Voles appreciate the value of good grooming

Grooming can serve important purposes beyond cleanliness. The man who pulls out his comb and slicks back his hair when a good-looking woman strolls by and the woman who files her perfect nails while pretending to ignore a hunk are sending a clear message.

Meadow voles, small polygamous rodents, may play the same game, a series of new experiments suggests. They groom to maintain their coats, of course, but the behavior also appears to help males and females communicate with each other, assert Michael H. Ferkin of the University of Memphis (Tenn.) and his colleagues.

A meadow vole produces different odors from various parts of its body. In the dim, winding tunnels they call home, the animals rely on these smells for numerous tasks, such as discerning family members from newcomers or identifying mates. Earlier studies hinted that self-grooming may play a part in this silent communication system. The monogamous prairie vole, for example, grooms more around his mate than around other females.

Ferkin and his colleagues examined how meadow voles respond to a whiff of the opposite sex. The researchers moved bedding from other voles' cages into their subjects' cages. In response to the material, which smelled like the original user, all of the test animals groomed for a few seconds. Males, however, when exposed to females' bedding, continued grooming for about 23 seconds, the researchers report in the April ANIMAL BEHAVIOUR.

Robert Tamarin

A meadow vole, Microtus pennsylvanicus.

During grooming, a vole rubs areas of its body that produce odors, so the males may be trying to enhance or amplify their smell to attract the attention of females, the authors speculate.

The investigators then tried to find out what in the females' scent induced grooming behavior in males. They removed the ovaries from another group of meadow voles. Bedding from these females triggered only brief grooming in males. When the scientists supplied the females with a hormone that their ovaries would have produced, males groomed longer, as they did in response to intact females.

The scientists also found that none of the males groomed in response to the scent of females whose physiology, in response to limited exposure to daylight, was set for winter instead of the mating season.

"Odors from females that stimulate self-grooming by males are dependent on ovarian hormones," the team concludes.

The authors also examined how females responded to a scented, oily substance taken from males. The females spent less time sniffing the odor of males that had groomed only briefly than those that had spent more time at it.

The series of studies by Ferkin's group provides further evidence that grooming may enhance communication, says Lee C. Drickamer of Southern Illinois University at Carbondale. To find out whether the behavior ranks as a form of communication, scientists need to observe how animals respond when in the presence of another animal grooming, he asserts.

— *T. Adler*

Rebounding electrons in quantum arenas

In the early days of atomic theory, physicists often pictured an atom as a miniature solar system with electrons orbiting at any distance from a central nucleus. The advent of quantum mechanics altered that image.

Quantum theory specified that an electron's position is determined by a kind of map, called a wave function, that mathematically describes a quantum particle's probability of being at any particular location as it travels in a stable, periodic orbit.

By measuring the energy of electrons trapped in a microscopic box threaded by a strong magnetic field, researchers have now observed the quantum equivalent of the motion of electrons following irregular or chaotic orbits.

Physicists Laurence Eaves, T. M. Fromhold, and their coworkers at the University of Nottingham in England, along with collaborators at the University of Tokyo, report their findings in the April 18 NATURE.

Theorists had predicted that this chaotic motion would correspond to wave functions having features called scars, which represent concentrations of probability associated with periodic, but unstable, electron orbits (SN: 11/2/91, p. 282). Under appropriate conditions, such quantum scars can manifest themselves as abrupt increases in an electric current.

Eaves and his colleagues obtained their results using a tunnel diode, in which electrons leak into a so-called quantum well consisting of a thin layer of gallium arsenide sandwiched between walls of aluminum gallium arsenide. Confined to the well, an electron bounces from wall to wall like a billiard ball.

In a strong magnetic field at right angles to the walls, the electron spirals around a magnetic field line as it bounces back and forth. If the magnetic field is tilted, the electron's corkscrew motion becomes more complicated—even chaotic.

As the researchers changed the voltage across the tunnel diode, they observed large fluctuations in current due to the appearance and disappearance of wave function scars.

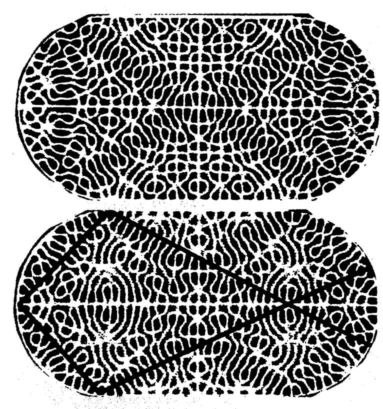
"We've shown that for quantum particles, scars can be rather important experimentally," Eaves says. Now, the researchers are looking into what happens to this chaotic behavior when two quantum wells are coupled together.

Researchers had previously seen traces of scars in the patterns created by microwaves trapped inside thin, metallic boxes (SN: 4/29/95, p. 264) and in the spectrum of light emitted by hydrogen atoms in a magnetic field but not among electrons in a semiconductor device.

"Interesting as the hydrogen atom and the microwave experiments are, a novel tunnel diode and devices like it are more likely to show up in practical applications," notes Eric J. Heller of Harvard University.

— *I. Peterson*

Heller and S. L. Tomsovic



In computer simulations, the wave function of a quantum particle bouncing around inside a container exhibits regions of high probability, or scars (X shape above, solid line below), that correspond to periodic particle trajectories.