Cornell, Cambridge Scientists Win Nobel Prizes in Physics, Chemistry

By Philip J. Hills
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WASHINGTON — An American has won the Nobel Prize in physics this year for a mathematical theory explaining the odd changes in the behavior of matter at high temperature and high pressure, while the chemistry prize was won by a scientist in Britain who developed a method of deciphering the shapes of many biologically important molecules.

Kenneth Geddes Wilson, 46, a physicist at Cornell University, took the physics prize, and Aaron Klug, 56, a South African who has worked for 20 years at the Medical Research Council at Cambridge University's molecular laboratory, took the one in chemistry.

Mr. Wilson developed a simplified mathematical theory that allows physicists to predict the behavior of matter when it reaches "critical points" of temperature or pressure, such as the point at which a liquid turns to a gas, or a magnetic bar loses its magnetism.

Using only two critical numbers about the shape of the one-, two-, or three-dimensional nature of the matter, he was able to calculate curves that describe, for example, how the density of a hot liquid will fluctuate as its temperature rises toward the critical temperature at which it becomes vapor.

Mr. Wilson's mathematical method is so broad and powerful that it may be possible to apply it to things as different as the behavior of elementary particles like the quark — now thought to be the fundamental building blocks of all matter — up to the level of air turbulence around an airplane, and hurricanes, to the way metals mix together.

There were eight or more physicists who contributed background work to the development of the theory, including Michael Fisher of Cornell and Leo Kadanoff of the University of Chicago. But as the Royal Swedish Academy of Sciences said when it announced the award, Mr. Wilson took a different approach and solved the hundred-year-old problem "in a definite and profound way."

The other workers had only bits of an ad hoc theory that did not allow specific predictions to be made, but Mr. Wilson came up with a complete theory that allowed prediction and simplified the subject.

The announcement that Mr. Wilson had won the Nobel Prize was almost expected by his family and friends, according to his father, E. Bright Wilson, a retired professor of physical chemistry at Harvard University.

Mr. Wilson himself was not so sure, although he said, "I knew that I was a contender."

Aaron Klug's discovery in chemistry was of a method to figure out the shape of molecules important to life. It is the shape of biomolecules that determine what they do and how they do it — for example, the hemoglobin molecule that has a "pocket" in which it can capture an oxygen atom to be carried through the bloodstream.

When trying to figure out the shape of important molecules, researchers have crystallized them and then passed X-rays through them to study the scatter-pattern of the X-rays. The ricochet pattern gave a clue to the three-dimensional shape of the molecules.

But many molecules resist being crystallized in that way, and so could not have their shape determined.

Mr. Klug opened up a new branch of the study of the shape of molecules by using an electron microscope to take pictures of the molecules as they lay in a thin, two-dimensional crystal film, and then extracting three-dimensional images of the molecules from that.

A picture of a molecule taken through an electron microscope is only very fuzzy and blurred. But Mr. Klug managed through mathematical methods to extract three-dimensional pictures of the molecules from the blurred, two-dimensional images. "It is like taking a thousand blurred pictures of a face and extracting from them enough information to make one clear image," said Carl Pabo of Johns Hopkins University.