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Algae Opens Door To Producing Healthier Food

by Stacy Kish, CSREES

Genes and proteins from a common ancestor, which were lost to plants and animals as they evolved, are retained in *Chlamydomonas*, tiny green algae that live in ponds and soil. Understanding the genome of *Chlamydomonas* may have powerful implications, not only for understanding and treating human disease, but also for discovering new ways to remove natural limitations imposed on agricultural productivity. >>

Current studies with *Chlamydomonas* provide insights into how plants cope with limited nutrients and fight off the potential damaging effects of high intensity sunlight.

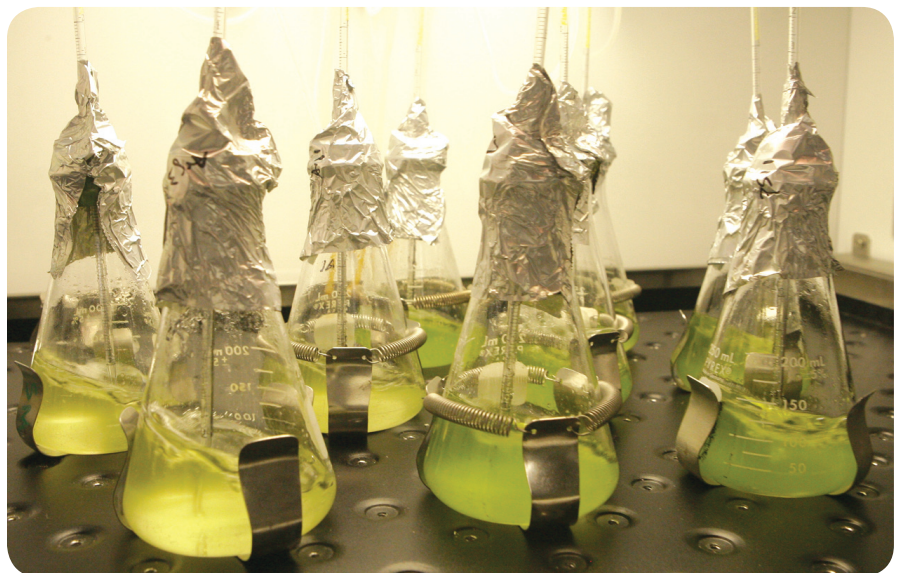
An international team of scientists, including members from the United States, France, China, Japan, Germany and Australia, compared the complete genome sequence of *Chlamydomonas* to similar organisms that also contain chloroplasts, the organelle where photosynthesis takes place inside the cell. The comparison led to the discovery of over 200 new proteins that the scientists believe are involved in chloroplast functions for all green plants.

The chloroplast, which is the site of photosynthesis in green plants, is also the production site for vitamins, amino acids, and starches. Many of these products are created to protect the plant, but have also been found to be beneficial to humans.

Photosynthesis produces powerful oxidizing agents that destroy cells. In order to protect itself, the chloroplast produces anti-oxidant compounds. The team of scientists believes that some of the newly identified proteins are critical for controlling the synthesis of these compounds.

The presence of anti-oxidants, such as vitamins A, C and E, are

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Right: *Chlamydomonas*, in Professor Sabeeha Merchant's UCLA laboratory.

Credit: Reed Hutchinson/UCLA

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Above: Professor Sabeeha Merchant UCLA.
Credit: Reed Hutchinson/UCLA

beneficial to plant and human health alike. The results of the study will help scientists naturally engineer plants to boost their nutrient value for humans. By manipulating the chloroplast, scientists may be able to enrich plants in essential vitamins, like A and E, as well as proteins and starches. In addition, boosting the production of antioxidant compounds may result in plants that are more tolerant of environmental stress, like low soil nutrients and drought.

Scientists now know 95 percent of the sequence of the *Chlamydomonas* genome, which contains more than 15,000 genes.

“It’s like having a dictionary of genes,” said Sabeeha Merchant, University of California-Los Angeles professor of biochemistry. “We know the words, and now we want to learn to talk. Each of us is trying to learn how to put the words and sentences together in our own research programs.”

Other newly identified proteins have been associated with the cell’s flagella, also called cilia, which are required for movement and sensing conditions in the surrounding environment. Humans affected by kidney, eye and brain diseases (ciliopathies) often contain mutated versions of the important proteins. Further understanding of the cilia may lead to innovative, new treatments of these diseases.

Scientists have also discovered that ciliary function is involved in obesity, but they do not yet understand the molecular connections.

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This research opens many doors of discovery to improve human health. It allows for research on the production of foods that are tolerant to stressed environments, providing a food source in hostile agricultural lands. It expands on research to make food products healthier and enriched in nutrients necessary for human health. Finally, it may lead to new insight into human disease and prevention.

The results of this research study are presented in the October 12th issue of the journal *Science*.

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