Male-female contrasts: The vole story

A stout rodent known as the vole has provided scientists with a peek at how sex differences may evolve in behavior and brain structure.

The hippocampus — an inner-brain structure critical to processing spatial information — takes up a significantly greater portion of the total brain in the polygamous male meadow vole than in the monogamous male pine vole, report biologist Lucia F. Jacobs of the University of Pittsburgh and her colleagues. Females of both species show a hippocampal size closely matching that of the faithful male pine vole, they add.

Breeding male meadow voles range over large areas in search of sexually receptive mates, while male pine voles and females of both species stick close to home. The polygamous males also perform better in laboratory mazes testing different types of spatial ability. These voles apparently evolved superior spatial skills—and larger hippocampi to regulate those skills — in order to navigate efficiently throughout their surroundings during breeding season, the researchers assert in the August PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.87, No.16).

Sex differences in hippocampal size related to spatial ability should occur in a wide variety of mammals, they theorize, since males in most mammalian species practice polygamy. Indeed, says Jacobs, anthropological research indicates that in most human societies, men engage in polygamy and range over larger territories than women. Men consistently score higher than women on tests of spatial ability, but scientists have not studied human sex differences in relative hippocampal size.

However, researchers have found differences in hippocampal size and spatial ability that favor male laboratory rats, the descendants of polygamous rodents. Hippocampal size also varies across related species with different spatial capacities. Bird species that store food in thousands of locations throughout a home range, for instance, possess markedly larger hippocampi relative to total brain size than non-food-storing bird species.

Hippocampal size contrasts show up more strongly between vole sexes in the same polygamous species than between vole species, Jacobs says. She and her coworkers studied the brains of 10 male and 10 female voles in each of the two species. All the voles came from wild populations.

"So far, we've looked at the hippocampus in a simple way, measuring its size relative to the overall brain," Jacobs says. In follow-up studies, they will attempt to determine whether specific parts of the hippocampus enlarge disproportionately in polygamous male voles.

Spatial abilities stem from several brain areas, although the hippocampus appears crucial for navigating a complex environment, Jacobs adds.

For now, the findings support a rarely tested principle of brain organization formulated in 1973 by neurologist Harry J. Jerison of the University of California, Los Angeles, the researchers say. Jerison proposed that the mass of brain tissue controlling a particular function corresponds to the amount of information processing required to perform that function. Applied to the new data on voles, his theory suggests that greater environmental demands on spatial navigation among polygamous male voles lead to larger hippocampi.

Environmental pressures may also lead to the enlargement of as-yet-unspecified brain regions in female voles, Jacobs notes. Since females need more calories than males for lactation and child care, brain regions regulating memory for the location and contents of food-storage sites may show a female-specific size advantage, she suggests. *—B. Bower*

Male fragrance attracts moth mates

Two years ago, entomologist Peter J. Landolt noticed something strange about the mating behavior of the cabbage looper moth, *Trichoplusia ni*. The caged insects hung upside down, vibrated their wings, raised their abdomens and partially exposed their genitalia in the familiar stance associated with the release of sex pheromone — a perfume irresistible to loopers of the opposite sex. Many female moths, including cabbage loopers, secrete such chemical lures.

But in this case the pheromone producers were males.

Landolt and chemist Robert R. Heath at the USDA's Insect Attractants, Behavior and Basic Biology Research Laboratory in Gainesville, Fla., have now isolated and identified a sex pheromone produced by male cabbage loopers — the first direct evidence, they say, that male moths of any species secrete a scented lure to announce their presence to potential mates.

Landolt and Heath say the finding suggests a better moth trap for limiting populations of this pest, whose larvae devour the leaves of cabbage, broccoli and other cruciferous vegetables. The discovery also highlights the male looper's unusual role in the insect mating game, the scientists note in the Aug. 31 SCIENCE.

Female cabbage loopers seek out males for breeding — a reversal of standard sex roles among insects, says Landolt. The females must also scout for suitable egg-laying sites. In the laboratory, Landolt and Heath found that male loopers often mark plants appropriate for egg-laying with a telltale pheromone scent. Thus, female cabbage loopers hit the jackpot when they follow their noses, finding both home and hubby with a minimal expenditure of time and energy.

Landolt calls sexual communication among looper moths "a two-way street" that likely evolved to ensure successful mating. The male pheromone consists of a mixture of a rare form of linalool—a sweet-smelling oil otherwise found only in coriander seeds—and cresols, a component of coal tar. Female loopers emit a chemically distinct male-attracting odor, the researchers find.

Males far outnumber females in this species, and efforts to reduce cabbage looper populations by luring males to traps sprayed with female sex pheromone have proved ineffective, leaving a large percentage of males still available for mating. Landolt and Heath suggest that traps baited with the newly isolated male pheromone may work better by targeting the smaller population of females. *—R. Cowen*

A chemical glance at short-lived elements

The chemical elements lawrencium, rutherfordium and hahnium hardly contribute to the stuff of everyday life. Synthesized one atom at a time by bombarding heavy nuclei with ions, these highly radioactive elements generally survive just a few seconds before decaying into other atomic isotopes.

Darleane C. Hoffman of the Lawrence Berkeley (Calif.) Laboratory and her coworkers, including collaborators in West Germany and Switzerland, have taken up the challenge of determining the chemical properties of these short-lived elements. Such studies enable researchers to see where the elements fit into the periodic table and whether they follow the trends in chemical behavior evident among lighter elements along the table's rows and columns. The researchers also look for evidence of new isotopes, in which the number of neutrons present in a nucleus differs from known varieties, and for traces of spontaneous fission, in which a newly synthesized nucleus immediately splits into two pieces.

Hoffman's team has been focusing on hahnium, or element 105. From its assigned position in the periodic table, hahnium ought to behave like its stable neighbor tantalum. However, recent ex-