BIOLOGY

Julie Ann Miller reports from Syracuse, N.Y., at the Symposium on Chemical Signals in Vertebrates and Aquatic Animals

Enticing aroma of mouse

As the Canadian Mountie generally gets his man, so the rattlesnake gets its mouse. Kent M. Scudder and David Chiszar at the University of Colorado explain how. They have been investigating the dramatic sequence of a rattlesnake attacking, tracking and finally swallowing its prey.

"Striking is a prerequisite for searching," Scudder says. Visual and thermal information seem to trigger the snake's initial attack on its prey. Full-fledged, tongue-flicking searching is seen only after the strike. Tongue flicking is one of a snake's primary methods of searching the environment. The tongue seems to pick up chemical clues from the air and carry them to the vomeronasal organ (see p. 390) in the snake's mouth. If a snake is presented with a mouse, but not allowed to strike it, the snake does not show signs of searching. But if the snake strikes, it flicks its tongue rapidly for as long as 30 minutes thereafter. Even if the snake strikes a cotton model of a mouse, tongue-flicking exploration follows.

A mouse usually does not die immediately after being struck by a rattlesnake, so the snake has to pursue its dinner. But there is something special to a snake about the mouse injected with its venom. A snake will track that particular mouse even through a crowd of others. The researchers suggest that the mouse's copious urine may be detectably different after it has been envenomated. When snakes were given a choice of two dead mice — one killed by their own venom and one killed by the experimenter — more than 75 percent chose the envenomated mouse.

Once the snake finds its mouse, it seems to pick up on a different chemical signal for the final action. The snake uses its chemical senses to determine which end of the mouse to swallow first. "Envenomation alters the chemical properties of the anterior end of the mouse," Scudder says. Nasal discharges probably identify the head. Scudder explains that mouse shape dictates that a mouse swallowed anterior end first goes down more easily.

The scent-uous dog

While the effects of chemical communication on mammals are generally expected to be subtle, there are cases of overt response. The female dog in heat is a salient example of odors triggering mammalian behavior, says Michael R. Goodwin of Purdue University. With Fred E. Regnier, he has identified one chemical component that informs a male dog of an estrous female.

For two months Goodwin and Regnier kept a behavioral, physiological and chemical diary for several female dogs. Every day they took a vaginal smear to determine each dog's point in the estrous cycle, and they observed the female's interaction with a male dog. They found behaviors characteristic of different stages of the cycle, with the female being most attractive and receptive to mounting behavior by males for 3 to 4 days.

The scientists examined volatile material from the vaginal smears taken at various times of the cycle. They found evidence of compounds that are present only in samples from the days of the female's maximally receptive behavior. They identified one of the chemicals as methyl *p*-hydroxybenzoate.

To see whether the single chemical could trigger sexual behavior, the scientists tricked the male dogs. Goodwin and Regnier observed the males paired with females not in heat; in no case was there overt sexual behavior. Then they removed the female and, hidden from the male dog, they rubbed over her vulvar area a small amount of methyl *p*-hydroxybenzoate (purchased from a supplier of biochemicals). When the female was returned to her pen, the male exhibited the full range of sexual behavior, from sniffing to mounting. The female's behavior, however, remained most unenticing. She tried to avoid the male and, when he persisted, barked and snapped at him.

The vaginal secretions produce a complex mixture of volatile chemicals, but these experiments (which were first reported in the Feb. 9 SCIENCE) demonstrate that a single compound can release behavior normally triggered by an estrous female dog.

Sniffing out alarm

J. A. Miller

A man shouts a warning, a beaver slaps its tail — they do so to communicate alarm to companions. But there are other ways of signaling fright. Dietland Muller-Schwarze at the State University of New York at Syracuse is investigating the behavior of silent, gentle deer. He has evidence that they, like social insects, give companions a chemical alarm.

When a black tail deer is frightened, a gland on the outside of its hind leg secretes an odorous substance. The conference attendees, who traveled by bus to a forest where the deer are raised, sniffed the leg of an anesthetized animal and found the smell strong; some said it resembles the smell of coriander.

Muller-Schwarze has done experiments demonstrating that the odor itself affects deer behavior. When he placed filter paper soaked with the secretion near the deers' food, it inhibited their feeding. The females appear to be the more cautious sex, Muller-Schwarze says. In more recent experiments, he exposed a group of deer to the secretion while they were moving freely. The secretion, and novel substances like gasoline and beaver odor, were propelled into the area with compressed air. Muller-Schwarze found that the metatarsal gland secretion increases the number of times an animal lifts its head to the alert posture and the number of times it leaves the area.

Muller-Schwarze suggests that in addition to being an alarm signal, the strong odor may have a defense function.

Chemical tips in housing market

Hermit crabs who have grown too big for their shells don't read want-ads to find more spacious accommodations. It seems that they pick up information on what shells are likely to be available by sensing chemicals in the sea.

Daniel Rittschof of the University of California at Los Angeles observes the aquatic species that visit underwater sites where gastropods (snails) have fallen to predators. Some animals come to the sites to feast on gastropod flesh. Two species of hermit crabs, however, apparently come just to shell-hunt. These hermit crabs do not feed on the flesh; in fact, they leave immediately if only flesh and no shell is present. If a shell is at the site, the hermit crab waits for it to become free, then rapidly leaves its old shell for the new one.

The information that travels through the water reveals some specifications on the type of housing soon to be available. One hermit crab species visits only sites where there is one specific species of gastropod; another is attracted by flesh of two other gastropod species. Rittschof believes short chains of amino acids, breakdown products of gastropod protein, signal the shell-borrowing species. He is now characterizing those peptides.

Rittschof has found that the hermit crabs showing up at a flesh site have poorer-fitting shells than the overall hermit crab population. Thus, only hermit crabs actually in the market for new housing seem to respond to the gastropod signals.