

BIOCHEMISTRY

Misshapen Molecules

Since body builds the wrong kind of molecules on occasion, thus causing many unconquered diseases, including cancer, scientists are seeking the reasons for abnormal cells.

► CAUSES OF unconquered diseases, including cancer, are being sought in misshapen molecules in the human body.

This new direction for research is being undertaken because diseases not caused by infections, but occurring because the body builds the wrong kind of molecules into the blood cells, have within the past five years become the most thoroughly understood illnesses.

These are the sickle cell anemias first recognized in 1911. The cause of this type of anemia was found in 1949 by research workers associated with Dr. Linus Pauling at California Institute of Technology, who explained this research during the American Chemical Society meeting in Kansas City, Mo.

Abnormal blood cells are to blame. The red coloring matter forms long strings that stick together and twist the red blood cells into the shape of a sickle blade. The condition is inherited and occurs almost exclusively in Negroes.

So long as only half the red cells are abnormal, the individual is not sick, but is a carrier of the dangerous hereditary trait. Anemia appears among children when both parents are such carriers.

Theoretically, one-fourth of such children are free from the condition. However, half are carriers and the remaining fourth will die because their blood cannot carry enough oxygen to keep their body processes going for a normal lifetime.

The blood cells are normal in everything but hemoglobin, which is responsible for the twisted stringy structure. This makes the cell membranes sticky and the blood sludgy so that it will not flow through the capillaries. Organs are damaged by lack of the oxygen that the blood should bring and does not. Infections set in which the body cannot fight successfully.

The condition is described as an inborn error of hemoglobin synthesis by Dr. Pauling and his associates, Dr. Harvey A. Itano, senior research fellow at California Institute of Technology, Drs. Phillip Sturgeon and William R. Bergren of department of research, Childrens Hospital, Los Angeles, and University of Southern California School of Medicine.

This group has identified three additional types of hemoglobin abnormalities, the newest represented by one patient whose case was described to this meeting of the American Chemical Society by Dr. Itano. (See SNL, April 3, p. 223.)

With normal hemoglobin and four abnormal kinds, there are 15 possible combinations, since an individual can be a carrier of more than one type of abnormality.

Nine of the 15 have been identified in patients. Some of the three newer types of blood cell abnormality have been found in members of the white race.

The only treatment which helps these sufferers consists of transfusions of normal blood, and this help lasts only three weeks. By that time, the transfused cells are worn out and the imperfect cells of the patient's own manufacture are making trouble again. Removal of the patient's spleen can be of some help, because the spleen is the organ that destroys damaged blood cells and, in this disease, the spleen becomes enlarged and both makes and takes out damaged cells too fast.

The California researchers are hoping to find some drug that will have the same effect as supplying more oxygen to the tissues. However, whether or not a cure is found, recognition of the possibility that other diseases, which do not yield to known kinds of treatment, may be due to other abnormalities is important.

Some cancers, Dr. Pauling said, will be studied to see whether any factors like those of sickle cell anemia can be recognized. There is, also, the chance that an abnormality, if found, may not be inborn but may result from reaction between body cells and some chemical in the environment.

In the early days of rubber manufacture, aniline was used in vulcanization and workers died because aniline changed the oxidation state of the iron in the hemoglobin of their blood. Some such reaction might occur due to certain molecular structures in tobacco smoke or in agricultural chemicals. If it occurred, it might affect any of the one hundred thousand different kinds of protein molecules in the human body.

In the case of sickle cell anemia, the scientists had discovered all about the disease only two years after they started looking for abnormal molecules as the possible cause.

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ICHTHYOLOGY

For Mouthbreeders, Males Carry the Eggs

See Front Cover

► FOR NINE to 30 days the male mouthbreeder fish carries eggs in his mouth, without a bite to eat for himself, until the eggs are old enough to be ejected.

The mouthbreeder, *Tilapia macrocephala*, protects his offspring from predatory fishes

and bacteria by churning them around and around in his throat pouch.

The whole mouthbreeding process of these unusual fishes went on display at a live exhibit, with photographs, at the American Museum of Natural History, New York.

Included are numerous live eggs, embryos, fishes, including males with eggs in their mouths, and a series of dishes containing eggs and embryos in various stages of development, ranging from newly laid eggs to embryos still attached to the yolk sacs from which they gain their first nourishment.

"Generally 40 to 120 eggs are carried in the mouth of the male," explained Dr. Lester R. Aronson, chairman of the department of animal behavior of the Museum. Dr. Aronson has recently returned from a year of Fulbright study in Nigeria, where he studied the calcium and protein-rich mouthbreeding fish in its natural West African environment.

This type of fish builds its nest exclusively by the mouth, he reported, in contrast to other fish who usually use their tails or bodies. The female does most of this work, while the male slaps at her body with his tail in a ritual of love-making.

"Courtship and nest building go on for several days before spawning," Dr. Aronson explained. Then the female lays her eggs, the male passes over them to fertilize them, and in a matter of a few minutes the eggs are picked up by the male, as shown on the cover of this week's SCIENCE NEWS LETTER. The male then begins the incubation period.

When the young have grown to one-quarter to one-half inch long, the father spits them out. In this species, the young fry, once released, never return to the parental mouth. In some related species, however, the young swim back to the mouth when disturbed.

One of the exhibits shows a batch of live eggs, placed in a test tube and churned constantly by a jet of water. The eggs remained alive. However, eggs that are placed in a dish where the water is stationary die in a day or two.

Fully mature fish measure from two to eight inches in length. Males have a golden yellow gill cover, whereas the female gill cover usually has a deep red spot near the center.

Found in brackish and freshwater ponds and creeks, they are an extremely hardy fish and are economically one of the most important inland fishes along the coastal region from Senegal to the Belgian Congo. Valued by Africans for their excellent food qualities, they are broiled or fried, sometimes dried and smoked.

In the small ones, much of the bone can be eaten—an important source of calcium in many regions where this mineral might otherwise be deficient in the local diet. Government fisheries officers in Nigeria have recently begun to show an interest in the study of this *Tilapia* and related species for stocking reservoirs, ponds and swamp rice fields and also for fish farming.

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