Biology

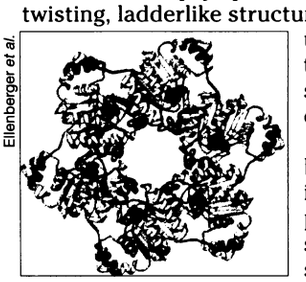
Birth control for breakfast, anyone?

Consider it further testament that there are no free lunches in nature. Small crustaceans called copepods devour diatoms when the microscopic algae bloom in the ocean, but the eggs produced by these satiated copepods hatch less than a quarter of the time. That's a success rate far below the normal 90 percent or so. The reason for the falloff, explain Italian researchers in the Nov. 11 NATURE, is that blooming diatoms produce substances that amount to copepod birth-control pills.

The substances, compounds known as aldehydes, were isolated from diatoms by Antonio Miralto of the Anton Dohrn Zoological Station in Naples, Italy, and his colleagues. The aldehydes seem to inhibit cell proliferation within copepod embryos. The researchers note that copepods have evolved defenses against algae-derived neurotoxins that directly kill them, so it's surprising that the crustaceans haven't kept ahead of toxins that affect their reproduction. "Possibly, the ability to cope with straightforward toxins evolves faster than the response to insidious ones," the investigators speculate. —*J.T.*

Picturing an enzyme that helps DNA unwind

For a cell to copy, repair, or read its genes, enzymes called helicases must pry apart the two joined strands that form the twisting, ladderlike structure of DNA. Investigators trying to understand how helicases unwind the DNA double helix can now study an atomic-resolution picture of one such enzyme.



Ellenberger *et al.*

A helicase.

In the Oct. 15 CELL, Tom Ellenberger of Harvard Medical School in Boston and his colleagues report determining the starlike structure of a viral helicase by shooting X rays through a crystallized version of the enzyme. Investigators hope that such images will provide a better understanding of how a helicase threads one of the DNA strands through its center and then speeds along the molecule. Mutations in the genes for human helicases can cause people to develop cancer or suffer aspects of premature aging, the researchers note. —*J.T.*

His hair today, hers tomorrow

An early Christmas present? In a first-of-its-kind procedure, a woman received a transplant of hair follicles from her husband's scalp. Placed on the wife's arm, the transferred follicles took root and started producing new hair within 3 weeks.

In addition to raising hopes that follicular transplants might aid people suffering from hair loss, the finding, reported in the Nov. 4 NATURE, confirms suspicions that hair follicles enjoy a status called immune privilege, which allows them to be transplanted between unrelated people without the risk of rejection.

Colin A.B. Jahoda and Amanda J. Reynolds, the researchers from Durham University in England who led the work and participated in the unusual experiment, had previously transplanted hair follicles between unrelated mice. In their latest endeavor, they removed bits of follicle-containing tissue from Jahoda's scalp and inserted them into small cuts made on Reynolds' forearm.

Within several weeks, dark, thick strands uncharacteristic of Reynolds' arm hair sprouted from the transplanted tissue. DNA analysis of follicles in the transplant area revealed Y chromosomes, also indicating that they originated with Jahoda. No signs of transplant rejection were observed, the scientists report. —*J.T.*

Biomedicine

Antidepressants increase brain steroids

Prozac, Paxil, Zoloft, and similar antidepressants, collectively called selective serotonin reuptake inhibitors (SSRIs), fly off pharmacy shelves even though scientists continue to argue about how the drugs lift a person's mood (SN:9/25/99, p. 196). The prevailing theory holds that the drugs work by inhibiting a protein that mops up the brain chemical serotonin. In the latest challenge to this view, a new study suggests that SSRIs may relieve depression by boosting the efficiency of brain enzymes that make several steroid hormones.

In the past decade, scientists have found that the brain, using the same enzymes employed by the testes and adrenal glands, produces steroids such as allopregnanolone. Moreover, these neurosteroids don't interact only with traditional hormone receptors deep within a cell. They also bind to some of the cell-surface proteins that receive signals from the brain chemicals known as neurotransmitters, which include serotonin.

The initial connection between neurosteroids and mood came when researchers associated brain concentrations of these hormones with symptoms of premenstrual syndrome (PMS), including depression. Since Prozac sometimes helps women who suffer from a severe form of PMS, investigators began to examine whether the SSRIs alter neurosteroid concentrations in the brain. In both rats and people, according to two recent studies, treatment with Prozac indeed seems to boost the concentration of allopregnanolone in the brain or spinal fluid.

To explore how the antidepressants may bring about this change, Lisa D. Griffin and Synthia H. Mellon, both of the University of California, San Francisco, recently did test-tube experiments to determine whether the drugs interact with the enzymes that make allopregnanolone from its steroid precursors. The SSRIs didn't influence the first enzyme in the steroid-production pathway, but they did enable a second enzyme to work with lower concentrations of the steroid's precursors, the two report in Nov. 9 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

"All this work suggests that there's another component of depression and that one should look at neurosteroids and their abnormal synthesis," says Mellon. In fact, she plans to study whether people with depression have subtle mutations in the genes for the hormone-synthesizing enzymes. —*J.T.*

DNA injections fight tumors in mice

Unlike mammalian DNA, the genetic material of bacteria often contains long stretches in which the cytosine-guanine nucleotide pair (CpG) repeats many times. Much to their surprise, scientists have found that the mammalian immune system can recognize bacterial DNA through this CpG motif. Indeed, CpG DNA serves as a potent stimulus to the immune system, an observation that investigators hope to exploit by adding such DNA to vaccines and other forms of immunotherapy.

A French group now reports that injections of synthesized CpG DNA can eradicate established tumors in mice. Antoine F. Carpentier of the Hôpital de la Pitié-Salpêtrière in Paris and his colleagues implanted human brain-tumor cells under the skin of mice and allowed the cancer cells to grow, a procedure that normally kills the animals. When the team injected synthetic CpG DNA into the tumors of some of the animals, the tumors disappeared in half of those mice and tumor growth slowed in the rest, the investigators report in the Nov. 1 CANCER RESEARCH.

"This group is the first that has directly injected DNA alone into a tumor and shown that you get [tumor] rejection," says Arthur M. Krieg of the University of Iowa in Iowa City. "It's a robust finding. It's real," he adds, noting that several other research groups plan to publish similar results. Physicians have already begun injecting CpG DNA into people with various infections and will soon start tests on cancer patients, says Krieg, a founder of CpG ImmunoPharmaceuticals in Wellesley, Mass. —*J.T.*