Male flies help the females to bank sperm

Long before people had the audacity to freeze sperm for use later, a variety of female insects, reptiles, birds, and even a few mammals evolved the ability to store sperm for periods ranging from weeks to months to years. Investigators have speculated that this odd talent gives sperm more time to compete with one another or allows females to avoid the rigors of frequent mating.

Female animals that hoard sperm often have specialized organs or regions of their reproductive tract devoted to the task. In at least one insect species, however, the male appears to provide critical assistance.

Seminal fluid produced by male fruit flies (*Drosophila melanogaster*) contains, in addition to sperm, a protein crucial to a female fly's ability to retain sperm, report Deborah M. Neubaum and Mariana F. Wolfner of Cornell University at this week's International Congress of Developmental Biology in Snowbird, Utah. The investigators found that after insemination, this protein, called Acp36DE, accumulates in the oviduct near the entrances to the female's sperm-storing organs.

Using a DNA-damaging chemical, the researchers created mutant fruit flies and identified those in which the gene for Acp36DE had been disabled.

Normal females that mated with males of this mutant strain produced 90 percent fewer offspring than usual. A close look showed that after mating with an Acp36DE-deficient male, a female fly typically stored fewer than 50 sperm. Ordinarily, she'd hold onto 300 to 600, says Neubaum.

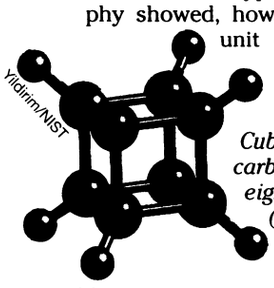
The female flies seemed to realize that they had banked fewer sperm. After a normal initial burst of egg laying triggered by mating, the insects slowed their rate of egg production. When a female has stored lots of sperm, she usually maintains a high rate of production, says Neubaum. The females mated to Acp36DE-mutant males also became receptive to subsequent mating much more quickly than did females that had just mated with normal males.

The investigators are now trying to explain how Acp36DE promotes the stashing of sperm. The mechanism may take advantage of the tight binding observed between the protein and sperm. Alternatively, Acp36DE may simply direct sperm into the female fly's storage areas by blocking the oviduct. "This plug only lasts for a few hours. That's enough time, however, for most sperm to get stored," says Neubaum. —*J. Travis*

Structure puts cubane in a slanted box

Boxes don't get much smaller than this. The molecule cubane consists of just eight carbon atoms bonded together in—as its name indicates—the shape of a cube, with hydrogen atoms at the corners. In the 33 years since cubane was first synthesized, scientists have learned a lot about its chemistry but not as much about its crystal structure.

Now, researchers at the National Institute of Standards and Technology (NIST) in Gaithersburg, Md., and the University of Chicago have determined the structure of solid cubane at high temperatures. The basic unit of the solid at room temperature, determined years ago, is a rhombohedron—"a cube squashed along the diagonals," says NIST's Peter M. Gehring. His team had expected that close to the melting point, the cube-shaped molecules would link to form larger cubes, as they do in other solids of that type. X-ray crystallography showed, however, that the basic unit of solid cubane is again a rhombohedron. The findings appear in the June 30 PHYSICAL REVIEW LETTERS.



Cubane contains eight carbon atoms (red) and eight hydrogen atoms (blue).

Cubane's strained 90° bonds store a lot of energy, so military scientists have tapped it as a potential high-powered explosive. Substituting eight nitrogen groups for the hydrogen, for example, would create a compound twice as powerful as TNT, Gehring predicts. So far, researchers have gotten as far as four substitutions, which make the cubane explosive. Other variations have shown antiviral and antitumor activity.

Solid cubane's structure at high temperatures remained elusive for so long because the compound sublimes readily: Crystals evaporate in minutes if left out on a table. Although sublimation is a "nuisance property," it doesn't generally cause much difficulty, says Chicago's Philip E. Eaton, who first synthesized cubane in 1964. "It's just a matter of putting a cork on the bottle. I still have some of the original samples."

By mixing amorphous carbon with cubane, study coauthor Taner Yildirim of NIST found that he could effectively suppress the sublimation long enough to collect the data needed to obtain the crystal structure. He also modified the crystallography technique to improve the reliability of the results. —*C. Wu*

High blood pressure can shrink the brain

Elderly people with chronic high blood pressure lose tissue from parts of the brain involved in memory and language skills, according to a study from the National Institute on Aging (NIA) in Bethesda, Md.

Meanwhile, other research finds a strong correlation between the number of years a person has high blood pressure and the amount of brain matter lost.

Using magnetic resonance imaging (MRI) of brain tissue and a battery of tests to assess mental skills, NIA researchers compared 19 men and 8 women who had had high blood pressure for nearly 2 decades with 20 healthy counterparts. All volunteers were nonsmokers; none had suffered a stroke. Most of the people with high blood pressure were taking medication before the tests.

Previous research had shown that overall brain tissue loss can stem from high blood pressure (SN: 9/12/92, p. 166) as well as the normal aging process. The new study, in the July STROKE, shows greater tissue loss in the temporal and occipital lobes of people with high blood pressure than in healthy people. These brain areas play key roles in language and memory. The tissue loss occurred even when blood pressure was controlled by medication. Other areas showed less difference between the groups.

Results from tests of mental acuity matched the MRI findings. Although participants fell within the average range for their age group, those with high blood pressure fared worse in recalling word definitions and memorized lists, says project leader Gene E. Alexander.

High blood pressure seemed to exacerbate the effects of aging. The older participants (age 70 to 84) with hypertension had more tissue loss in key areas than the younger ones (age 56 to 69) or the healthy controls in either age group. The older hypertension group also had the lowest scores on the mental tests.

"It's very important to understand how high blood pressure affects the brain so we can find a way to prevent the loss of cognitive function and improve the quality of life in the elderly," Alexander says.

In a study presented at the annual meeting of the American Academy of Neurology in Boston in April, researchers tracking the health of 166 male twins age 68 to 78 found that those who had contended with hypertension over 25 years lost more brain tissue than those with a shorter history of high blood pressure, even though nearly all were using medication in later years. Tests of cognitive function showed corresponding declines, according to Gary E. Swan and researchers at SRI International in Menlo Park, Calif. —*N. Seppa*