BIOCHEMISTRY

# Chemical Key Found

**Histone, a simple protein, has been found to be the chemical key that locks and unlocks the activity of the genes which regulate the processes of life.**

➤ THE CHEMICAL KEY that tells the millions of cells in your body when to go to work reproducing themselves has been found.

The protein doing the dictator's job is known as histone. It is a simple chemical, as proteins go, but its role is essential in the development of specialized tissue such as skin, hair or red blood cells.

Histone locks and unlocks the activity of the genes, tiny bits of matter that carry hereditary information and regulate the processes of life. When histone is present, much of the activity of genes is halted. When histone is removed from the genes, activity is resumed.

The chemical does not harm the genes, merely inactivates them for as long as they are associated with histone, Drs. James Bonner and Ru-Chih C. Huang, biologists at California Institute of Technology, Pasadena, have found.

They used the fast-growing cells of the pea embryo to make their discovery. They studied the activity of the genetic "blueprint" in these cells, trying to determine how the genes transmit their instructions.

Genes carry the information by which new generations of animals and plants are duplicated. Every one of the millions of cells in every person contains a complete blueprint of that person. This blueprint consists of perhaps 100,000 genes, grouped in chains called chromosomes.

A portion of the blueprint is for making the protein structures found in every cell and another portion is for making specialized proteins such as brain and skin.

However, every gene in every cell is not active all of the time. If genes were that active, then all the cells would try to produce all of the proteins. If they did so, there would not be any humans, who can do a great variety of complex things because their cells are specialized.

Dr. Bonner and his group have shown that chromosomes consist of two kinds of genes—those covered with histone and those not covered. They have further shown that only those genes not covered with histone are doing the work. Of the genes in pea cell embryos, 80% are covered with histone, and only 20% are not.

Histone is a small, simple protein molecule composed of about 150 amino acid building blocks. There are 20 different kinds of these blocks and they are assembled into proteins by being strung together in chains. Histone is said to be simple because it is composed principally of only two of the 20 amino acids, lysine and alanine.

Because the histone units are small, several are required to cover one gene. Histone is believed to be made in the cell nucleus, where the genes are located.

To obtain the genetic material, Dr. Bonner and his group developed a "pea-popping" technique in which the embryo pea stems are chopped, then the walls of cells slit open to yield the nuclei, or cores, containing the genes linked in chromosome chains.

The chains are made of DNA, short for deoxyribonucleic acid, which comes in long, fibrous strands coiled in a spiral. Parts of the DNA strands of the chromosome are covered with histone.

Indications are that the DNA chains transmit their instruction in the following three steps:

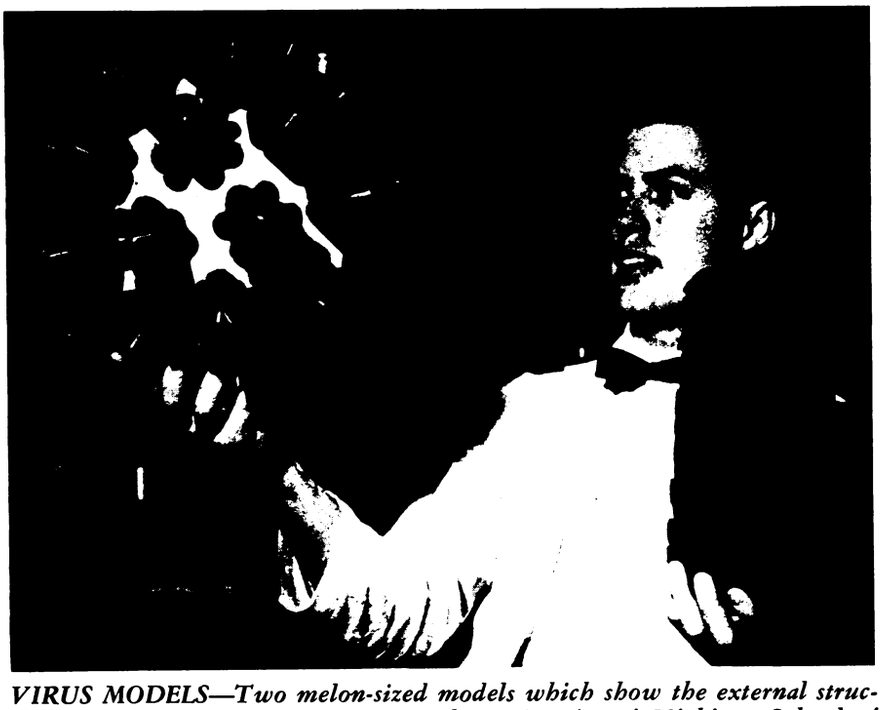
1. The genes sending out instructions synthesize bits of another kind of nucleic acid, ribonucleic acid, or RNA. The strips of RNA are complementary copies of the DNA genes. Probably for structural strength, each RNA strip is placed on a strip of nucleoprotein, the RNA-protein combination being called a ribosome.

2. The ribosome moves out of the cell's nucleus into the main body, or cytoplasm, of the cell.

3. The ribosome then assembles amino acids into an enzyme that, in turn, participates in converting the cell's food into building blocks for making more cells.

Dr. Bonner said that human cancer cells have been found to contain less histone than normal. This could mean that too many of its genes are "turned on," which could account for a distinguishing feature of cancer cells—the apparent loss of their ability to specialize.

• Science News Letter, 81:403 June 30, 1962



*VIRUS MODELS—Two melon-sized models which show the external structure of viruses have been created at the University of Michigan School of Public Health, Ann Arbor. The model shaped like a ball represents a polio virus and the other, a hollow tube, the tobacco mosaic virus.*

MEDICINE

## Cigarette Smoke Cancer Causing Agents Studied

➤ANOTHER CHEMICAL as well as the often blamed 3,4-benzopyrene is a cancer-causing agent in cigarette smoke.

This is true at least for mice, and the evidence is "clear-cut," Dr. Francis J. C. Roe of the Royal Cancer Hospital, London, reported in Nature 194:1089, 1962.

He divided 200 mice into five groups of 40 each, half male and half female. The backs of three groups of mice were painted with tar collected from machine-smoked cigarettes to which varying amounts of 3,4-benzopyrene were added. Of the two "control" groups, one was painted with condensed cigarette smoke only, the other with 3,4-benzopyrene only.

The mice were painted three times a week for 68 weeks, and examined every two weeks, both during and after treatment for benign (non-cancerous) or malignant (cancerous) tumors.

In the group treated with benzopyrene mixed with condensed smoke, "far more" cancer developed than in the group treated with the same amount of pure benzopyrene. This indicates some other chemical is involved.

• Science News Letter, 81:403 June 30, 1962