life sciences

MOLECULAR BIOLOGY

Gene fusion and evolution

A clue to the evolutionary mechanism for the formation of complex proteins has emerged from experiments with a strain of bacteria that causes food poisoning in man, the *Salmonella typhimurium*.

In the Nov. 28 NATURE, Drs. Joseph Yourno and Tadahiko Kohno of the Brookhaven National Laboratory, with Dr. John R. Roth of the University of California at Berkeley, report evidence to support the theory that large, complex proteins and enzymes evolved by a process of gene fusion. They discovered that in the bacteria, two of the genes of the nine-gene operon, the unit the controls histidine production, had fused. Thus, instead of directing two separate RNA molecules to carry information for the manufacture of two distinct proteins, the fused genes coded for the production of a single protein able to perform the functions normally carried out by the two separate proteins.

Says Dr. Roth, "The main significance is that if you can [fuse genes] experimentally, events like this conceivably may happen in nature. Complex enzymes may have evolved this way. It could be a step in the evolution of proteins."

SICKLE-CELL ANEMIA

Urea normalizes cells

Sickle-cell anemia, which occurs in one of every 400 Negroes in the United States, usually claims its victims' lives before the age of 40. Because the misshapen blood cells cannot transport oxygen, individuals with this disorder suffer from progressive damage to vital organs.

Intravenous infusions of urea now appear to promise successful treatment of sickle-cell patients. Dr. Robert M. Nalbandian of Blodgett Memorial Hospital in Grand Rapids, Mich., with Dr. Raymond L. Henry of Wayne State University in Detroit, finds that urea causes sickled cells to revert to their normal, doughnut shape. Thus far, intravenous infusions of urea have relieved sickle-cell crises in 22 patients tested. Studies of three patients show evidence that oral doses of urea, mixed in soft drinks, may also be effective.

Dr. Nalbandian's clinical experiments are grounded in fundamental studies by Dr. Makio Murayama of the National Institutes of Health in Bethesda, Md., (SN: 8/5/67, p. 134). Dr. Murayama showed that sickling occurs when two hemoglobin molecules form an abnormal bond that distorts the red cell shape.

BIOCHEMISTRY

Tumors and capillary growth

Tumors, like any other tissue, need nutrients in order to grow. Thus, they develop their own vascular network of capillaries which carry nutrients from the blood. A team of Boston scientists headed by Dr. M. Judah Folkman of the Harvard Medical School has identified a substance that promotes this capillary network formation, enabling malignant tumors to direct their own vascularization.

At the recent meeting of the American Academy of Pediatrics in San Francisco, Dr. Folkman, a surgeon, reported that the growth-promoting chemical, called tumor angiogenesis factor (TAF), has been isolated from 15 different types of human tumors as well as from tumors in mice and rats. The only case in which the investigators have looked for but failed to find TAF is leukemia. In addition to its presence in a wide range of malignancies, TAF has also been isolated from normal human placenta, Dr. Folkman says.

Although its precise composition remains unknown, TAF is approximately one-fourth RNA and three-fourths protein. Having isolated TAF, the scientists are now searching for a substance that will destroy it and thereby block the growth of capillaries that enable tumors to thrive.

HEPATITIS

New York to screen blood donors

Serum hepatitis is frequently transmitted to patients receiving transfusions of blood from individuals who may be unknowing carriers of the so-called Australia antigen associated with the hepatitis virus. According to Dr. Hollis S. Ingraham, health commissioner of New York State, approximately one in every 200 units of blood is contaminated. Recent court decisions, notably one in Illinois, hold hospitals and physicians liable if patients contract hepatitis from contaminated blood (SN: 12/12, p. 446).

As of Jan. 1, New York will become the first state to require screening of all donor blood for the presence of Australia antigen. Reagents for conducting the blood analysis will be supplied, at first, by the state to its more than 350 laboratories, because no commercial supplies are available. However, commercial supplies are now beginning to be produced and will be substituted when approved by the National Institutes of Health's Division of Biologic Standards. Using current test methods, it is possible to detect the antigen in approximately three-fifths of the cases.

BIOCHEMISTRY

MS protein synthesized

Myelin, the substance that forms a protective sheath around brain and nerve cells, degenerates in patients with multiple sclerosis. It is composed of two basic protein units; one of these, called the A1 protein, has long been suspected of contributing to the onset of the disease, possibly by escaping from the myelin and into the blood, where it elicits a lethal autoimmune response. When A1 is injected into animals, they develop experimental allergic encephalomyelitis (EAE), a condition parallel to multiple sclerosis.

Scientists at the Salk Institute in La Jolla, Calif., now report that the A1 protein has been sequenced—the order of its amino acids determined—and synthesized. Chemically modified versions of the protein, says Dr. Edwin H. Eyler, relieve symptoms of EAE in animals.

Comparisons of the bovine and human A1 protein, he says, show striking similarities; preliminary evidence suggests that the same segment of nine amino acids in each may be the portion of the molecule implicated in causing the diseases.