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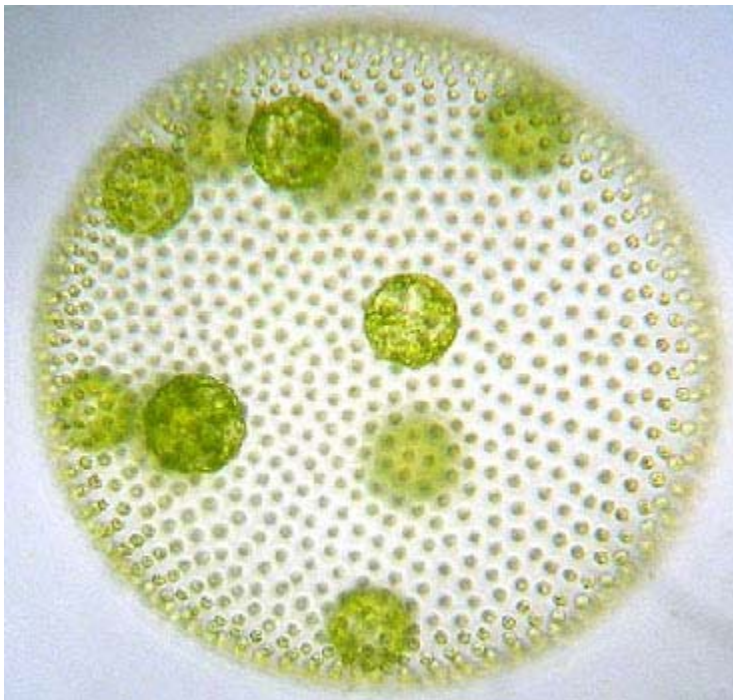
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15 June 2004

Sex Gets Algae Through Hard Times

Some people take vitamins to reduce their exposure to cell-wrecking free radicals. A round alga called volvox protects itself against these rogue molecules through sex. New research finds that free radicals stimulate a gene that prompts the alga to switch from asexual to sexual reproduction. The finding suggests that sex may have evolved to cope with environmental stresses that generate free radicals.



Free radicals, otherwise known as reactive oxygen species, are a byproduct of metabolism. They're produced in cells all the time, but usually cells manage to keep them from doing harm. However, stress can upset this balance, causing free radical concentrations to rise and damage DNA or destroy cells. *Volvox carteri* live in freshwater, reproducing asexually, except when the water gets too warm--then they change to sexual reproduction. Unlike the offspring of asexual reproduction, the fertilized cells have hard cell walls that allow them to lie dormant on the bottom of ponds as they dry out for the summer. Aurora Nedelcu, an evolutionary biologist at the University of New Brunswick, Canada, wanted to know if extra free radicals resulting from the high temperatures had anything to do with this switch.

Stress relief. When faced with an unpleasant environment, volvox ceases to use asexual reproductive cells (darker green) and switches to sexual reproduction.

CREDIT: A. NEDELCU

radicals. When the researchers turned up the heat, the free radical concentration shot up in the first 10 minutes and doubled within 2 hours. By that time, the sex-inducing gene was active and the volvox began making male and female gametes instead of asexual ones, the group reports online 9 June in the *Proceedings of the Royal Society, London, B*. When the researchers added an enzyme that dismantled free radicals, gene activity decreased, a further indication that free radicals were flipping the reproductive switch.

She and her colleagues grew asexual volvox in the lab, where they measured the free radical concentrations by adding a chemical that fluoresces when exposed to free

The advantages of sex are twofold, Nedelcu says. For starters, the resulting hard shell helps the organism wait out the tough times. But perhaps more importantly, it mixes up parts of each gamete's chromosomes and thus can accelerate the repair of DNA damaged by the free radicals.

That's consistent with a somewhat controversial theory that holds that sex evolved as a means to repair DNA damage, she says.

"The assumption that sex is an adaptive response to the damaging effects of stress-induced [free radicals] really makes sense," says Armin Hallmann from the University of Bielefeld, Germany, who thinks the new evidence is compelling. "These ideas bring a breath of fresh air into the studies of sex and stress in these lower eukaryotes."

--ELIZABETH PENNISI

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[Nedelcu's Web site, with more information about volvox](#)

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