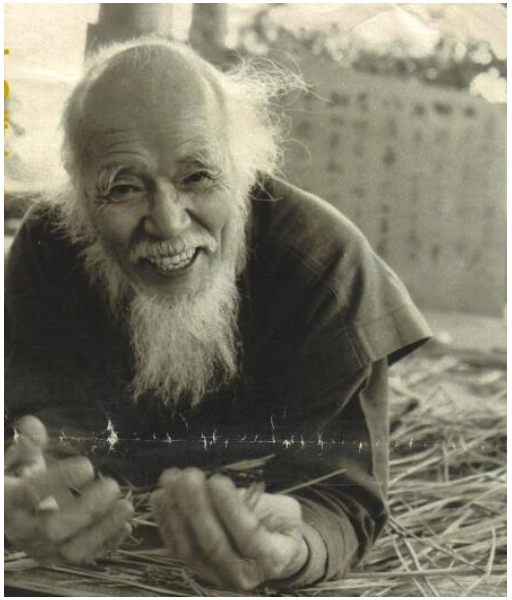
Mokichi Okada was among the first in Japan to encourage a return to pre-industrial, traditional farming, what he called fertility farming, and eventually Shizen Noho or **Nature Farming**. He was part of the Oomoto Movement, an offshoot of Shinto based practices that led to among other things, Aikido and Reiki.
His theories were that:.
-Fertilizers pollute the soil and weaken its power of production.
-Pests would break out from the excessive use of fertilizers
-The difference in disease incidence between resistant and susceptible plants is attributed to nutritional conditions inside the body.
-Vegetables and fruits produced by nature farming taste better than those by chemical farming
After his death in 1953, these ideals were continued by the **Mokichi Okada Association** and **Sekai Kyusei Kyo**.

From: Wikipedia.org/wiki/Mokichi_Okada

After accidental exposure to chemicals while working as a professor at the University of Ryukus, **Dr. Teruo Higa** started working in the 1970's on various microbial consortiums to see what was more symbiotic in action. One day before vacation he decided to pour some mixed cultures out in the lawn and when he came back he saw that the area that received microbes was more vibrant., Because previous microbiology studies were more focused on individual species and their exact effects, he looked at his notes and tried to recreate the blend. Over many years of research and experimentation, what we now call **Effective Microorganisms**(**EM**) was simplified to Lactic Acid Bacteria, Yeast and Purple Non-Sulfur Bacteria. All microbes that have a long history of fermentation and are Generally Recognized As Safe by FDA standards. In earlier times other species such as *Aspergillus Oryzae*(Koji Mold), *Rhizopus Oligosporus*(Tempeh mold) and various *Actinomycetes* have been included, and are listed in many of the patents under Dr. Higa's name. One of his students in the 1980's was part of the **Kyusei Nature Farming** organization, which led to a partnership and eventual formation of such organizations such the **Asia Pacific Natural Agriculture Network(APNAN)**, the **International Nature Farming Research Center(INFRC)** and the **EM Research Organization(EMRO)**. In 2001-2005, EMRO was involved in large scale cleanup of Japan's Inland Sea, which has spawned similar projects in Malaysia, the Philippines and many other countries. EM is sold in over 130 countries, and has inspired many similar products, but is the single most researched microbial cocktail in the world.
"The world is currently facing a time of great change and upheaval. I believe this condition has arisen mainly because of our present civilization becoming increasingly structured along the lines of competitive principles. An excessive reliance on competition certainly does not excite feelings of generosity and sharing."-Teruo Higa



From:
www.emrojapan.com/dr-higa/



From:
https://www.servicespace.org/blog/view.php?id=1666

Masanobu Fukuoka started his life in Okinawa, the son of a rice and citrus farmer. He went to school and became a plant pathologist but had an existential crises whereupon he realized the myth of "progress" imported from Europe was destroying the culture and environment of Japan. He sought solitude in a Zen-like existence, living on a mountainside in a small cabin, testing out his theories on agriculture. His magnum opus, the One Straw Revolution, shares how he one day saw a single rice plant growing in an abandoned field, and it was the most healthy specimen he ever saw, though it was unassisted by the hands of man. Realizing that nature knows how to grow plants better than any human, he came up with his unique system of planting using seedballs of compost, clay and seeds, scattering them before harvesting his rotational crops, rye and barley for winter, and rice for summer. Then while harvesting, all the leftover straw and chaff would be distributed on top of the germinating seeds, acting as a both weed suppressant and returning nutrition to the soil with mulch, what was too often just being burned as "waste". Within ten years of not disturbing the soil, his yields were equivalent to chemical farmers. By the end of his life he was getting double the production of industrial farmers, and thought that the potential of the land was possibly 30 bushels of rice an acre(10 per acre was standard). He also realized that by never pruning a tree it would grow itself fine, with no crossing branches and advocated not ever pruning once if the plant was grown from seed. He talked much about the "discriminating mind" and said that if the universities sent out specialists to study his work, that they wouldn't be able to see the whole picture because they were only looking through a narrow gaze of specialized training. As he strived for natural balance, a whole system developed in which he claimed no credit, merely helping foster a relationship once again between man and nature.

Kyusei Nature Farming

1. To produce foods which can sustain and promote human health.
2. To be beneficial economically and mentally to both the producers and consumers.
3. To be practicable by anyone, with durability.
4. To be responsible for an environmental integrity, paying respect to nature.
5. To be responsible for the production and supply of provisions in such a manner to meet the growth of population.

Fukuoka's principles

1. No tillage
2. No fertilizer
3. No pesticides or herbicides.
4. No weeding
5. No pruning

From: www.cgnfindia.com

Cho Han-Kyu has been promoting Korean Nature Farming since 1967. He learned about the nutritive cycle theory, microorganisms and the power of enzymes in Japan. In 1965, he went to Japan as an agriculture research student for three years, and studied the natural farming method of three teachers: Miyozo Yamagishi, Kinshi Shibata(author of The True Aspect of Enzymes), and Yasushi Oinoue. His Janong Natural Farming eventually became what is called **Cho's Global Natural Farming(CGNF)** which has chapters from Hawaii to India. Cho has helped promote the capturing of indigenous microorganisms(IMO) and many other preparations like fermented plant juice(FPJ or Heavenly Blessing Green Juice) and helped train many people in an approach that is more symphonic than several other methods such as the Kyusei Nature Farming or the Zero Budget Natural Farming/Subhash Palekar Spiritual Farming. Hoon Park helped bring him out to Hawaii in 2005 for his first visit after seeing with his own eyes(and nose) the no-smell piggeries in S. Korea, and another student Rohini Reddy published the freely published SARRA manual in India that has spread far and wide. "New vision of farming techniques is needed to recover the the nature of farming, There is a hidden possibility to realize a new vision in the ways that farmers make and apply which are necessary farming materials by making use of local materials actively." -Dr Han Kyu Cho

This image is from Cho's Global Natural Farming-SARRA by Rohini Reddy. This concept of nutrioperiodism was learned by Cho in Japan from Oinoue Yusashi who wrote the book The Systematic Theory of New Cultivation Techniques. Nutrioperiodism is the emphasis on different nutritional requirements for plants at various stages. Oinoue is also credited with saying the most important part of farming is species not technique, in relation to growing something well adapted for your microclimate. Plant based biostimulants can be tailored to help in these transitions between growth and reproduction. For me personally, this image changed my perspective beyond just different NPK needs and an understanding towards the need for hormones and enzymes.

From: https://www.facebook.com/gilcarandangofficialpage/

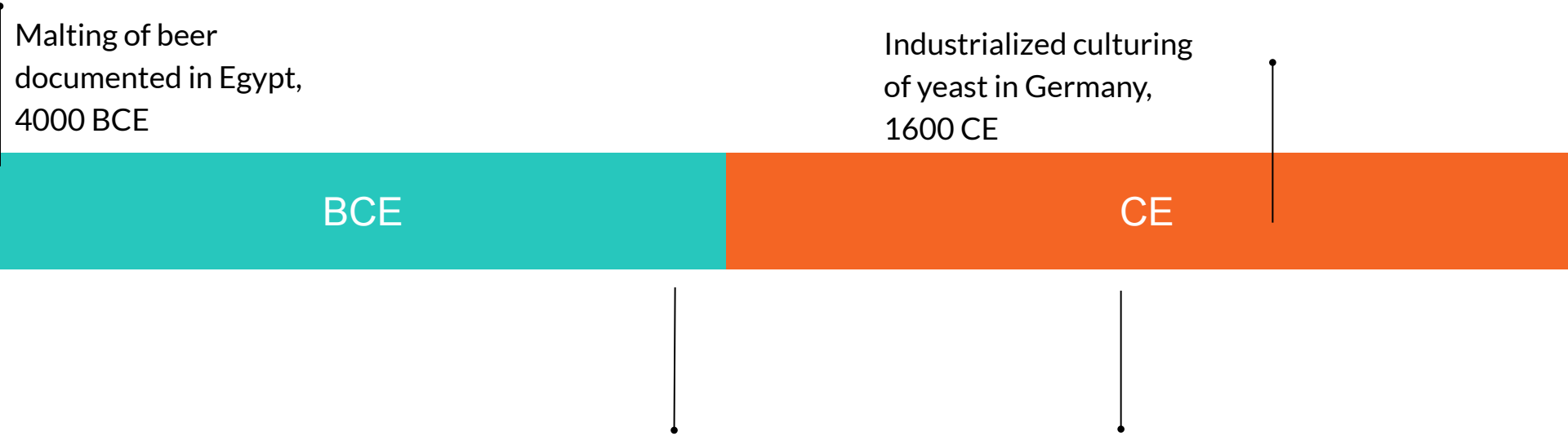
Gil Carandang is known as the father of organic farming in the Philippines. He studied with Master Cho as well as in Japan and crafted his own unique hybrid between the two styles that was popularised through his booklet Grow Your Own Beneficial Indigenous Microorganisms and Bionutrients in Natural Organic Farming, as well as on his former website theunconventionalfarmer.com(still on archive.org.) In 2003, Gil came to the USA on a Fulbright Scholarship and worked with Steve Diver, who was then working with ATTRA. Gil was among the first to bring IMO methodologies to North America, and in 2008 went out to the Big Island of Hawaii. Gil saw that lactobacillus are a large component of EM and mixed his IMO cultures with LAB to create what he called Beneficial Indigenous Microorganisms or BIM.

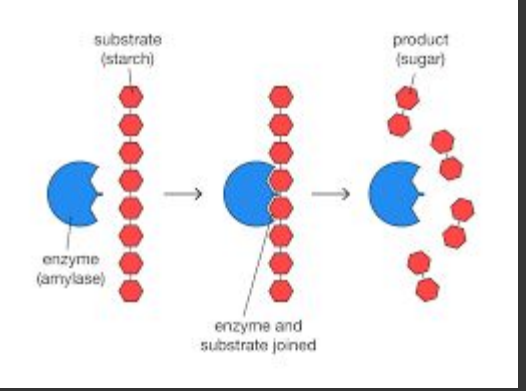
EM and IMO

-EM or Effective Microorganisms is a lab grown culture developed by Dr. Teruo Higa and licensed by the EMRO worldwide. No cultures are distributed from Japan, only a proprietary method of creating the inoculant. The *Lactobacilli*, *Sacchoromyces*, and *Rhodopseudomonas* are ubiquitous strains that can be found worldwide in waters and soils. *R. Palustris* is considered the backbone or atomic center of the consortium around which the other two types of microbes revolve around.

-IMO or Indigenous Microorganisms has been streamlined into a process by Master Cho, though it's origins are much older than the 20th Century. By choosing healthy, undisturbed environments to collect microbes from, then transplanting those into our agricultural zones, we increase soil food web diversity that has been damaged by tillage, clearcutting, chemicals, soil compaction or erosion. Many microbes are reproducing every twenty to one hundred minutes, so that level of adaptation to our local ecosystems makes their use unparalleled in terms of performance.

Fermentation Timeline





Enzymes

-Enzymes are chains of proteins which are made up of amino acids, and they act as catalysts to biochemical reactions.
-They are able to speed up processes that would normally take a long time much faster, and often function in chains of metabolic pathways, as in the ten step stage of glycolysis.
-Enzymes are able to work on substrates together using a lock and key model, as they have very specific functions for each of the over 5,000 known examples. Cellulose needs cellulase in order to break down in the absence of fire or drastic changes in Ph. For degradation of Chitin, there is chitinase. In our own saliva, we secrete amylase and protease to break down starches and proteins into more assimilable forms, just as root tips and microbes predigest compounds in the soil.
-In industrial applications, lignase and cellulase are used for production of biofuel, and amylase, protease, and pectinase are used in various aspects of brewing, food processing, and cleaning supplies

Amylase in brewing

-The oldest known method of making a grain beer is utilizing the enzyme amylase found in our saliva by chewing up the grains or seeds and spitting them into a barrel before adding water.

-The malting process in the Mediterranean goes back into ancient Egypt where the sprouting wheat or barley seed produces its own amylase.

-In the Asian continent since 300 BC, *Aspergillus* mold has been domesticated to perform the saccharification of starches into sugars in rice, again using amylase.

-*Sacchoromyces* yeast are not able to digest the starches themselves, so predigestion is needed, before the fermentation path of alcohol is unlocked.

Bokashi: Japanese for Fermented Organic Matter

Bokashi is a fermentation technique for fertility that goes back hundreds of years. The main person responsible was Naoe Kanetsugu who was able to study old Chinese books written about farming techniques in the Shogunate era about 400 years ago. However the written history of fermentation of rice for wine goes back at least 2300 years with *Aspergillus Oryzae*. The similarities of domesticating mold for alcohol production and capturing mold for compost acceleration give a picture that these techniques share a intertwined history. Composting is a very similar practice, but relies more on aerobic respiration in the modern era, versus the fermentation being done anaerobically by Lactic Acid Bacteria in Bokashi, which is more similar to silage.

mortar which sometimes cracked on drying, as seen in the illustration. The purpose of this careful shaping and plastering we did not learn although our interpreter stated it was to prevent the compost from being appropriated for use on adjacent fields. Such a finish would have the effect of a seal, showing if the pile had been disturbed, but we suspect other advantages are sought by the treatment, which involves so large an amount of labor.

The amount of this earth compost prepared and used

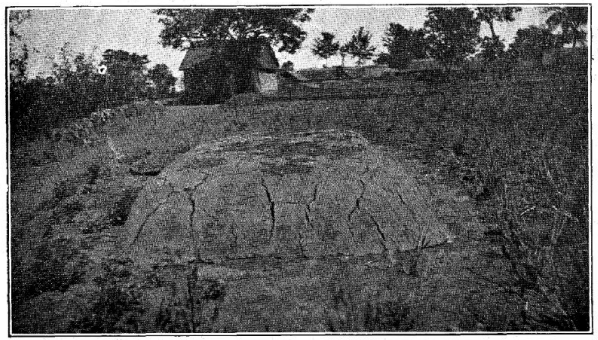


Fig. 133.—Carefully plastered earth compost stacked in the field awaiting distribution, Shantung, China.

annually in Shantung is large, as indicated by the cases cited, where more than five thousand pounds, in one instance, and seven thousand pounds in another, were applied per acre for one crop. When two or more crops are grown the same year on the same ground, each is fertilized, hence from three to six or more tons may be applied to each cultivated acre. The methods of preparing compost and of fertilizing in Kiangsu, Chekiang and Kwangtung provinces have been described. In this part of Shantung, in Chihli and north in Manchuria as far as Mukden, the methods are materially different and if possible even more laborious, but clearly rational and

From *Farmer's of Forty Centuries* by F. H. King,
an image of a compost pile sealed with clay to promote fermentation. King designed the cylindrical storage silo.

Healthy Soils Healthy Guts

Probiotics+Prebiotics=Synbiotics

Probiotics

Live microorganisms which when administered in adequate amounts confer a health benefit on the host (FAO/WHO 2001)

Prebiotic

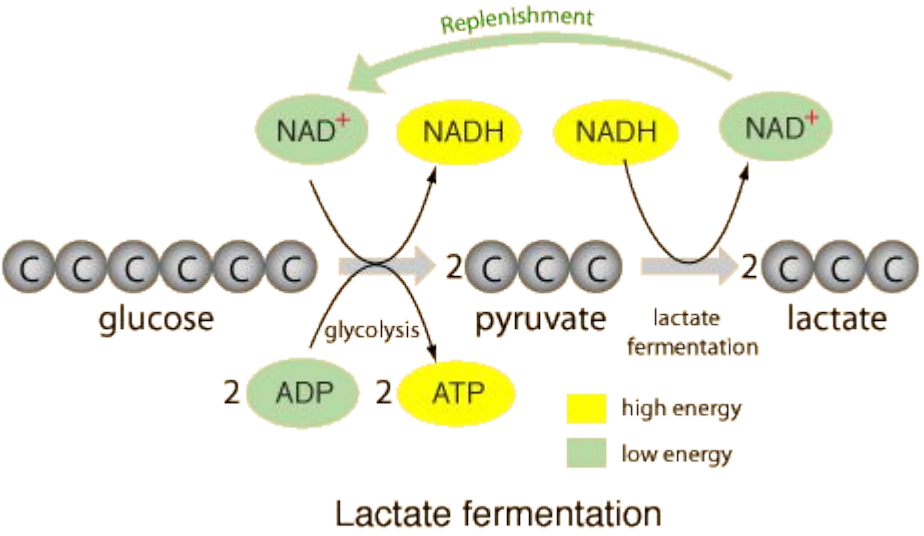
Fibers that pass undigested through the upper part of the gastrointestinal tract and stimulate the growth or activity of advantageous bacteria that colonize the large bowels

Synbiotics

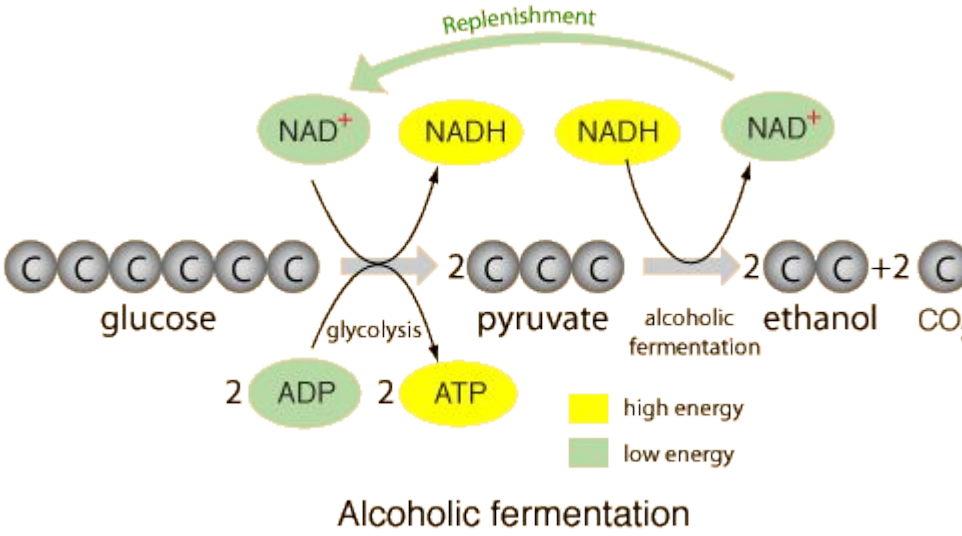
the creation of a food or supplement that is greater than the simple sum of the parts

Hippocrates said 90% of disease originates in the gut, so too does 90% of blights originate in the mismanagement of soil. In the soil food web the three main foods are starches, cellulose and chitin. Fungicides and pesticides have removed lots of chitin out of the nutrient cycling process, even though many insects and fungi are helpful. As antibiotics remove the good and the bad with many unintended consequences, a probiotic approach to farming yields many positive results.

Pathways of Fermentation



Lactate fermentation



Alcoholic fermentation

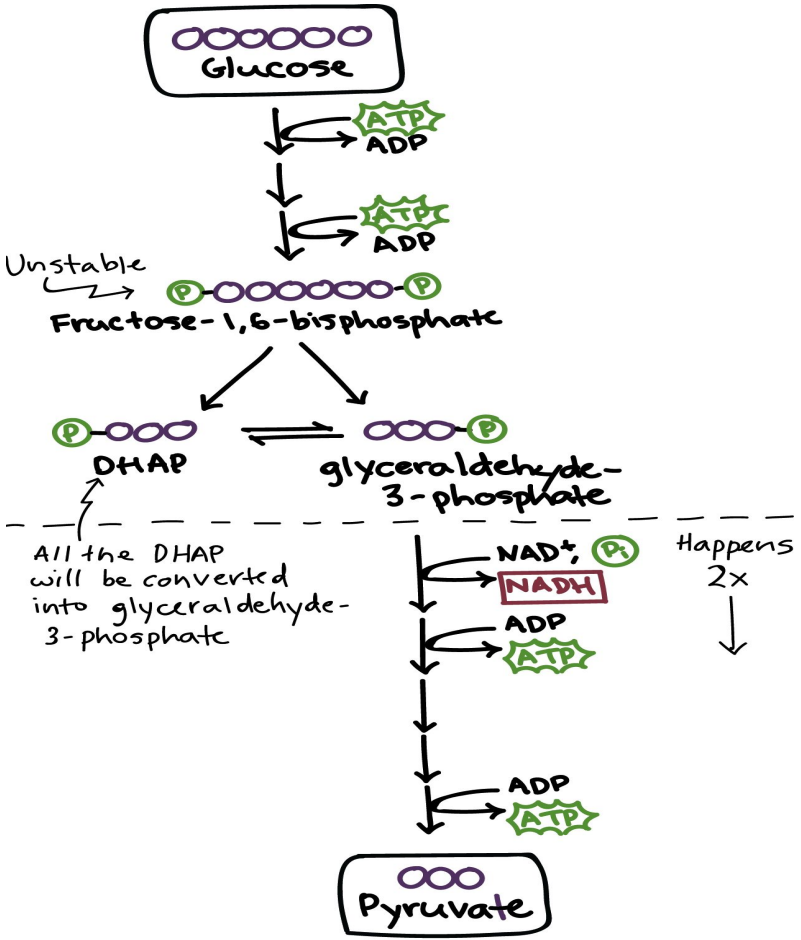
Source: Khan Academy

Glycolysis

Louis Pasteur laid some of the groundwork for understanding the breakdown of glucose when he was studying why some wines spoiled and others fermented. Later work by Eduard Buchner showed that yeast didn't even need to be alive, and just enzymes could turn sugar into alcohol.

Plants store energy from the sun in the form of sugars, carbohydrates, fats and oils.

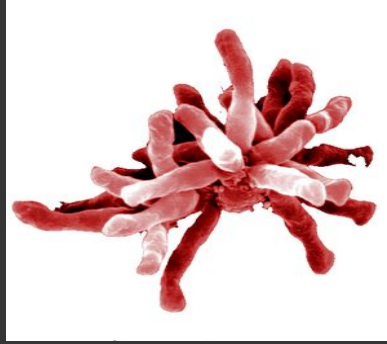
Independent of oxygen, glycolysis is how energy is liberated from sugars. It probably originated as a metabolic pathway when Archaea ruled the oceans, prior to the creation of our oxygen rich atmosphere.



Facultative Anaerobes

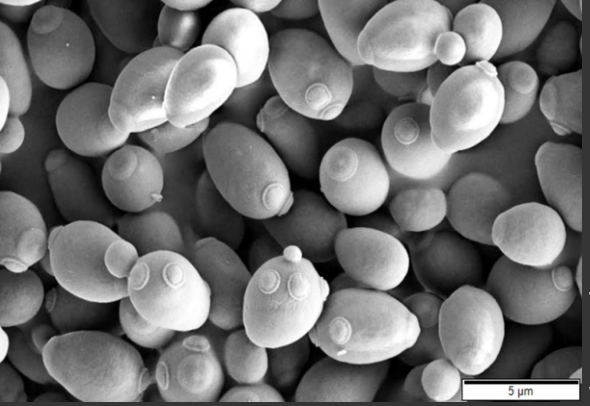
Many bacteria and archaea are **facultative anaerobes**, meaning they can switch between aerobic respiration and anaerobic pathways (fermentation or anaerobic respiration) depending on the availability of oxygen. This approach allows them to get more adenosine triphosphate(ATP) out of their glucose molecules when oxygen is around—since aerobic cellular respiration makes more ATP than anaerobic pathways—but to keep metabolizing and stay alive when oxygen is scarce. Purple Non-Sulfur Bacteria, Yeast and Lactic Acid Bacteria all belong in this category. Effective Microorganisms(EM-1) is a combination of those species.

Purple Non-Sulfur Bacteria



From:
Wikipedia

PNSB have four modes of respiration and metabolism and can fix CO2 and nitrogen, and photosynthesize without having an oxygen byproduct. One well studied species, *Rhodospeudomonas palustris* can metabolize lignin and acids found in degrading plant and animal waste by metabolizing carbon dioxide. PNSB have been extensively studied with patents going back to the 1930's in cleaning up manure lagoons in concentrated animal feeding operations. This bacterium is an efficient biodegradation catalyst in both aerobic and anaerobic environments. *R. palustris* is found extensively in nature and has been isolated from swine waste lagoons, earthworm droppings, marine coastal sediments and pond water. These microbes, belonging to the kingdom known as Archaea, are between complex eukaryotic kingdoms like Fungi, Plantae, and Animalia, and the simpler prokaryotic kingdoms like Bacteria and Protista. The Archaea may be ancestrally related to both chloroplasts and mitochondria, having not been assimilated like the latter into being organelles. The reason we are breathing an oxygen rich atmosphere today is due to ancient photosynthesizing and chemosynthetic microbes being able to tolerate the harsh conditions of proto-earth with its methane rich atmosphere. This is why you can find Archaea at the bottom of the seafloor feeding off sulfur vents and in mountainous hot springs, as they are extremophiles able to tolerate what to others is inhospitable living conditions. In a sense, they wrote the blueprint that spawned the rest of Life, they are the original alchemists.



From: ‘Sample Preparations for Scanning Electron Microscopy – Life Sciences’

Sacchoromyces Yeast

The kind of fungus known as yeast produce a diversity of enzymes in addition to making alcohol, and in the medieval era, low alcohol beverages were consumed in place of water that was unsafe, as the acids and alcohols are good sterilizing agents. There has been extensive research on yeast in wastewater management as well. Yeasts will not only feed on sugars and carbohydrates but fats too. In chemistry, lipids(such as fats and oils), sugars/starches and alcohols are all made of the same simple building blocks: carbon, hydrogen, and oxygen Plant based alcohols and petroleum hydrocarbons are all made up of the same simple bonds, and the fungal kingdom employs a variety of enzymes to turn carbohydrates into hydrocarbons and vice versa, much like how our body turns sugar into fat and fat into energy. The building up and taking apart of elements through the pathways of fermentation and photosynthesis are the two main ways which life feeds on air, water and earth to sustain the fire of life. Yeast demonstrate the principle of *Solv et Coagula*(dissolve and coagulate), a Latin phrase that teaches how to achieve the elementary conversion by volatilizing the fixed and fixing the volatile! The addition of live or dead yeast to fertilized soil substantially increases the nitrogen (N) and phosphorus (P) content of roots and shoots of plants. Yeast additions to soils also increases the root-to-shoot ratio and plants also respond well to the B vitamins.

Lactic Acid Bacteria

The lactic acid bacteria are a group of organisms with a diverse metabolic capacities. Despite their complexity, the whole basis of lactic acid fermentation centers on the ability of lactic acid bacteria to produce acid, which then inhibits the growth of other non-desirable organisms. This is why sauerkraut and yogurt are more stable than cabbage or milk. Not many microorganisms can thrive at a low pH, or the high salinity of a salt brine which happens to be the same percentage sodium as the oceans. This is also why they are universal probiotics, because they are able to get through our human stomach acids into the intestines. As we are having increasing acidity in our oceans and soils, their usefulness is more apparent than ever. Don't over do their application though, as they can be used too much. Lactic acid decomposes or chelates minerals stuck to soil particles, which are not easily dissolved; thus making the minerals available in a form plants can absorb. It also has odor eating properties that are useful in rearing of animals, and can be added to their water or sprayed on their bedding. They enable resistance from the rhizosphere to phyllosphere against fusarium, powdery mildew and botrytis.

From Screening of potential probiotic lactic acid bacteria and production of amylase and its partial purification'

Syntropic Antioxidative Microbes

“microbial species and microbial consortia (that is, cooperative aggregate microbial communities consisting of anywhere from three to over forty species of microbes working together) that exhibit all of the following significant properties:

-they exhibit antioxidative properties, that is, they produce significant quantities of various antioxidants as metabolites when digesting foodstuffs (which may range from plant matter to sewage to toxic waste), in a fashion analogous to the manner in which brewer's yeast digests sugars and produces alcohol as a metabolite, that is, as a waste product. As a result of the production of these antioxidant compounds (aka reducing compounds), most SAMs, in most settings, tend to exhibit pronounced deodorizing properties, and also detoxification properties as well.

-most SAM also tend to produce as metabolites a unique class of *antioxidant assistant* compounds that are very important in certain biological process within living organisms, and also quite important in in-situ bio-remediation of contaminated soils and bodies of water; these compounds are variously referenced in both the popular literature and the scientific literature by names such as *antioxidant assistants*, *antioxidant helpers*, *electron shuttles*, *electron transfer agents*, *electron relays* and *electron mediators*. One example of such an antioxidant assistant compound is ubiquinone, also known as Coenzyme Q10 (aka CoQ10), and other related quinones which also exhibit electron shuttle properties. As a result of the production of these compounds, most SAMs, in most settings, tend to exhibit pronounced deodorizing properties, and also detoxification properties as well.

-SAMs also exhibit syntropic (also known as negentropic or anti-entropic) properties, that is, they seem to prevent destructive *decay*, or breakdown of various compounds, and instead seem to encourage creation of compounds with higher order and structure; that is, they tend to enhance or preserve the order, entropy and energy in a system.

As you will see below, some syntropic antioxidative microbes are found in nature, while others are combined, usually via fermentation processes, by humans for special applications ranging from making foodstuffs to treating agricultural soils, to remediating toxic waste.”

-Vinny Pinto http://sam.vmicrobial.info/

Fermenting Fungi

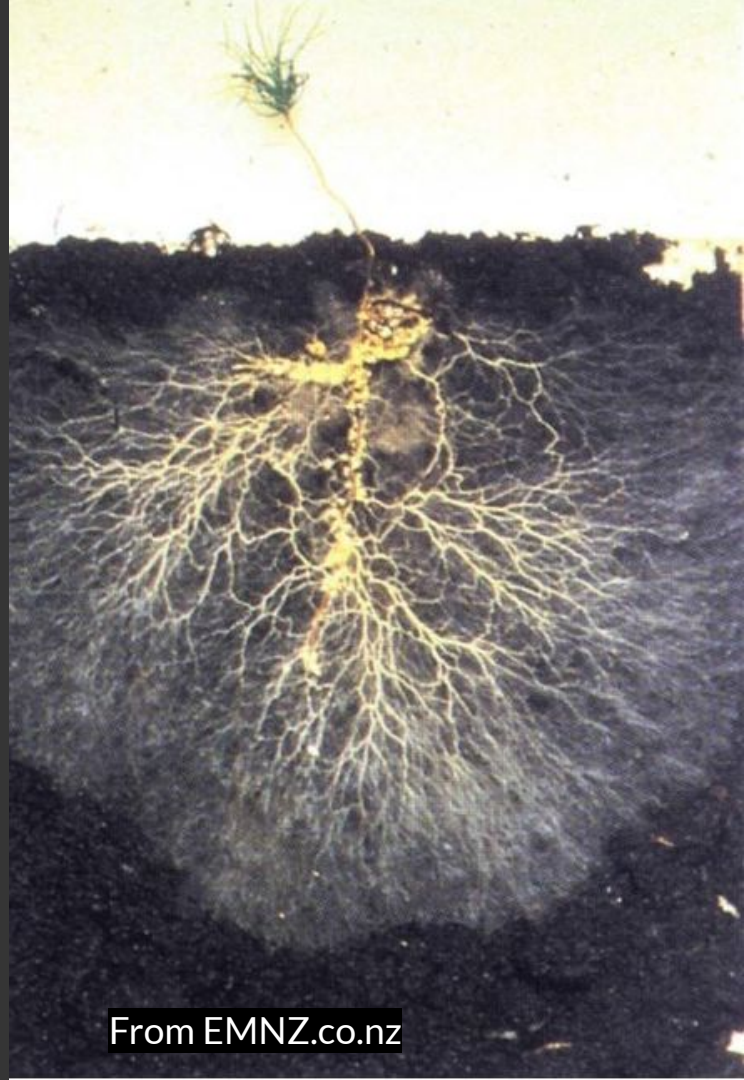
Aspergillus Oryzae, also known as the Koji mold, is a species of fungus used in the production of rice wine going back to 2400 years ago in China. It is also used in the production of miso and soy sauce. The amylase it secretes performs the function of saccharifying the starches in rice for the yeast to make alcohol.

Rhizopus Microsporus var. Oligosporus, the tempeh mold has a history going back in Indonesia to 1000AD and is used for fermenting grains and legumes. Not only does the fermentation unlock nutrients and destroy anti-nutrients such as phytic acid, it provides unique flavor compounds, proteins, and D vitamin.

Mycorrhizae

Meaning mushroom(myco) roots(rhizome) in latin, mycorrhizae are symbiotic fungi that fall into to two categories, obligate and facultative. The obligate, meaning they need host roots to propagate, include the Arbuscular Mycorrhizal Fungi(AMF) which fall into the endo category like *Glomus*, as they fit between the cell walls of the plant roots. The facultative, meaning they are able to function with or without symbiotic relations include species of ectomycorrhizal fungi like *Rhizopogon*, which bond primarily with pine trees in the northern hemispheres.Some 17% of white rot fungi is thought to also have symbiotic relations that just haven't been charted. 90% of all land plants have fungal connections, with a few notable exceptions such as *Brassica*'s. Certain varieties of mushroom like Chanterelles, Truffles, Porcini, Matsutake and Morels are edible mycorrhizal fungi.

Unlike the saprophytes, which are primarily digesting dead matter, the mycorrhizae form a sheath either between or around the cell walls of plant roots, enabling greater nutrient acquisition with fungal hyphae as well as water retention and storage. In return the plant sends exudates such as sugars and vitamins down through the root network. Phosphorus use has been shown to discourage mycelia as that is one of the primary compounds they solubilize.

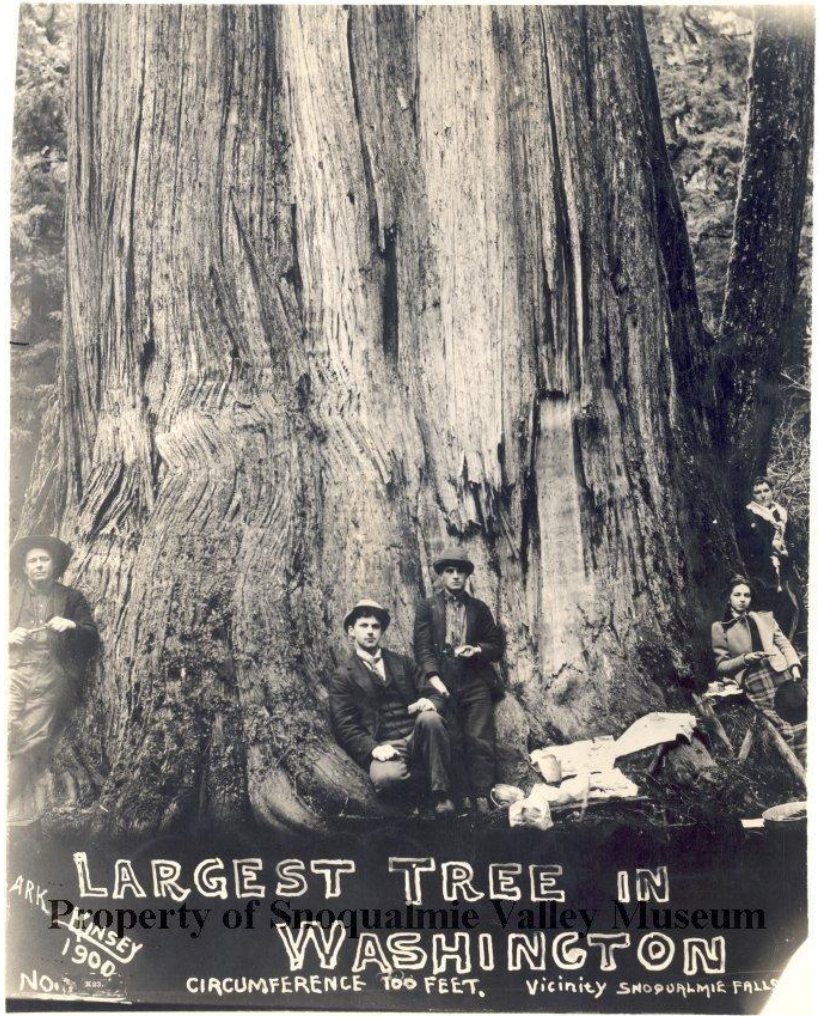

From EMNZ.co.nz

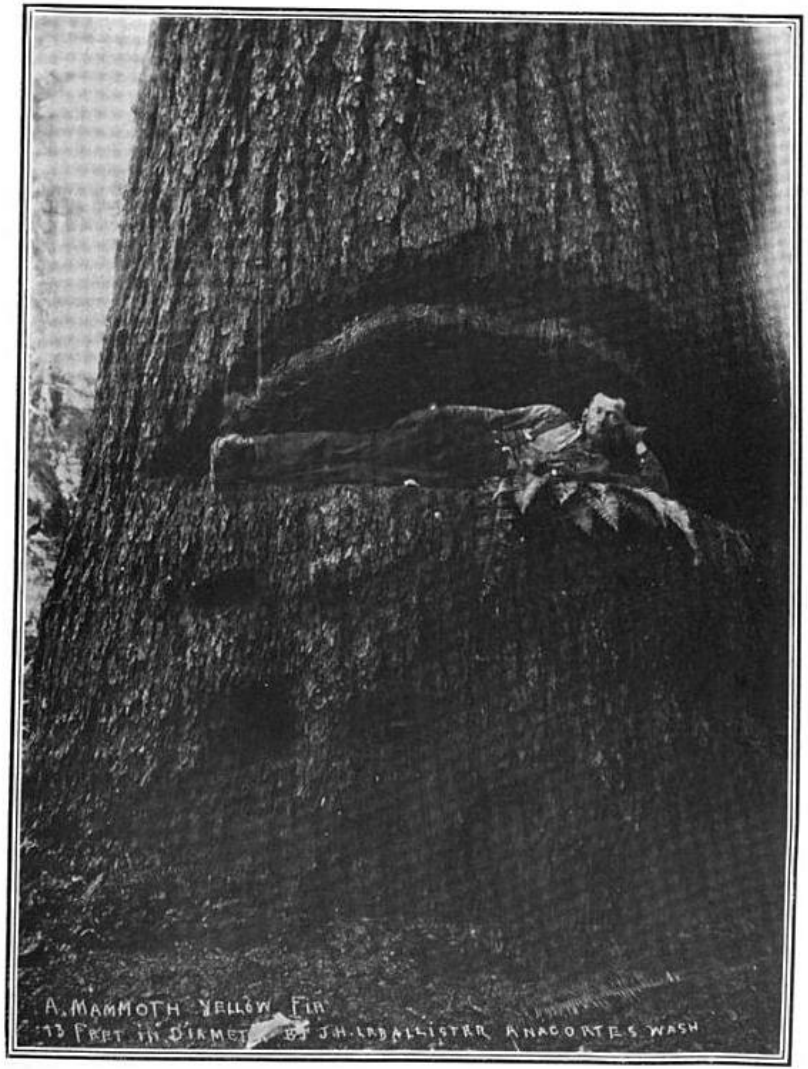
Actinomycetes

Actinomycetes also belong in the realm of archaea. They are responsible for the majority of antibiotic compounds and used to be classified as ray fungi for their creation of pseudo-hyphae. Their roles are primarily in the realm of nutrient cycling of harder to decompose wastes like chitin, cellulose and lignin, nitrogen fixation(species in the *Frankia* genus) and producing plant growth hormones.

Rhizobacteria

Rhizobacteria are responsible for the common knowledge of legumes being nitrogen fixers, taking it out of the air and helping convert it to more plant available forms such as ammonia, NH_3. They also help chelate iron and secrete phytohormones that are plant growth promoting. *Azospirillium* is one of the most common genuses to be found in this category. Chemical nitrates discourage their associations.





Cation Exchange Capacity

Cation exchange capacity is a measurement of the availability in soil of positively charged minerals such as Calcium, Magnesium, Potassium and Sodium. Because of their willingness to act as reducing agents and gain electrons they are more likely to be washed out of soils which is why we often find Calcium deficiencies in the damp Cascadian bioregion and worldwide the oceans are full of Sodium. Anions such Nitrogen, Sulfur, and Phosphorus, are less likely to be deficient in soils because the nitrogen can be fixed by Rhizobacteria, and Phosphorus is chelated from rocks by the acids and enzymes that are secreted by fungi. Anions act as oxidizing agents to complete the chemical reaction known as Redox or Reduction-Oxidation, the cycling of electrons between elements. For the planet, volcanoes, glaciers, wildfires and robust riverine ecosystems stretching thousands of kilometers have been a part of the remineralization and nutrient cycling of the earth and seas. Rock dusts have been championed by the likes of Julius Hensel, William Albrecht, Phil Callahan, Joanna Campe and Gary Kline. Sea Minerals have gained an important understanding in agriculture as well for supplying trace minerals.

Rockdusts & Remineralization

From the intro to Bread From Stones

‘The use of chemical fertilizers, claimed Hensel, leads to the following evil consequences:
(1) It poisons the soil, destroying beneficial soil bacteria, earthworks and humus,
(2) It creates unhealthy, unbalanced, mineral-deficient plants, lacking resistance to disease and insect pests, thus leading to the spraying menace in an effort to preserve these defective specimens,
(3) It leads to diseases among animals and men who feed on these abnormal plants and their products,
(4) It leads to a tremendous expense to the farmer, because chemical fertilizers, being extremely soluble, are quickly washed from the soil by rainfall and needs constant replacement.(Powdered rocks, on the other hand, being less soluble, are not so easily washed from the soil,but keep releasing minerals to it for many years).’ ...

‘1. That Stone Meal creates healthier, tastier,more vitaminized and mineralized foods.
2. That Stone Meal creates immunity to insect infestation, worms, fungi and plant diseases of all kinds.
3. That Stone Meal improves the keeping and shipping quality of foods, so that they keep a long time, in contrast to the rapid deterioration of foods given abundant animal manure.
4. That Stone Meal helps plants to resist drought and frost, enabling them to survive when those fed on manure and chemicals perish.
5. That Stone Meal produces larger crops which are more profitable because the farmer is saved the expense of buying chemical fertilizers which are rapidly leached from the soil by rain-fall, whereas Stone Meal, being less soluble, is gradually released during the course of years and remain in the soil, being the most economical of fertilizers.
6. That foods raised with Stone Meal are better for human health and the prevention of dis-ease than those grown with chemicals or animal manure.
7. That use of Stone Meal, in place of chemical or animal fertilizers, helps to end the spraying menace (by removing its cause) is proven by the fact that plants and trees grown with Stone Meal are immune to pests and so require no spraying.’

Nutrient Density and Rhizophagy

So how does the plant absorb these minerals? Obviously we don't see much growing in either pure sand or pure clay. Organic matter is an important part of soil, and what constitutes the majority of unstable carbon in soils is roots and microbes. Through photosynthetic production of sugars, a language is spoken between the root exudates and the microbial community, attracting symbiotes at just the right time that certain minerals are required for metabolism. Using synthetic nitrogen instead of letting the microbes do the work is similar to why a diet high in processed food leads to illness, but prebiotic fibers pass through our stomachs mostly undigested to feed probiotics unlocking more nutrients along the way through fermentation. Modern reductionism will feed the the sugar junkie or plant,with how easily available glucose is assimilated through glycolysis in our cells or synthetic nitrogen causing rapid growth, but both systems will end up being weakened as noted by Mokichi Okada in the 1930's. Rhizophagy, meaning root eating, is the degradation of symbiotic microbes within the cell walls of roots. Endo and Ecto symbionts like mycorrhizal fungi both enable the surface areas of the roots to be increased up to 1000x, they also act as highways for bacteria that alternate between a free-living soil phase chelating minerals in the soil and a root intracellular or endophytic stage wherein the nutrients they have mobilized are absorbed through oxidation. Use of biocidal agents as is common in chemical agriculture harms the soil food web and humus structure and so is detrimental to the nutrient density of the plants. "Food and medicine are not two different things: they are the front and back of one body. Chemically grown vegetables may be eaten for food, but they cannot be used as medicine."- Masanobu Fukuoka

Bacteria on the 'Fungal Highway': Pseudomonas putida moving along hyphae of Cunninghamella elegans

Terroir

A French concept coming from the older root word terra, it is the set of environmental conditions that can affect genetic expression of the same crops character, even between neighboring valleys. In essence it is the taste of the land. Mineral composition of soil, climate, microbiology, and growing practices are all factors that can affect the taste and quality of the final product, be it wine, cannabis, bread, cheese, or an apple. Research in the Waimea Valley of Oahu by University of Hawaii has shown that between the soil and the sea, there is a series of nested microbiomes. The order of least to most diverse communities were predators, followed by herbivores, then plants, then soil and then the ocean. This sort of fractal recursion fits into the notion of we are what we eat, we are what we eat eats, and how healing the soil, ultimately heals our own guts. Many studies have been done showing how different yeasts and strains of lactic and malolactic bacteria impart different esters and other flavor compounds into the final taste of fermented alcohols as well, and in the realm of flowers those same bacteria are found to be responsible for many of the smells we associate with plants. One can imagine the effect fungicides have on these symbioses. By focusing on soil health and improving the nutrient density of our crops, the plants have more ability to synthesize secondary metabolites, creating a more complex flavor. In the realm of biodynamic farming, the vineyards in California with the most carbon in the soil and the highest brix content in the grapes were related to those farming practices. Nature Farming has great premise in this realm as it is part of the initial ethos of providing nourishing foods. Ecosystems in agriculture that utilize diversity and biomimicry will find that mixed associations of species create climax environments similar to old growth forests. Harvesting and propagating microbes from undisturbed areas be it prairie or jungle can act like faecal transplants in humans.

Water

-Often taken for granted in this time of microplastics permeating every facet of our existence, good clean water is one of the most precious components of all life, yet often seen as little more than another commodity.
-Research by the likes of Walter Jehne show important it is to replant forest as well as protecting what little old growth remains when dealing with global exacerbation of wildfires, as clearcuts cause not only erosion, but a lack of infiltration into the aquifers. Forests literally breath in moisture off the oceans as well as keep it from evaporating and help prevent loss of soil. Evapotranspiration cycles can be restored, ending droughts that are a result of human mismanagement of ecosystems worldwide.
-Chlorine treatment leaves water dead, as does flowing in straight oxygen sucking canals and pies, instead of being vortexed by the fractal nature of streams.
-Research from Victor Schauberger, Dan Winter, Masaru Emoto and Gerald Pollack shows that water has memory, and reacts to everything from thoughts to charge differentials of the minerals it dissolves.
-”Life is water dancing to the tune of elements”-Albert Szent-Gyorgi

The Microbiome

latin for micro=small and bio=life

The microbiome is an ecological assembly of all commensal, symbiotic and pathogenic organisms functioning as a synergistic unit.

Holobionts

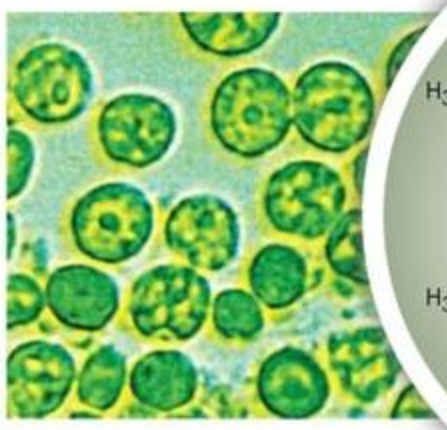
Lynn Margulis defined it as an assemblage of a host and the many other species living in or around it, which together form a discrete ecological unit. Holobionts include the host, virome, microbiome, and other members, all of which contributed in some way to the function of the whole. Examples include the human body, a tree, and coral reefs.

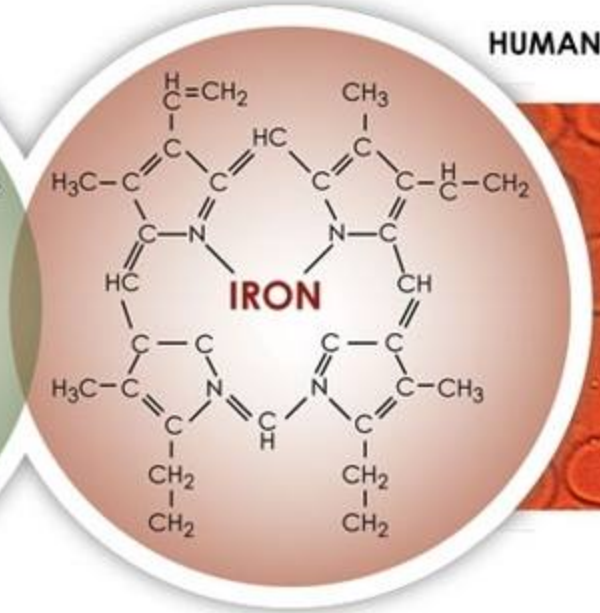
"The outline of your body is the inline of the world"
-Alan Watts

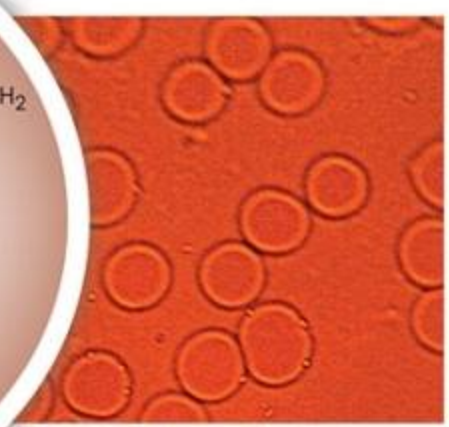
Epigenetics

While we have our own DNA, the DNA of our microbiome is just as important and together is called the hologenome. The holobiont can adapt to environmental stresses far more rapidly than through selection and mutation alone. Trauma and nutrition can either turn genes on or off in one lifetime, and so can our microbes affect us in a world of fast food, antibiotics, lack of mothers milk and C-section births. If a plant or animal gets to live a nice life with an abundance of quality food, those traits that will be expressed more fully will in turn be passed onto the next generation. What we are finding is that trauma too gets passed down generationally. Species of bacteria have been studied for PTSD alleviation, as gut bacteria are responsible for producing up to 60% of our endogenous neurotransmitters, affecting our mental health in the realm of psychobiotics. Soil bacteria also secrete plant growth hormones. So living a microbe rich life helps with plant and human well-being! Phenotype, Genotype and Chemotype can all be affected from pollination to germination in seeds or conception in animals.

PLANT BLOOD (CHLOROPHYLL)







HUMAN BLOOD (HEMOGLOBIN)

Plant Growth Hormones

Abscisic acid: affecting bud growth, and seed and bud dormancy, mediating changes within the meristem. Within droughts stressed plants, it regulates the closing of the stomata.

Auxins: influencing bud formation and root division, stimulates cambium and cause xylem differentiation, converting stems into flowers

Cytokinins: important for cell division, node length and leaf growth, acting as a mediator to auxins and ethylene

Ethylenes: important for the ripening of fruit as well as seeds emergence

Gibberillins: used in germination, cell elongation, transition between vegetative, fertilization and reproduction stages

Jasmonates: important in response to herbivore attack, pathogens and signaling to other plants.

Salicylic Acid: used in response to abiotic stress and defense against pathogens

Biostimulants

The term “**biostimulant**” is defined in the USA’s 2018 Farm Bill as “a substance or microorganism that, when applied to seeds, plants, or on the rhizosphere, stimulates natural processes to enhance or benefit nutrient uptake, nutrient use efficiency, tolerance to abiotic stress, or crop quality and yield.” the European Biostimulants Industry Council describes them as “Substances and/or microorganisms whose function when applied to plants or the rhizosphere is to stimulate natural processes to benefit nutrient uptake, nutrient use efficiency tolerance to abiotic stress, and/or crop quality, independently of its nutrient content.” Humic and fulvic acids, hydrolysates and amino acids, seaweed and plant extracts, and chitosan all fall into this category. Often used nowadays to refer to microorganisms found to bioaugment the soil, many commercial products are found not to meet their claims of either spore count or species listed. Most of what we are doing with inoculants/biostimulants is just feeding the native fungi and bacteria that are already present.

Fermented plant juice and fermented plant extracts capture various endogenous plant growth promoting hormones as well as produce similar secondary metabolites during fermentation.

Ethnobotany and Herbalism

One part of why nature farming can be successful is it is often grounded in older traditions of wellness and being, such as Traditional Chinese Medicine. The inspiration for Master Cho's creation of the Fermented Plant Juice came from substitution of sugar for salt in the brining process of Kimchi, but the plants he decided to use were informed by his culture's knowledge of plants that assist women in childbirth. Sometimes we have oral histories, other places may have written compilations of folk wisdom, but whether tending the wild or cultivating in our human dominated areas, it is always helpful to know the aspects of the plants we hope to ferment into biostimulants. It is part of the pattern language of nature, acknowledging the interrelationships and ways we can dynamically learn to understand, speak and communicate with the botanical realm. Herbalism often tries to treat not just symptoms, but the cause of disease. Even paying attention to animals when they are sick can teach people important things about plants in our areas. There is also the Doctrine of Signatures, based off the Hermetic principle of Correspondence(As Above, So Below), which teaches us that nature shows us through form how ailments can be dealt with by plants with certain resemblances to correlating organs. It is very much like reading the grains of wood for sculpture or navigating with attention to the currents and tides.

Bioremediation

Bioremediation is the use of either naturally occurring or deliberately introduced microorganisms or other forms of life to consume and break down environmental pollutants, in order to clean up a polluted site. Subsets include phytoremedation using plants to bioaccumulate heavy metals, and mycoremediation as in the case of Oyster Mushrooms(*Pleurotus Ostreatus*) breaking down hydrocarbons and making carbohydrates. The cleaning of the Seto Inland Sea in Japan is one of the largest undertakings using EM-1 and bokashi mudballs to restore balance to an ecosystem. When plants such as dandelions were found growing in waste from the tar sands, it was due to the fungal allies the seeds found, enabling toxins to be made into more suitable compounds through acids and enzymes. The vinegar causing bacteria, *Acetobacter* have found to be good for degrading glyphosate.

Soil contaminated by glyphosate in the process of being being rehabilitated using IMO at the WWFRF orchard in Mt. Vernon, WA

Biomimicry

-Biomimicry is the design and production of materials, structures, and systems that are modeled on biological entities and processes.
-Examples include velcro and using slime molds to design transit systems.
-A large part of permaculture food forests philosophy comes from the orchards of Fukuoka, where he incorporated many vegetables, herbs, vines and animals in amongst his citrus trees.
-Similarly the farm of John Hershey was a great example of integration in the book *Tree Crops, A Permanent Agriculture*
-By working with Nature, we can more effectively learn her secrets, not to exploit, but to share the bounty.

Symbiosis

-Symbiosis is the interaction of different physical organisms in close proximity, typically beneficial to them both.
-These relationships are the product of many eons. Bacteria were the first living things on the planet, and all of our planet's more complex life forms have been living and evolving with them for hundreds of millions of years.
-In our own era, microbes are necessary for many organisms' basic functions, including digestion, reproduction, and protection.

Classification of Soils Based on the Functions of Microorganisms

Disease-Inducing Soils. In this type of soil, plant pathogenic microorganisms such as Fusarium fungi can comprise 5 to 20 percent of the total microflora. If fresh organic matter with a high nitrogen content is applied to such a soil, incompletely oxidized products can arise that are malodorous and toxic to growing plants. Such soils tend to cause frequent infestations of disease organisms, and harmful insects. Thus, the application of fresh organic matter to these soils is often harmful to crops. Probably more than 90 percent of the agricultural land devoted to crop production worldwide can be classified as having disease-inducing soils. Such soils generally have poor physical properties, and large amounts of energy are lost as "greenhouse gases," particularly in the case of rice fields. Plant nutrients are also subject to immobilization into unavailable forms.

Disease-Suppressive Soils. The microflora of disease-suppressive soils is usually dominated by antagonistic microorganisms that produce copious amounts of antibiotics. These include fungi of the genera Penicillium, Tricho-derma, and Aspergillus, and actinomycetes of the genus Streptomyces. The antibiotics they produce can have biostatic and biocidal effects on soil-borne plant pathogens, including Fusarium which would have an incidence in these soils of less than 5 percent. Crops planted in these soils are rarely affected by diseases or insect pests. Even if fresh organic matter with a high nitrogen content is applied, the production of putrescent substances is very low and the soil has a pleasant earthy odor after the organic matter is decomposed. These soils generally have excellent physical properties; for example, they readily form water-stable aggregates and they are well-aerated, and have a high permeability to both air and water. Crop yields in the disease- suppressive soils are often slightly lower than those in synthetic soils. Highly acceptable crop yields are obtained when-ever a soil has a predominance of both disease-suppressive and synthetic microorganisms.

Zymogenic Soils. These soils are dominated by a microflora that can perform useful kinds of fermentations, i.e., the breakdown of complex organic molecules into simple organic substances and inorganic materials. The organisms can be either obligate or facultative anaerobes. Such fermentation-producing microorganisms often comprise the microflora of various organic materials, i.e., crop residues, animal manures, green manures and municipal wastes including composts. After these amendments are applied to the soil, their numbers and fermentative activities can increase dramatically and overwhelm the indigenous soil microflora for an indefinite period. While these microorganisms remain pre- dominant, the soil can be classified as a zymogenic soil which is generally characterized by a) pleasant, fermentative odors especially after tillage, b) favorable soil physical properties (e.g., increased aggregate stability, permeability, aeration and decreased resistance to tillage), c) large amounts of inorganic nutrients, amino acids, carbohydrates, vitamins and other bioactive substances which can directly or indirectly enhance the growth, yield and quality of crops, d) low occupancy of Fusarium fungi which is usually less than 5 percent, and e) low production of greenhouse gases (e.g., meth- ane, ammonia, and carbon dioxide) from croplands, even where flooded rice is grown.

Synthetic Soils. These soils contain significant populations of microorganisms which are able to fix atmospheric nitrogen and carbon dioxide into complex molecules such as amino acids, proteins and carbohydrates. Such micro- organisms include photosynthetic bacteria which perform incomplete photosynthesis anaerobically, certain Phycomycetes (fungi that resemble algae), and both green algae and blue-green algae which function aerobically. All of these are photosynthetic organisms that fix atmospheric nitrogen. If the water content of these soils is stable, their fertility can be largely maintained by regular additions of only small amounts of organic materials. These soils have a low Fusarium occupancy, and they are often of the disease-suppressive type. The production of gases from fields where synthetic soils are present is minimal, even for flooded rice.

from: BENEFICIAL AND EFFECTIVE MICROORGANISMS for a SUSTAINABLE AGRICULTURE AND ENVIRONMENT
Dr. Teruo Higa, Dr. James F. Parr International Nature Farming Research Center Atami, Japan 1994

Nature Farming combines ancestral fermentation with the myriad insights we have gained since Anton Von Leeuwenhook invented the microscope.

Pathogens

While pasteurization may have been a breakthrough, the antibiotic approach has arisen from Germ Theory, when many infections are a sign of deeper imbalance.

Oppurtunists

A lot of microbes are fairly neutral and some pathogens are benign until conditions change, which is in line with Bechamp's Terrain Theory.

Mutualists

The difference between eubiosis or dysbiosis is often based on the presence of probiotics as well as providing food for them.

Cover crops, Mulching, No-Till

-The main premise of nature we see outside of deserts, is to keep soil continuously covered, pumping exudates into the ground, building soil that started with the lichen weathering rocks. The only ecosystem we see barren earth on is in modern settings such as in Industrial Agriculture . Fukuoka believed all deserts are manmade, or at least heavily exacerbated by our practices as in the case of the once Fertile Crescent. Cover crops not only prevent erosion, they keep the biology present, some of which only exist in the presence of roots.
-The second best option is to mulch with whatever material is at hand, be it leaves, straw, ramial woodchips, or other assorted options. The mulch holds water in, and opens up porosity as worms feed on decaying matter, in turn followed by rodents tunneling, naturally improving the aeration and structure of the soil as well as infiltration and storage of water. Alternately it can keep the soil warmer in winter, and cooler in summer.
-By not tilling we maintain the aggregate structure generated by the complex associations of fungi and roots. Over seven pounds of soil is lost for one pound of wheat grown in some conventional settings.

Pattern Languages

Christopher Alexander author of *A Pattern Language* and *A Timeless Way of Building*, talks about Quality Without A Name, as the Quality that can be named is not the true Quality. Ancient systems thinkers like Lao Tzu wrote the Tao Te Ching to help explain the paradoxes of water to that of human civilization. If you look at the translation from Chinese into English of the word Order, it's not arranging everything into neat, little boxes ala Cartesian paradigms but instead refers to the markings of Jade. The way rivers flow, trees grow, clouds show, children know, results from being connected to a little bit of everything and if you take a small segment of the whole it appears to be "chaotic" but that chaos is actually the true fabric of the improbable nature of the world. The Eastern Alchemists used Feng Shui and Astrology to map out their environment. The Western Alchemists referred to the Lingua Universalis, the Green Language or Language of the Birds. Part of the Quest for comprehension of the totality of existence was to find how God/Nature/Universe spoke. The I Ching has 64 hexagrams and DNA has 64 codons. Coincidence? I think not! DNA itself is the master pattern language of Life, being able to metamorphosize into myriad forms. To learn pattern languages helps to read the land, read the plants, and to synchronize our own Chi flows with our surroundings. Principles of emergence, recursion and fractality define the patterns we inhabit everyday, and to quote Buckminster Fuller, "I appear to be a Verb." Bucky also coined the term synergistics, as the patterns as a whole create more than the individual sum of the parts.

Psychobiotics

The definition of a psychobiotic is a living organism capable of causing positive changes in mental health when ingested in adequate amounts. Many probiotic, fermented foods meet these qualifications. So if the vision of Mokichi Okada is fulfilled and we are all eating nutrient dense food that is also spiritually nourishing, what are some of the results? “Food and medicine are not two different things, they are the front and back of one body.”-Masanobu Fukuoka. Our stomachs are like the plant roots in that our microbiome feeds us through a combination of pre-digestion and fermentation, which produces secondary metabolites along the way, be it plant growth hormones or neurotransmitters. In the case of our mammalian nervous systems, various things fed to us via our gut brain axis include the majority of our serotonin, GABA, dopamine and other important modulators of our psyche. The realm of nutritional psychiatry is just starting to realize the therapeutic potential of our symbiotes, but like in other parts of nature farming, the prebiotics are just as important as the probiotics to create synergy. The more diverse sources of fiber we consume, the better environment we create for the bacteria and fungi that keep us in eubiosis instead of dysbiosis. Eventually we may return to what I call the Neanderthal Level! Soil Health=Gut Health=Nervous System Health

By harnessing the awesome power of microbial fermentation, soils can be restored much quicker. With healthy soils, we will have healthy humans. As Fukuoka said, “The ultimate goal of farming is not the growing of crops, but the cultivation and perfection of human beings.”

Food Sovereignty

A term coined by La Via Campesina in 1996. With soils providing all the essential minerals into crops and livestock, we will be less reliant on imported foods.

Bioregionalism

By adapting these methods to any locale, nature farming provides the versatility that is needed to heal relationships with our watersheds.

R̄eturning farming to farmers

Using homemade microbes from the local environment, we increase adaptivity to changing conditions far faster than when things are removed from nature and grown in a lab.

Learning to ferment biostimulants and bionutrients, we are able to alchemically transform waste and weeds into powerful, fast acting preparations for vigor and strength.

Plant based herbal remedies can help rectify the symptoms of imbalance in the form of insect damage or fungal pathogens, while still striving to deal with root causes. Companion planting can encourage predatory insects.

Current Generation

In the current era we have many to thank for spreading knowledge such as Rei Yoon of SARM Soil and Soul Society (www.sarm.guru); Steve Diver longtime researcher, consultant and speaker; John Kempf of the Regenerative Agriculture Podcast and Advancing Ecoagriculture (www.regenerativeagriculturepodcast.com); many of the researchers and distributors of EM such as the Effective Microbes Research Organization(www.emrojapan.com) and their US distributor, Teraganix; Christine Jones researcher, lecturer, scientist (http://amazingcarbon.com/); Michael Philips, author, speaker, holistic orchardist (www.groworganicapples.com); Cho's Global Natural Farming India and CGNF-Hawaii(www.cgnfindia.com); Dr. Elaine Ingham (www.soilfoodweb.com); Eric Drake Weinert of the Pure KNF Foundation and admin of the Korean Natural Farming group (www.naturalfarminghawaii.net); ; Alan Adkisson of the Probiotic Farmers Alliance and founder of Grokashi(www.facebook.com/groups/526778890711264/); Chris Trump (www.naturalfarming.co); Youngsang Cho and JADAM(www.jadam.kr)and of course all the wonderful permaculture, biodynamic, and permadynamic bioculture teachers and farmers!

Conclusion

We have to change our present system. Cognitive dissonance can be replaced with cognitive consonance. Planned obsolescence can be rejected for fractal symbiosis. As it is now, Biophilia appears to be a learned trait in the modern era. By looking holistically at our current multitude of crises, we can simultaneously address many problems at once with simple solutions offered by our microbial allies. Stacking functions we can reverse the spread of deserts, garden mountains, clean rivers and farm oceans. Nature Farming is one path up that mountain.

Peter Jackson
www.cascadiannaturalfarming.org