CYTOLOGY

Way Life Is Handed On

Scientists have new key to duplication of life patterns within cells in proposed chemical structure for DNA, desoxyribonucleic acid. Suggestion has implications for cancer.

➤ ONE OF the fundamental problems of living matter is the way life is handed on, that is, how the molecules that carry on heredity are duplicated within the cells. It seems to be near solution through a new chemical structure proposed for the substance that is most essential in the dividing cells involved in life of all varieties.

This sort of "chemical essence of life" is DNA, the full name of which is desoxyribonucleic acid. Its importance within living cells is today undisputed. The stature of this chemical has grown in the past year or two.

A suggested structure for this chemical, telling how the molecules that compose it are put together, is creating about as much interest and hopeful speculation in chemistry and biology as anything that has happened in many months.

For the mystery being solved is not alone how the stream of life of human beings, animals, plants and all other living things is carried on. It involves the multiplication of all cells and units of living matter. It is therefore basic to disease, such as cancer, which is unruly multiplication of cells. It may tell how unconquered viruses, recently photographed with the electron microscope, proliferate, which should be a step toward keeping them in hand.

DNA's architects are two scientists working in the famous Cavendish Laboratory at Cambridge University, England, where so many important discoveries have been made over the decades. One of them is Dr. J. D. Watson, who has been working on a fellowship from the National Foundation for Infantile Paralysis supported by the March of Dimes in the United States. The other is Dr. F. H. C. Crick, who has collaborated on the mathematical theory that protein molecules are wound into the shape of a helix or coiled spring.

These two scientists are a part of Britain's Medical Council unit "for the study of the molecular structure of biological systems.

They have succeeded in working out a manner of construction of DNA that suggests how it can accomplish an exact duplication of itself.

This is something new. It may solve a major puzzle. DNA is found in all dividing cells, largely if not entirely in the nucleus. It is an essential constituent of the chromosomes, the parts of the cell in which the stuff of heredity is located. Many lines of evidence indicate that DNA is the carrier of a part, if not all, of the genetic specificity of the chromosomes. Thus it is the chemical of the genes, the actual transmitting agent of all characteristics of the parents to their offspring. It is one of the world's most important substances.

Incidentally, DNA is desoxyribonucleic acid in the United States, while the British drop the "s" and write it deoxyribonucleic acid.

Far too minute ever to be seen with the most powerful microscopes, X-ray crystal studies give evidence to support the theoretical and mathematical ideas suggested.

The DNA molecule is a long chain. Its backbone consists of a regular alternation of sugar and phosphate groups. To each sugar is attached irregularly a nitrogenous base, which can be of four different types, two of which are purines, called adenine and guanine, and the others are pyrimidines, called thymine and cytosine. The unit consisting of phosphate, sugar and base is called a nucleotide.

The structure has two chains both coiled around a common axis of the fiber. These two chains are held together by hydrogen bonds between the bases, and the bases are joined together in pairs. One member of the pair must be a purine and the other a pyrimidine in order to bridge the two chains.

Any sequence of pairs of the bases can fit into the structure and, in a long molecule, many different permutations are possible. The Cavendish Laboratory scientists suggest that the precise sequence of the bases is the code which carriers the genetical information.

One of the chains is the complement of the other. This feature suggests how the DNA molecule might duplicate itself.

In the process of duplication, it is visualized that the two chains unwind and separate. Each chain then acts as the model or template for the formation on itself of a new companion chain. There are two pairs of chains where there was only one pair before. There has been exact duplication, carrying the qualities of the original structure.

Enthusiastically, the scientists speculate on just how much these supposed happenings can explain. The unusual changes in heredity—are they due to one of the bases occasionally occurring in a less likely form? What makes the pair of chains unwind and separate? What is the chemical origin of the stuff of the crystal?

This discussion is part of the great and inspiring push toward understanding the complexities of the materials of life. Dr. Linus Pauling and Dr. Robert B. Corey of the California Institute of Technology are solving the related problems of the structure of individual kinds of protein materials. The researches and the ideas of one group aid those of another.

Almost every issue of leading scientific journals adds new facts and theories. The most important chemicals of life are being better understood and man reaches for the very mystery of life.

Science News Letter, December 19, 1953

TECHNOLOGY

Ash from Volcano Makes Cement for Constructions

➤ WHEN A New Guinea volcano erupted violently in 1951, it produced ash that can be used in making cement useful for construction purposes.

Two specialists of the Australian government's scientific and research organization, K. M. Alexander and H. E. Vivian, report in *Nature* (Nov. 28) results of tests that show volcanic ashes from Mt. Lamington's recent explosion, when combined with lime, can be used in mass concrete work.

The ash is what is called pozzolanic material. Tests on the ash blended with portland cement are also being made.

Science News Letter, December 19, 1953

MEDICINE

New Miners' Disease Hits Lungs and Joints

➤ DISCOVERY THAT a combination of rheumatism and a new lung condition, making up what may be a new kind of disease, hits coal miners is announced by Medical Research Council scientists in the *British Medical Journal* (Dec. 5).

The lung condition, which the scientists term "rheumatoid lung lesion," shows quite a different X-ray picture in some respects from that of progressive massive fibrosis in the pneumoconiosis which doctors are accustomed to seeing in coal miners.

It can develop several years before, at the same time as, or several years after the arthritis starts.

The arthritis affects more than half the patients with the peculiar lung condition, whereas arthritis is found in only three out of every 100 miners with the more usual lung disease, progressive massive fibrosis. No cases of arthritis were found in miners without any lung disease or in those with only simple pneumoconiosis.

Best explanation for the new combination of diseases, the scientists think, is that there may be a particular type of tissue reaction to dust and tuberculosis in the lungs of miners who are predisposed to rheumatoid arthritis.

The scientists who made the study in the Rhondda Fach, a South Wales mining valley, are Drs. W. E. Miall, Anthony Caplan, A. L. Cochrane and G. S. Kilpatrick, and P. D. Oldham of Cardliff, Wales, and London.

Science News Letter, December 19, 1953