Biology

Bait-and-capture by an insect in disguise

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The termite colony is well defended by its hardened nest and by soldier members that squirt a gummy liquid at invaders. But another insect, an assassin bug, still feeds well on colony members. Its strategy is unusual, sophisticated and carefully tailored to its task. Elizabeth A. McMahan of the University of North Carolina observed the insect's surprising behaviors while doing research in the Costa Rican rain forests, and she described them recently in INSECTES SOCIAUX, PARIS (Vol. 29, p. 346, 1982).

"I had made a hole in the nest and was siphoning out termites to determine the ages of the workers that repaired the hole," McMahan says. "Then what looked like a small piece of the nest walked over to the edge of the hole and grabbed a termite."

The predator turned out to be a nymph assassin bug *(Salyavata variegata)* covered with pieces of the nest of the termite *(Nasutitermes corniger)*. The nymph antennae secrete a sticky substance, and the insect scratches off bits of termite nest and plasters them to hairlike projections on its back. The soldier termites, which are blind, run right over the bug because it smells, tastes and feels like part of their nest. The disguise also protects the assassin bug from such large predators as lizards.

The most novel aspect of the assassin bug behavior is that it fishes for termites with the empty carcasses of its previous prey. "The bug snatches the first termite out of the hole in the nest as best it can and then sucks it dry with its long mouth parts. Then it takes up the dead termite in its front legs, moves forward to the hole again and dangles the body over the edge," McMahan reports. "It even jiggles the carcass slightly in a movement that might be described as tantalizing."

Worker termites inside the nest are attracted to the bait because they eat their own dead as a source of nitrogen and protein. When a termite grasps the bait, the assassin bug slowly draws it out of the nest, then drops the carcass and grabs its fresh prey. McMahan says, "I think the way the assassin bug baits and captures termites is one of the most interesting examples of tool use in the animal kingdom because it's so specifically adapted to taking advantage of termite behavior."

New grasps for quadriplegics

Quadriplegic outpatients can eat, write and groom themselves with a system that electrically activates their paralyzed hand muscles. P. Hunter Peckham and colleagues at Case Western Reserve University reported at the recent meeting in Minneapolis of the Society for Neuroscience success in producing two grasps in patients, who use shoulder motion to control a portable stimulation system. Small fine wire electrodes were implanted in nine muscles including those that control finger and thumb movements. First the muscles were exercised with electrical stimulation to reverse disuse atrophy. Then the investigators used a computer to determine the amount of activity needed in each muscle for the hand to produce a functional movement.

So far the scientists have programmed a key grip — thumb against the side of the index finger — and palmar prehension — thumb against the index and middle finger tips. The program is transferred from the laboratory computer into a portable stimulation system. The patient activates the grasp by moving his shoulder forward or back. "In associated studies we have now provided devices which produce at least one of the grasps to eleven patients," Peckham and his associates say. "Thus, this technique of functional neuromuscular stimulation has demonstrated the capacity to enhance the rehabilitation of persons with severe spinal cord paralysis by restoring hand function, which has been lost due to the original injury."

Technology

Signaling the presence of tritium

One particularly tricky research task involved in harnessing nuclear fusion reactions is learning how to cope with tritium, a radioactive isotope of hydrogen and one of the reaction's fuels. Assessing accurately the tritium content of structural components in a fusion reactor is critically important to proper control of tritium. At a recent American Vacuum Society meeting, Michael E. Malinowski of Sandia National Laboratories described a simple, rapid method for detecting tritium.

Tritium decays to produce a helium nucleus and an electron. If the tritium is trapped in a metal surface, the decay electrons bounce around among the solid's atoms. The excited solid in turn emits secondary electrons with a sharply defined energy. Malinowski's method is based on the detection of these secondary electrons. A simple electrostatic lens focuses the electrons onto a screen, and the resulting image of the contaminated area is displayed on a video monitor.

Although the method is qualitative, it allows scanning across a sample to detect areas of tritium contamination, says Malinowski. Unlike older, more cumbersome methods, this technique allows researchers to obtain immediate results.

Funds for semiconductor research

In November, the Semiconductor Research Corp. (SRC), funded cooperatively by several of the semiconductor industry's largest companies (SN: 10/23/82, p. 271), announced its first research contracts with universities. Cornell University will receive just under $1 million for the first year of its research into microstructures. Initially, 18 faculty members and an equal number of graduate students will study the properties of integrated circuits with minimum dimensions measured on the scale of atomic spacings. The University of California at Berkeley and Carnegie-Mellon University are receiving a total of $1.75 million for joint research in computer-aided design of integrated circuits. In addition to funding the first two of about a dozen major research centers, the SRC awarded five smaller research contracts to university groups that proposed innovative research ideas related to very-large-scale integrated circuits.

Resolving a heavyweight energy debate

Preliminary results from National Bureau of Standards field tests may help resolve a controversy over whether residences with walls made from heavyweight materials, like bricks, logs or concrete blocks, consume less energy for space heating and cooling than buildings having lightweight walls with the same thermal resistance. For many years, the masonry industry and others have argued that the "R-value," a measure of thermal resistance or insulating ability, ignores the mass effect of heavyweight construction. This mass effect arises from the delay of heat transfer through a building's walls because of the walls' high heat capacity. Their claim is that the mass effect increases the insulating effectiveness of heavyweight walls beyond that shown solely by the "R-value."

The NBS researchers confirmed that heavyweight walls show an energy-conserving mass effect in residential buildings during the summer cooling season and the fall and spring heating seasons in a moderate climate. No evidence of a mass effect was observed during the winter heating season. The tests, which are continuing, were done at NBS headquarters in Gaithersburg, Md., on six one-room structures representing different construction materials and practices.

NBS mechanical engineer Doug Burch warns, "While these test data will help improve our understanding of the mass effect, they are not sufficient by themselves for making decisions about different construction options." Climatic conditions and construction costs, for example, must be taken into account.