BIOMEDICINE

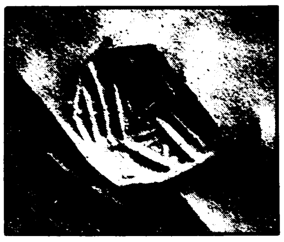
Noradrenaline rhythms

Quantities of the nerve transmitter noradrenaline fluctuate in a 24-hour rhythm in the pineal gland, hypothalamus and some other brain areas. Since noradrenaline is present in the cerebrospinal fluid in generous amounts, one would also expect it to show a circadian rhythm. Indeed it does, according to a report in the Dec. 16 NATURE by M.G. Ziegler and his colleagues at the National Institutes of Health.

They measured the noradrenaline content of the cerebrospinal fluid from both monkeys and human subjects and found a circadian peak in the afternoon—the period when primates are most active. (Noradrenaline also peaks in the brain during the most active time of the day.) They also found that this 24-hour rhythm persisted in spite of lighting conditions. (Lighting does not alter noradrenaline rhythms in brain areas either, with the exception of that in the pineal gland.)

Whether disease can upset the daily rhythm of noradrenaline in the cerebrospinal fluid and brain remains to be explored. However, it may well do so since other investigators have found increased levels of noradrenaline in patients with stroke, high blood pressure and psychiatric disorders.

Virus-cell fusion



Paramyxoviruses are a class of RNA virus that cause mumps, parainfluenza and Newcastle disease. They undergo a dramatic change in structure before they infect cells, according to a report in the Dec. 16 NATURE by S. Knutton of St. George's Hospital Medical School in London.

Shortly after the viruses are incubated with red blood cells, they bind to the cells. Then their envelopes (outer coats) change from spherical to a convoluted shape with smooth ridged regions. These regions allow the viruses to fuse with the red cell membranes. Pictured here is a freeze fracture replica of a viral envelope that has fused with a red cell membrane and that has become completely incorporated into it.

The biochemical changes that accompany these structural modifications are unknown.

Prostaglandins and asthma

Prostaglandins are a group of chemicals that serve as local hormones throughout the body and perform numerous and sometimes conflicting roles. Those of the E series, for instance, relax muscles and blood vessels in the lungs; one of the F series—PGF_{2a}—constricts these muscles and vessels. This bronchoconstricting prostaglandin has been proposed as a causative factor in asthma, in which a victim's lung muscles and vessels contract so severely that he cannot breathe and may even die.

But how might PGF_{2a} actually bring about bronchoconstriction and asthma? H.M. Coleridge and his co-workers at the University of California at San Francisco recorded the firing of several groups of sensory nerves in the lungs of anesthetized dogs. Then they injected PGF_{2a} into the dogs' lungs. This prostaglandin strongly stimulated a group of sensory nerves known as "irritant" receptors. The E series of prostaglandins, in contrast, had only a modest effect on the firing of these nerves.

"If PGF_{2a} has a causative role in asthma," the researchers conclude in the Dec. 2 NATURE, "then our finding that PGF_{2a} stimulates 'irritant' receptors acquires considerable pathophysiological significance."

BIOLOGY

Roaches feel fine during molt

Animals that molt provide an interesting engineering puzzle. How do the sense organs located on the body surface provide continuous coverage of the surroundings? Biologists at the University of Colorado School of Medicine report that touch receptors in cockroaches remain functional throughout all the stages leading to molting.

To fire the mechanoreceptor cell, a cap of modified cuticle must be indented. The earliest preparation for molting appears to be elongation of the cellular process that reaches from the nerve cell to that cap. "Insects, it seems 'tool up' for the intermolt phase by building a functional 'extension cord'," David T. Moran, J. Carter Rowley III, Sasha N. Zill and Francisco G. Varela report in the December JOURNAL OF CELL BIOLOGY. As a new exoskeleton forms inside the old, the receptor nerve cell process passes through a tiny hole in the new cap and runs 11 times its normal length to a connection with the old cap.

The geometry of the connections just before molting provide insight into normal functioning of these mechanoreceptors. The researchers suggest that indentation of the cuticle cap causes deformation of the sensory process membrane, which initiates electrical signals in the nervous system.

Analyzing the inner membranes

Membranes not only define the boundaries of animal cells, but also organize internal components. Most research on membrane composition has examined outer cell membranes. In the Dec. 14 BIOCHEMISTRY, Robert C. Jackson, now at Rockefeller University, describes membranes that surround cell nuclei.

Jackson found different proteins in the nuclear membrane than in the cell membrane. The compositions of nuclear membranes from two different types of chicken cells, however, were very similar. In erythrocyte and liver nuclear membranes, the same three polypeptides constituted a large portion of the total protein. An important characteristic of nuclear membrane is its permeability to large organic molecules. But none of the three polypeptides common to erythrocyte and liver nuclear membranes appeared to be involved in forming membrane pores. Jackson's experiments indicated that one of the three polypeptides sits deep in the membrane, while the other two form a more peripheral matrix.

Blood pressure and snake evolution

Regulating the blood flow along the length of a snake body is more of a problem for some snakes than for others. Researchers have found that blood pressure and its control vary among species and that the differences reflect the snakes' habitats. Demand for effective blood pressure regulation is greater in tree dwellers, which spend much time in a vertical position, than in sea snakes, which are surrounded by water.

Roger S. Seymour of the University of Adelaide in Australia and Harvey B. Lillywhite, now at the University of Kansas, analyzed nine snake species. They found blood pressures ranging from 74 mm Hg in an arboreal snake to 22 mm Hg in an aquatic snake. The arboreal snake was best able to increase its blood pressure when its body was tilted, the researchers report in the Dec. 16 NATURE. They also found that the location of the heart varied with habitat. In arboreal and terrestrial snakes the heart was proportionally nearer to the head to better maintain blood pressure in the brain, but in aquatic species, the heart was nearer the middle of the body. The researchers conclude that changes in blood pressure regulation evolved during transitions between snake life-styles.