

Chlorella is now regarded as a synonym for health food. However, do you really know about chlorella? Our "Chlorella Library" provide basic knowledge and related information about chlorella.

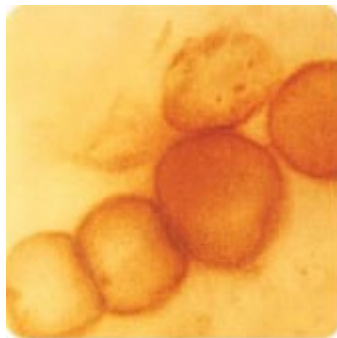


540 million years of memories remembered in Chlorella's genes

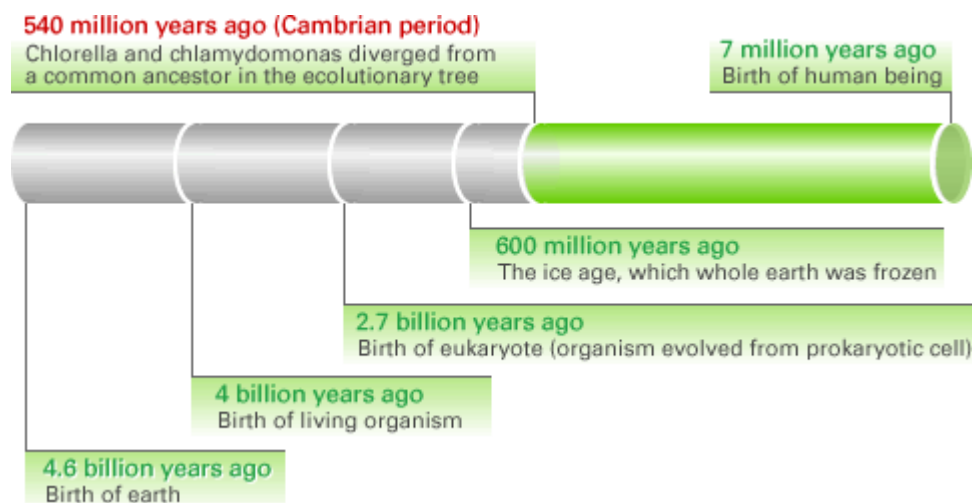
-Fascinating plant raised by sunshine and water-

Chlorella — a gift from nature in ancient time.

Chlorella is attracting widespread popularity today as a basic health food and it has an extremely long history. It is said that it is 4.6 billion years ago that earth came into existence, and 3.5-3.8 billion years ago that organisms first came into existence on earth. It was over 2 billion years ago during the pre-Cambrian period when eukaryotic cells, which belong to the same family as Chlorella first came into existence on earth. This is demonstrated by chlorella-like fossil excavated from a stratum from the pre-Cambrian period. From the latest gene analysis of Chlorella, it turned out that it was 540 million years ago that Chlorella and Chlamydomonas diverged from a common ancestor. Since then, chlorella has survived every convulsion of nature in the long history, and remained unchanged until today.



Pre-Cambrian Chlorella-like fossil



Why could chlorella in the long history survived every convulsion of nature and remain unchanged until today? The first reason is that chlorella is so small with 3 to 8 micrometers in diameter, and also covered by tough outer cell wall protecting in the

internal organs from environmental changes outside. The second reason is that it has rapid reproductive ability. There are two ways in reproduction of creatures, one is sexual reproduction and other is asexual reproduction. Chlorella is asexual reproducible plant. It divides four times every 20-24 hours. One cell reproduces 4 new cells the next day, and 16 cells the day after... Chlorella has kept reproducing since over 2 billion years ago.

Chlorella widely watched as a saviour of food shortages

The 1930s

Chlorella researched worldwide
as future food source

It was only 100 years ago from now, the end of 19 century, when human beings discovered live chlorella. Chlorella was first discovered by a Dutch microbiologist, Dr. Bilink. At that time, chlorella was named after "chlor" which means green and "ella" which means a small thing. At the very end of the 1930s, Dr. Lidner in Germany reported that chlorella contains a volume of protein of good quality, and it caused a sensation in the world. Then many researches on chlorella were performed in the world under an idea that chlorella could be useful as future food source

After World War II

Chlorella reserched as
space food

Although the researches were interrupted during World War II, the studies were resumed after the war. In the U.S and the former U.S.S.R, they investigated Chlorella as a sp ace food, and began to cultivate it. In Japan, in order to resolve the food insecurity after defeat in the war, the research on full-scale culture of chlorella was started suggested by Carnegie Research Laboratory. However, the interest in Chlorella had gradually vanished due to the low harvesting efficiency and high cost as well as bumper crop of rice.

The 1960s

Chlorella growing as a
synonym for health food

Later on, being recognized its health effects, chlorella attracted attention again. In the middle of the 1960s, chlorella came into the world market as health food, and became

popular in the 1970s. Since then, its market has been growing as a synonym of health food.

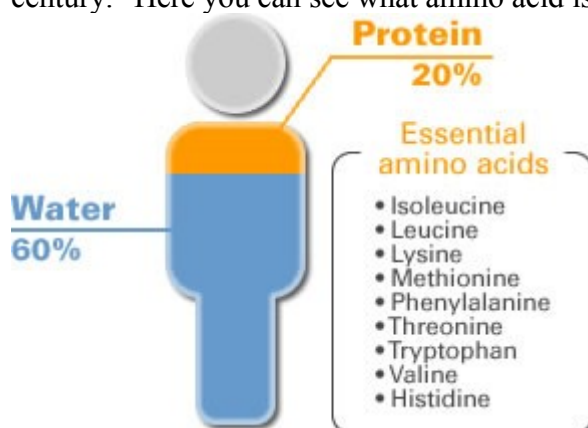


Chlorella is a mine of amino acids (1)

- Indispensable nutrients for life support -

What is amino acid?

Today amino acid often becomes a hot topic of conversation. Various effects of amino acid on physical strength, diets or beauty are attracting lots of attention. Recently its functions have been belatedly discovered, and it has been called "the nutrients of 21st century." Here you can see what amino acid is.



80 percent of human body is composed of water and protein. It is 20 kinds of amino acids that constitute the protein. Our brains, organs, muscles, and nerve transmitter substances are produced depending on combinations of amino acids. 9 kinds among 20 kinds of indispensable amino acids are not produced into body, so they are called "essential amino acids" because they need to be taken from daily diets. Amino acids are contained in protein of meats, fishes, and eggs, but the types and amounts differ from each other.

Therefore, taking enough essential amino acids over protein is a key to good health. If you find yourself losing energy to do something, getting tired easily, or having hard time to get over from cold, you may not have enough amino acids. The most important thing is to take all 9 kinds of essential amino acids properly. Nutrients like amino acids work at the lowest level in accordance with a nutrient with the smallest amount, so they do not work effectively if any of them lacks. Amino acid does not come short as long as you have a balanced diet, however, it is one of the most important nutrients for modern people who tend to take unbalanced diets in the diversified lives.

Chlorella with an excellent composition of amino acids

Amino acids Per 100g Chlorella Per 30 tabs. Chlorella Essential
Amino Acids Isoleucine 1990mg 119.4mg Leucine 4320mg 259.2mg Lysine 3430mg
205.8mg Methionine 1280mg 76.8mg Phenylalanine 2360mg 141.6mg Threonine

2530mg 151.8mg Tryptophan 1030mg 61.8mg Valine 2910mg 174.6mg Histidine
1080mg 64.8mg Nonessential
Amino Acids Cystine 730mg 43.8mg Tyrosine 1980mg 118.8mg Arginine 3080mg
184.8mg Alanine 4320mg 259.2mg Aspartic Acid 4700mg 282mg Glutamic Acid
6180mg 370.8mg Glycine 2960mg 177.6mg Proline 2370mg 142.2mg Serine 2060mg
123.6mg



Chlorella is a mine of amino acids (2)

- Amino-acid power for health in the public limelight -

Amino-acid power for health.

Besides the fact that amino acids form a human body, new research reveals that they have various important functions for a body. 20 kinds of amino acids function in the body with their distinctive functions. Amino-acid power is now introduced on TV and magazines, and attracting public attention. Top athletes take amino acids intensively to improve physical strength, and women take some supplements for their diets and beauty. The expectations for amino acids are growing stronger. In addition to taking amino acids, it is necessary to perform aerobic exercise if you are on a diet, or to try to avoid UV ray if you wish to produce beautiful skin.

Collagen made from amino acids

There is another reason that amino acids are widely watched. The reason is that amino acids are components for collagen. Collagen is connective tissue that covers one third of the body, and has strong elasticity in form of braids. However, if collagen cannot be produced as needed due to lack of amino acids, collagen will loose gradually and the elasticity will be worn out. This may cause wrinkles. Also, buttocks and breasts come down by the gravity. Not only skin but also bones and internal organs are covered with bone collagen. When people attain old age, they reduce their food intake and lose gastrointestinal function. Therefore, they need to contrive ways how to take amino acids.

Keeping a balanced diet is a basis



Essential amino acids cannot be produced in the body, so they need to be taken from food directly by mouth. People used to take amino acids without regard to it because they had balanced diets. However, lately many people seem to bring on a lack of amino

acids because of their unbalanced diets that come from prioritizing their food preferences and conveniences. In this case, how about taking your daily diet with chlorella, which contains plenty natural amino acids and vitamins and minerals in a balanced manner?

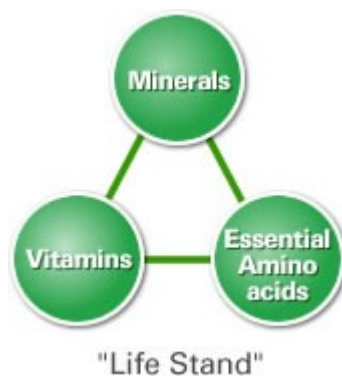


Chlorella as whole food (1)

- Lesson from a diet regimen -

Nutrients work in cooperation with one another keeping a balance as a team

An American biochemist, R. J. Williams (the former chairman of American Chemical Society) who is known as the discoverer of pantothenic acid, brought up a new important guiding concept for dietetics in his great book "Nutrition Against Disease" published in 1971.



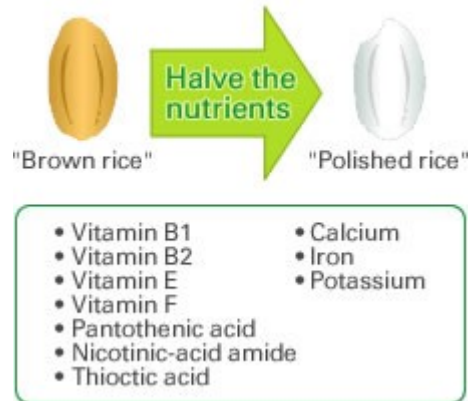
All nutrients such as vitamins, minerals and essential amino acids work in cooperation with one another keeping a balance as a team. They are like a necklace connected with a strand, so-called "Life Strand", and if any one lacks and any part gets thin, the strand will break easily. This means that all nutrients are important, and there is no rank relationship in value between them. Also, it is said that taking too much of certain nutrients collapse the whole balance and weaken power that human beings have by nature to maintain their health (constancy retention, active force and natural healing power).

Research and development of dietetics are undertaken at quite a pace even now. However, it is said that in there is a linkage effect (life force) that has not yet been figured out in all natural food.

In a diet regimen, "eat bones/rind and all" whether fish or vegetables

In a diet regimen, it emphasizes the need to eat bones/rind and all whether rice or oats, whether fish or vegetables, and not to eat the prime cut. Lives whether they are animals or plants keep an internal harmony and balance. Because of this, if you eat the whole, you can absorb necessary components in full measure to metabolize nutrients (to break down, produce and store nutrients) or keep balance.

[Lost nutrients in rice polishing]



It is often said that polished rice is just lees, and hearty components (sugar) are contained in brown rice. Actually when brown rice is milled, large part of fiber, which is effective against cancer, heart disease, diabetes, vitamin B1, vitamin B2, pantothenic acid, nicotinic-acid amide, thioctic acid, vitamin E, vitamin F are removed. Calcium, Iron and potassium are also reduced by half. When Japanese people eat meat, they only eat a fillet. However, in Chinese cuisine or Asian and European folk cuisine they use an entire body from head to tail of pig, goat and chicken. In this way, they could absorb evenly all components that constitute a life. Even in Japan, people used to eat bones/rind and all contriving ways to cook. In these modern days, not many people eat in whole due to their food preferences and conveniences and problems such as dioxin pollution.

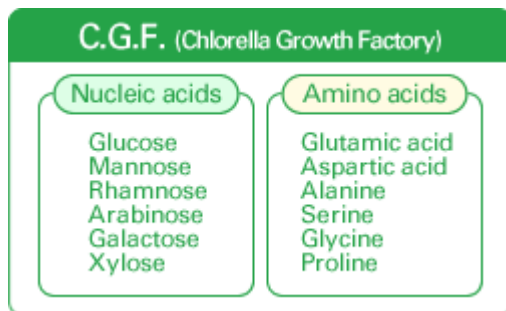
Chlorella fulfills the conditions of the whole food best among a wide variety of foods. The smaller are foods, the more they are likely to be used in whole. Spotted shrimps, firefly squids and ocellated octopuses are examples among many. Almost everyone eats the whole in a moment. Chlorella is only 3 to 8 micrometers in diameter. Infinitude of lives overlaps one another even in a little amount of chlorella. Elements that are necessary for harmony and balance of all lives are contained plentifully and in a well balanced.



"C.G.F." - a component contained only in chlorella

It is known from a long time ago that certain parts of plants at certain times contain active substance that promotes differentiation and proliferation (physiological phenomena) of organismic plants. The cell of chlorella, which is a kind of plants also includes unique growth accelerator factor called "C.G.F. (Chlorella Growth Factor)." While animals including human beings and plants multiply their cell by binary fission, chlorella divides its cell into four every 20 to 24 hours, and has tremendous life force. It is said that this involves the C.G.F. deeply. The C.G.F. is identified only in chlorella, and a rare substance. Unfortunately, the research has not entirely shown what kind of

structures C.G.F. has or what kind of constituents work, however the following constituents the C.G.F. has are revealed.



Structurally it is a complex of nucleic acid including sulfur and amino acid. The sugar part of nucleic acid is formed by glucose mainly and others such as mannose, rhamnose, arabinose, galactose, xylose, and also amino acid composition of peptide is formed by glutamic acid, asparagine acid, alanin, serine, glycine, proline. These constituents are considered to work synergistically.

C.G.F. content depends on species of chlorella



**PT. Sun Chlorella
Indonesia Manufacturing**
Outdoor culture with the blessing of
plenty of solar energy

There are many species of chlorella, and the C.G.F. content entirely varies depends on species and culture method. Chlorella pyrenoidosa has the largest amount of C.G.F. than other species, and chlorella cultured outside under full exposure to sunlight has larger amount of C.G.F. than one cultured in tank from the aspect of culture method.

Certainly the tank culture has the advantage of being able to control temperature of culture solution and nutrients, prevent contamination, and increase the concentration of chlorella in culture solution. However, chlorella cannot photosynthesize, and the chlorella harvested differs from chlorella cultured outside from the standpoint of its constituent because it is tank-cultured in a dark place. This is similar to the way vegetables under garden farming differ from in greenhouse in taste and nutrients.

Difference between chlorella and spirulina

Chlorella significantly draws a line between other green foods such as spirulina because chlorella contains C.G.F.. It would not be an exaggeration to say that C.G.F. that

promotes growth of cell and maintains health of organism is the most valuable ingredient in other active substances in chlorella.



Tough cell wall for protecting chlorella

- Pulverized cell wall technology proprietary developed -

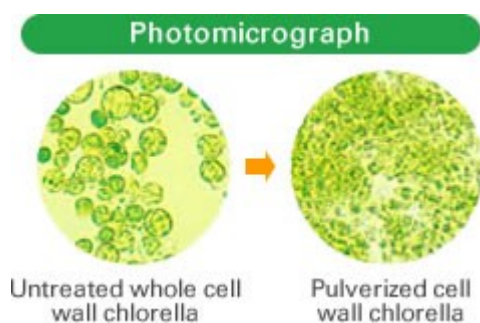
Cell walls inhibit digestion and absorption of nutrients

Covered by the tough cell wall, chlorella has kept its delicate life form at the micro level for 540 million years. We can receive the benefit of the abundant nutrients of chlorella now because of not only its highly proliferation potency but also the firm cell wall.

The cell wall of chlorella is mainly made of cellulose. However, human body doesn't have "enzyme cellulase" that can digest cellulose. Therefore, approaching chlorella from health food field, the tough cell wall of chlorella is nothing more or less than a fatal barrier that block digestion and absorption when taken into human body.

Pulverized cell wall technology that improved the digestibility

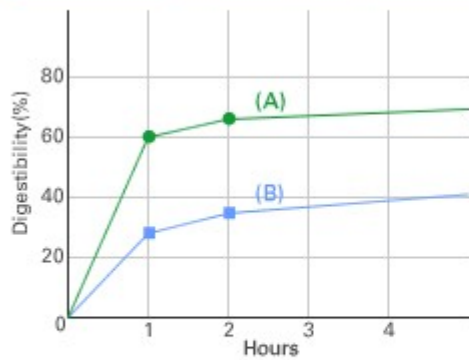
Our proprietary technology of pulverize chlorella's cell wall has achieved a dramatic improvement in digestibility. This cell wall pulverization technology is proprietary, an ideal physical method in accordance with the natural law, not using any chemicals, enzymes, or heat.



The technology applies the DYNO-MILL used for manufacturing of powdered milk in Europe and America. When chlorella is rotated by the DYNO-MILL at high speed, a vertical interval of atmospheric pressure arises inside the mill. This pressure difference enables to pulverize almost 95% of cell wall which firmly covers chlorella.

Compared with the difference in digestibility between the chlorella manufactured by the existing methods (a method that cracks the cell wall by heat so-called the branching method, or a method that dissolves fibers by enzyme) and the pulverized cell wall chlorella, the digestibility of the pulverized cell wall chlorella improves dramatically as the diagram indicates below.

Chlorella Digestibility Comparison



● Pulverized cell wall chlorella (Sun Chlorella 'A')
■ Heat treated (blanched) Chlorella
 Research done by Kyoto University, Dept. of Food Science & Technology.

Process patent for ruptured cell wall chlorella



Japanese patent
No.3143636

U.S. Patent
No.5330913



Chlorella contributing to global environment
 -Great expectations on chlorella to reduce the amount of CO2 on the earth-

Another possibility of chlorella

We have mentioned about chlorella as health food so far, but this time we would like to talk about a surprising usage of chlorella. Chlorella is utilized to protect not only human health but also the whole earth we are living. Global warming is rapidly increasing, and the measures are discussed on a worldwide basis. Under the circumstances, it is discovered that chlorella has a capability to absorb CO₂, which causes the global warming, more than 10 times as much as other ordinary plants do. Chlorella, which generated oxygen and produced the prosperity of creatures in the former times, is now saving the earth facing the human-driven crisis.

PGlobal warming



In November 2004, the issue of Kyoto Protocol on global warming became reality when Russia approved ratification. Global warming is a phenomenon that globe's average temperature heats up due to the increase of amount of greenhouse gases such as carbonic anhydride caused by high usage of chemical fuel after Industrial Revolution in 18th century. When the global warming progresses, seawater will expand and glacier will melt. As a result, sea levels will rise and many shores will be submerged. Or such big changes of global climate will cause extreme weather in many places. To prevent the global warming, not only a country but all countries must tackle this problem together.

Project to reduce CO₂ by chlorella

To reduce CO₂ concentration, that is the main factor of earth warming, is one of the great challenge for 21st century. Today various basic studies related to this subject are undergoing. "The Project for Biological Fixation and Utilization" by Research Institute of Innovative Technology for the Earth (RITE) is attracting attentions as one of the innovative environmental technologies. This project optimizes the activities of bacteria and micro algae in freshwater or seawater to absorb CO₂ into their bodies by photosynthesis. This is a big project trying to reduce CO₂ by using photosynthetic activities of bacteria and micro algae.

Chlorella is playing an important role in this project. Chlorella that can fix CO₂ in high-efficiency has already been discovered. Because chlorella can fix CO₂ with over 10 times of photosynthetic efficiency than that of the ordinary plants, it might be no longer a dream that it reduces CO₂ 10 times as much as forests do. In this way, chlorella is helpful not only for one's health but also preventing earth warming and recharging the health of earth.



Chlorella and the 21st century

-Possible benefits of chlorella-

Idea of healthy life expectancy for the 21st century

According to the World Health Report 2002 by the World Health Organization (WHO), the average of "healthy life expectancy" in Japan was 73.6 years old, which was No. 1 in the world. The "healthy life expectancy" means the length of life people can spend in good health. WHO advised that it could extend by 5 years longer if Japan works on the improvement of "10 biggest risks" that threaten their health such as smoking or hypertension. The "healthy life expectancy" is calculated by deducting the period that someone is very sick or injured from the average length of life. In Japan, it is 71.4 years old for men and 75.8 years old for women, and both have been No. 1 for 3 years in a row out of 191 members of WHO.

However, the average of Japanese life expectancy in 2001 was 81.5 years old, while the average of its healthy life expectancy was 73.6 years old. This 8 years difference is the period that people cannot live in good health, in short, one cannot live on one's own, being in bed and in need of care. During this period, big burden will rest on oneself and his/her family, too. To extend the healthy life expectancy will be a big challenge for the nation and individuals.

The medical care system will also change dramatically. The individual payment of medical expenses has been increased by 30% since April 2003, and it is expected to rise up to 50% in near future. The nation is no longer responsible for all of the medical services. Also, we cannot rely on doctors any longer. The existing medical care is focused on diagnosing and treatment, but it will be important to think about health comprehensively including healthcare and prevention. We cannot depend on other people about healthcare and prevention, so we need to be responsible for our own health. From this aspect, health information is overflowing in the fitness boom these days. What should we sort out from these too much information?

Possible benefits of chlorella



Various factors can be thought to damage human health. However, the loss of nutritional balance caused from unbalanced diet, lack of exercise, and dioxin and pesticide residues are major factors of sickness in today. Because of them, the body functionality (homeostatic retentivity, active force and natural healing power) decrease, and various symptoms will appear. Even if symptomatic treatment improves the symptom, it will recur if fundamental factor of the disease is not solved.

As already has explained through Chlorella Library, chlorella makes up for nutrients, and C.G.F. (Chlorella Growth Factor) contained only in chlorella comprehensively works to maintain our natural-born health.

We often receive questions on what disease chlorella works. As already mentioned, chlorella does not affect to certain disease directly. It is necessary for anyone to take food that contains various constituents in the right balance. Any people who are healthy, sick, pregnant, and children can take it. This is the difference from medicine. Even if you get sick and fully recovered after treatment, you cannot be assured. You need to think why you became sick, and how your health condition was. You will not achieve a real health unless you improve the underlying cause of disease. There is no doubt that chlorella will become a big supporter of you who needs self-medication.