BIOMEDICINE

Calcium's role in bioelectricity

A nerve cell is known to electrically stimulate the muscle cell it innervates by releasing the neurotransmitter acetylcholine. Acetylcholine hooks up with an acetylcholine receptor on the muscle cell membrane, which presumably alters the membrane's permeability to the flow of ions. Ions then flow into the muscle cell and purportedly excite the muscle cell electrically.

How might the acetylcholine receptor translate acetylcholine binding into a change in membrane permeability to ions? Hai Won Chang of Columbia University College of Physicians and Surgeons and Eberhard Neumann of the Max Planck Institute for Biochemistry suspected that calcium ions, which have been proposed to have a role in bioelectricity, might be involved.

Chang and Neumann's experiments depended on two major factors: Chang's isolation and characterization of the acetylcholine receptor in 1974 and their development of a method to detect extremely small changes in calcium ion concentrations. Their results, reported in the October PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, show that calcium ions indeed have a high binding capacity for the acetylcholine receptor. Also, the calcium ions and acetylcholine compete for the receptor. So a competition between calcium and acetylcholine for the receptor might help control which ions pass through the muscle cell membrane and when, and thus regulate muscle cell excitability.

Urine proteins do in more cancers

Last April, Stanislaw R. Burzynski and his group at Baylor College of Medicine reported a promising treatment for cancer: proteins that are naturally present in human urine. When isolated, the proteins were able to kill three types of cancer cells without harming normal cells (SN: 4/24/76, p. 260).

They have now used the proteins to make more inroads against cancer. Specifically, they have tested the proteins against three more types of cancers in tissue culture and have achieved 100 percent inhibition. They have injected the proteins into birds with Rous sarcomas. Only 20 percent of these birds died compared with a 100 percent mortality among birds with sarcomas that did not receive treatment.

The Baylor scientists hope to try the proteins on cancer patients in another three months or so. Patients with colon cancer, uterine cancer, osteosarcoma and leukemia will probably receive the proteins first since the proteins have shown killer ability against these cancers in laboratory experiments.

Knocking bacterial gene translation

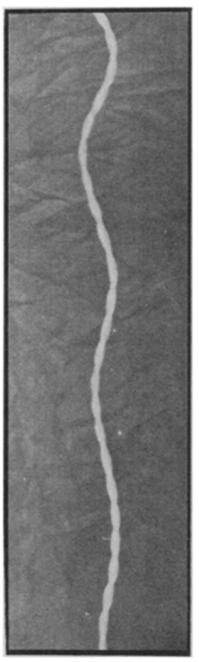
It has been generally thought that gene expression in prokaryotes (one-celled organisms without a nucleus) is regulated only at the level of transcription of DNA into RNA, not at the level of translation of mRNA into a protein. Research conducted by Peter Herrlich and Manfred Schweiger of the Max Planck Institute for Molecular Genetics in Berlin-Dahlem now suggests otherwise.

Nitrofurans have been used for various antibacterial purposes ever since detection of their antimicrobial action in 1944. Even today they are widely used as drugs and food additives. However, their mode of action on bacteria has been totally unknown. Herrlich and Schweiger set out to elucidate their action on the bacterium *Escherichia coli*.

As they report in the October PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, the drugs do not interfere with *E. coli's* membrane integrity, energy generation or DNA and RNA synthesis. But the drugs do interfere with the bacterium's gene expression by inhibiting the expression of mRNA.

BIOLOGY

Another twist to DNA structure



Helix is a recurrent theme among those studying the structure of DNA. First James D. Watson and Francis Crick reported that the molecule was itself shaped as a double helix. Then Jerry Vinograd showed that circular pieces of DNA were twisted back on themselves in a pattern called a superhelix. Now biochemists have evidence of an even higher order of helical coiling in viral DNA.

George W. Brady and David B. Fein (now at New York State Department of Health, Albany) of Bell Laboratories and Harry Brumberger of Syracuse University observed the scattering pattern of X-rays beamed at purified circular DNA from a bacteria-infecting virus called PM2. They compared those results to patterns from DNA that was partially unwound by chemical agents or completely unwound by an enzyme that cuts through one strand of the double helix.

The researchers believe that their new data, reported in the Nov. 18 NATURE, result from the mechanical properties of the double helical DNA molecule, whose strain is not completely relieved by formation of a simple superhelical coil.

They illustrate this property of flexible helical structures by twisting a piece of rubber tubing and connecting the ends. The tubing coils on itself and that coil also curves in a helical shape (see photo).

This model, they say, shows that if the first superhelix conformation is primarily the result of a torsional strain on the double helical DNA molecule, then that helix must be accompanied by a second-order helix.

Dietary lack increases rat aggression

A specific dietary deficiency can increase predatory aggression in laboratory rats. When the amino acid tryptophan, a normal food constituent, was eliminated from their diet for a few days, rats that did not previously kill mice began to kill. Killer rats attacked mice with a shorter than usual delay and failed to be satiated after repeated exposures to mice. These behavioral changes could be reversed by returning tryptophan to the diet, report Judith Gibbons, Gordon Barr and Wagner Bridger of Albert Einstein College of Medicine and Sarah Leibowitz of Rockefeller University.

During the period of increased mouse killing, other aspects of behavior were unchanged. The rats did not attack rat pups, show irritability to handling or alter the manner in which they attacked mice.

The amino acid tryptophan is a precursor of one of the chemical transmitters carrying signals between nerve cells in the brain. Four days of the tryptophan-free diet decreased rat brain serotonin levels by 40 percent. The data on mouse killing, reported at the recent annual meeting of the Society for Neuroscience in Toronto, support the hypothesis that the brain cells producing serotonin normally act to inhibit predatory aggression.

Other experiments, using a drug that temporarily decreased the amount of serotonin in the brain, confirmed that mouse-killing behavior by rats correlates with the level of that neurotransmitter.

Science Service, Inc. is collaborating with JSTOR to digitize, preserve, and extend access to *Science News*. www.jstor.org