A Billion Years of Starvation

The question of what caused bacteria to evolve into single-celled plants and animals—which they did more than a billion years ago—has long puzzled scientists. Now geologists from Oxford and Canberra claim to have evidence to bolster one intriguing theory: that prolonged nutrient deprivation forced simple organisms (prokaryotes) to cooperate and gradually merge as complex eukaryotic organisms.

The time between 2 billion and 1 billion years ago has been described as "the dullest period in Earth's history," with little going on geologically, climatically, or biologically. But because a lack of geologic activity meant that the oceans contained little erosion-generated phosphorus—the fundamental "biofuel" of the time—the stage was being set for the most momentous chapter in biological evolution, argue Martin Brasier of the University of Oxford and John Lindsay of the Australian Geological Survey in Canberra in the June issue of *Geology*.

The scientists did their study in an area of Northern Australia near the Gulf of Carpentaria where ancient oceans left a 6-kilometer-thick succession of limestone sediments. They measured carbon isotopes—which reflect total biological matter produced and buried in the oceans—at 10-meter intervals through 1.5 billion years of limestone and confirmed what others have inferred from the fossil record: a prolonged period of biological stasis. Brasier and Lindsay argue that the shortage of phosphorus, which is abundant only in younger rocks, pushed bacterial life into symbiotic associations which in turn developed into more complex cells with nuclei—the ancestors of today's plants and animals.

The idea that "long-term geological events [that kept phosphorus scarce] drove the evolution of eukaryotes" has been floating around for some time, notes geochemist Julie Bartley at the University of West Georgia, Carrollton. But, she says, "this is the first good database to support the notion of nutrient deprivation as the driving force."

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Close-up of *Daphnia*'s head showing green gut.

Green Strategy for Water Flea?

Turning light into energy isn't a strategy used only by plants. Dozens of animals, including sea slugs and giant clams, adapt to meager environments by engulfing and modifying tiny photosynthesizing plants, such as blue-green algae. Now scientists may have identified the first arthropod player in the photosynthesis game: the water flea, a transparent crustacean called *Daphnia obtusa* that thrives in nutrient-starved ponds.

Gut samples from *Daphnia* living in shaded, temporary ponds that support little phytoplankton or oxygen have revealed what look like chloroplasts, the chlorophyll-containing parts of plant cells that convert photons to chemical energy. By comparison, *Daphnia* collected from a sunny, year-round farm pond have much fewer such structures, reported ecologist David Jenkins and physiologist Nada Chang of the University of Illinois, Springfield, at the June meeting of the American Society of Limnology and Oceanography/Ecological Society of America in St. Louis.

The scientists speculate that *Daphnia* in temporary ponds absorb—rather than digest—algal chloroplasts. Now they are trying to determine if these structures act like chloroplasts, fixing carbon to supply *Daphnia* with the sugar or oxygen it can't get from its environment. Says Paul Hebert, an aquatic biologist at the University of Guelph in Ontario, "Maybe these organisms are smarter than we thought."

Combating Student Torpor

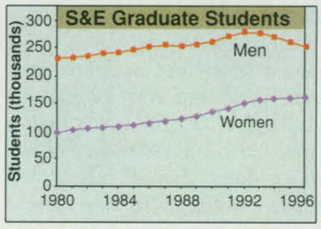
Snoozing through algebra class may not be a capital crime, but it is now mobilizing action on Capitol Hill: On 24 June, Representative Zoe Lofgren (D–CA) introduced a bill that would grant any school district in the United States $25,000 to rearrange high school schedules so kids can sleep later.

It's not just sex, drugs, and rock 'n' roll that lead to teen morning drowsiness, according to scientists who appeared at a Capitol Hill press conference. There's also a bona fide biological reason: During puberty, the timing of surges of the sleep-inducing hormone melatonin moves back about an hour from 9:30 to 10:30 p.m. Stanford University sleep researcher William Dement said that because most teens need up to 10 hours of sleep, early rising—many high schools now start classes shortly after 7:00 a.m.—is creating such a problem that it's "not uncommon to look at a high school classroom in the morning and see one-third of the students with their heads on their desks." Making kids go to bed earlier won't work because they won't be able to go to sleep, he said.

But districts that want to delay school face tough obstacles, such as potential disruptions in after-school sports and jobs, as well as increased costs for school buses, which, because of staggered schedules, also transport grade schoolers. Brown University sleep researcher Mary Carskadon related that "a district in Iowa debated the topic for 6 months" before finally agreeing to start the school day 5 minutes later.

Feminizing Science

The gender gap in science and engineering graduate studies continues to narrow, while total enrollments in all major fields except computer science continue a 3-year decline, according to the latest statistics from the National Science Foundation. Enrollment by white males took the biggest hit, falling by almost 7000 students, or 4.5%, between 1995 and 1996. Enrollments by non–U.S. males also went down slightly, while minority and non–U.S. women increased slightly.



Former AAAS Chief Dies

William Carey, former chief executive of AAAS, *Science*'s publisher, died at his home in Washington, D.C., on 24 June at the age of 82. A former official of the Bureau of the Budget, Carey steered the AAAS from 1975 to 1987.