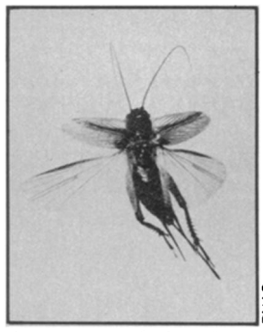
BIOLOGY

Julie Ann Miller reports from Atlanta at the annual meeting of the Society for Neuroscience

The simple anatomy of an escape


PNAS

When a cricket listens for the call of a mate, it uses the full power of its rather simple brain to distinguish among the songs of the various cricket species. But a cricket's behavioral response to the sound emitted by a bat hunting insects is, in contrast, quick and absolute, uncomplicated by fine distinctions. Ronald R. Hoy of Cornell University reports that a single pair of nerve cells, one cell on each side of the body, seems responsible for that streamlined action. The cell, called interneuron-1, is stimulated by any high-frequency sound, such as those bats emit for echolocation, and is inhibited by sounds in the frequency range emitted by singing crickets. The nerve cell receives input from an auditory organ on each of the front legs and sends its output to motor control areas of the brain. The flying cricket then steers away from the source of high-frequency sound by bending its abdomen and hindlegs to one side to act as a rudder (photo above right). The simple information processing takes less than 0.1 second. "In escape, you don't want a lot of circuitry," Hoy says.

More action at the Valium receptors

Although the drugs Valium, Librium and other benzodiazepines have been in clinical use almost 20 years, the details of their action are still being untangled and the distribution of their sites of action still being charted. The first visualization with a light microscope of benzodiazepine receptors in the human brain was reported by W. Scott Young III, Mary K. Conrad and Michael J. Kuhar of Johns Hopkins University. They treat thin slices of brain with a radioactive form of a drug called flunitrazepam, which binds to the same brain molecules as Valium does. In a photographic emulsion, black dots appear at the radioactive sites. With this autoradiographic method, they can detect smaller quantities of receptors than with previous procedures. They find high receptor levels in about twenty areas of the rat brain and a similar heterogeneity of distribution in human brain tissue.

Valium and related drugs act by enhancing the inhibitory activities of a brain chemical called gamma-aminobutyric acid (GABA). Last year scientists learned that GABA itself influences the benzodiazepine receptor; GABA makes the benzodiazepine receptor bind benzodiazepines more tightly (SN: 12/16/78, p. 424). Now Gino Toffano of FIDIA Research Laboratory in Italy reports a further complication in the interactions. He has identified a group of natural brain substances that modulate binding of GABA to its receptors. These substances are chains of amino acids, like the enkephalins. Toffano suggests that the longer chain is a precursor molecule from which the smaller "GABA-modulins" are snipped.

Laboratory simplification of this complex biological problem is underway. Both Solomon Snyder of Johns Hopkins University and John F. Tallman of the National Institutes of Health have purified components of the system. Tallman has isolated the benzodiazepine receptor and finds it to be a molecule with four sub-units. Snyder and colleagues have also removed the GABA receptor from its membrane site and find it to be more than four times the size of the benzodiazepine receptor. Now it will only be a matter of months, Snyder says, before the scientists can answer questions about the details of drug and GABA interactions.

SPACE SCIENCES

The winds of Venus: From stale to gale

The hellish temperatures and sulfurous, acidic chemistry of the atmosphere of Venus would seem to suggest, at least subjectively, that it ought to be a tempestuous place of wild, erratic winds. In fact, however, recent spacecraft data are pointing to a surprisingly ordered wind system, describable in terms of relatively regular patterns and layers. A major source of information has been the hard-landing probes of the Pioneer Venus mission, which plunged through the atmosphere last December while a complicated system of radio interferometry tracked the wind-caused perturbations in their descent paths.

The most conspicuous "pattern" is that virtually the whole atmosphere is one big, westward-blowing wind, with the upper regions circling the planet about every four days — far faster than Venus's 243-day rotation. It had been thought possible that signs of this movement (visible by ultraviolet light) were simply wave motions. But, says Gerald Schubert of the University of California at Los Angeles, the interferometry measurements "put to rest any lingering doubt that the 4-day retrograde circulation represents an actual mass motion of the atmosphere."

Near the surface, according to Charles C. Counselman III and colleagues from the Massachusetts Institute of Technology, the winds blow at a leisurely 1 meter per second (about 2.24 miles per hour), with their latitudinal flow essentially unblemished by even traces of north-south movement. At the bottom of the clouds, slightly less than 50 kilometers up, the speed has risen to about 50 meters per second. Above that level begin the planet's cloud layers, which Pioneer Venus researchers view in essence as three discrete strata. In the most dense of them — the middle stratum — the wind speed is about 200 meters per second (nearly 450 m.p.h.), Counselman recently reported to the meeting of the American Astronomical Society's Division for Planetary Sciences. Here, and beginning about 25 km above the surface, the wind direction develops a slight equatorward slant.

There had been earlier signs, in interpretations of data from the Soviet Venera 4 through 8 spacecraft, that some turbulence, at least, was stirring up all this regularity. But according to Richard Woo and J. W. Armstrong of Jet Propulsion Laboratory, the Pioneer Venus data indicate that the observed fluctuations in the Venera radio signals were probably not due to widespread atmospheric turbulence at all. Still, the researchers told the DPS, "a region of strong turbulence is always present in the vicinity of 60 km [above the surface]," and probably shows in the Pioneer Venus interferometry data, which did include some large velocity fluctuations around that level.

Austria links with ESA

When the European Space Research Organization and the European Launcher Development Organization combined to form the European Space Agency (ESA) in 1975, 10 nations enrolled in the new venture: Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, Switzerland and the United Kingdom. Since that time, only one more country — Ireland — has signed up for full ESA membership. On Oct. 17, however, Austria joined the list, at least in a preliminary way, signing an agreement for five years of "associate membership," from which the agency hopes that full membership will follow.

As an associate member, Austria will be limited in voting and policy-making matters, though it may place delegates on the ESA council and may be represented in an "observer" capacity at any meetings of the agency's subordinate bodies or working groups. In addition, it will contribute funds equivalent to one percent of ESA's net fixed common costs, as well as an additional sum based on the country's gross national product.

Possibly next in line: Norway, now on "observer" status.