The 1975 Nobel Prizes

Physics: Motions inside the atomic nucleus

Wide World Photos

Columbia Univ.

Theorists of the rotating, distorted nucleus: Bohr and Mottelson (left), Rainwater (right).

Work in nuclear physics has taken the 1975 Nobel physics prize. The $143,000 award will be shared by three men: Aage Bohr of the Niels Bohr Institute in Copenhagen, Ben Mottelson of NORDITA in Copenhagen and James Rainwater of Columbia University. They are cited, in the words of the Swedish Academy of Sciences: "for the discovery of the connection between collective motion and particle motion in atomic nuclei and the development of the theory of the structure of the atomic nucleus based on this connection."

It is a nuclear model that combines features of the two most prevalent and rather discordant pictures of the nucleus, the shell model and the liquid-drop model. The liquid-drop model tends to take the interior of a nucleus as rather amorphous, treating the neutrons and protons like the atoms or molecules in a liquid and endowing the nucleus over all with such liquid-like properties as surface tension. The shell model divides the interior of the nucleus into layers like those of an onion and distributes the neutrons and protons among them according to energy. Combining collective motions of the neutrons and protons that result in slow rotations of the entire nucleus with individual-particle motions permits elaboration of a theory combining features of both models, and explaining the changes of shape and extreme distortion from spherical symmetry found in some nuclei. The distortion and oscillations in the model play a role in predictions about fission. In the words of one of the standard texts (Robert S. Shankland, *Atomic and Nuclear Physics*: New York, 1960, the Macmillan Co.), "Many nuclear properties can be explained by this model."

Bohr is the first person to win the physics prize, whose parent also won it. His father, after whom the Niels Bohr Institute is named, won the 1922 prize for his quantum theory of atomic structure. □

Medicine: Basics for study of cancer, viruses

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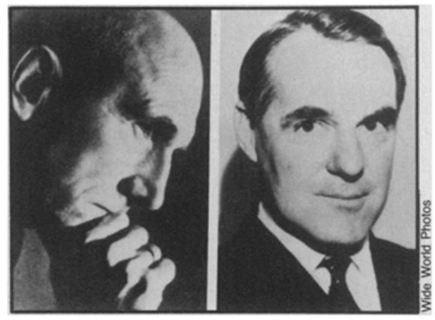
DNA transformations by viruses: Baltimore (left), Temin, Dulbecco.

Three biologists whose work successfully challenged the "central dogma" of molecular biology were awarded the Nobel Prize in physiology or medicine for 1975. The discoveries by two American scientists, David Baltimore and Howard M. Temin, and Italian-born Renato Dulbecco have both broadened understanding of basic molecular processes in the cell, and have, according to the Nobel committee, provided the "conceptual foundation" for studying the links between cancer and viruses.

Dulbecco is a researcher at the Imperial Cancer Laboratory in London. He did much of his famous work on the transformation of normal genes by DNA tumor viruses at the Salk Institute and the California Institute of Technology. It was at those institutions that he served as "research father" to Temin and Baltimore —Temin in the mid-1950's and Baltimore in the mid-1960's.

Temin, now at the University of Wisconsin at Madison, and Baltimore, of the Massachussetts Institute of Technology, independently discovered in 1970 an enzyme called "reverse transcriptase" that has, in effect, rewritten biology's central dogma. It was believed that genetic information within the cell was always passed from DNA to RNA to proteins. Temin had hypothesized in 1964 that tumor viruses containing only RNA might transform part of an animal's DNA to allow viral replication. The simultaneous discovery of an enzyme that carries out this reverse transcription (RNA to DNA) confirmed the theory and provided a new set of concepts for studying viruses and cancer. □

Chemistry: Form begets function in biomolecules



Wide World Photos

Prelog *Cornforth*

The 1975 Nobel Prize in chemistry was awarded jointly to an Australian and a Swiss chemist for their work in stereochemistry. Together, their research has provided much of the fundamental understanding of the form-function relationships of biological molecules, "research," the Swedish Royal Academy of Sciences says, "of fundamental importance to an understanding of biological processes."

John W. Cornforth, a native Australian who has worked most of his life in Great Britain, and Vladimir Prelog, a naturalized Swiss citizen born in Yugoslavia, will share the $143,000 prize equally.

Cornforth, who has been deaf since childhood (many ascribe his superior concentration to this fact) is a professor at the University of Sussex. He worked, along with Sir Robert Robinson (Nobel laureate in 1947) during World War II to unravel the structure of penicillin, in an effort to provide more of the antibiotic for wounded soldiers. He has, for many years since, studied enzymes, specifically how the structures of these essential proteins enable them to act as catalysts for biochemical activity.

Prelog, a professor at the Federal Technical University at Zurich, has long been interested in both basic stereochemistry and industrial applications. He is credited with the system for determining D- and L-isomerism in molecules (the right- or left-handedness of certain compounds with the same chemical formulas) and the relationship of "handedness" to biological activity. He, too, has long studied the stereochemistry of antibiotics, and is the director of CIBA-Geigy in Basel. □