Physics Nobel for neutron-scattering work

Two veterans of the early atomic age earned the 1994 Nobel Prize in Physics, announced last week. They won the honor for their pioneering and independent contributions some four decades ago to the development of neutron-scattering techniques for studying solids and liquids.

As electrically neutral particles, neutrons can penetrate deeply into matter. Unlike X rays, they can readily evade a material's electrons to interact directly with atomic nuclei. These interactions produce changes in the direction and speed of the incoming neutrons. From these data, researchers can deduce the atomic structure of solids and determine the vibrations that typically shake these materials.

Discovered in 1932, neutrons became available for research purposes shortly after World War II. The construction of a number of relatively simple, inexpensive nuclear reactors provided several sources of neutron beams, which scientists could direct at samples of various materials.

Clifford G. Shull, now retired from the Massachusetts Institute of Technology, was then at Oak Ridge (Tenn.) National Laboratory. He and his coworkers used neutron beams to study the way simple crystals, such as sodium chloride, deflect neutrons. These scattering experiments provided the basis for determining the locations of different types of atoms in a wide range of materials.

Neutron diffraction techniques have since become particularly important for locating hydrogen atoms, which are practically invisible to X rays. Because neutrons are themselves tiny magnets, neutron-scattering techniques have also played a key role in elucidating the structure of magnetic materials.

Bertram N. Brockhouse of McMaster University in Hamilton, Ontario, worked at the Chalk River (Ontario) Nuclear Laboratories, concentrating on neutron spectroscopy. Using neutrons of a particular energy to probe a material, he and his colleagues determined the energies of these neutrons as they emerged from the material. Energy losses could be attributed to the excitation of phonons — collective movements of the atoms within the material.

Nowadays, thousands of researchers worldwide rely on neutron-scattering techniques descended from those developed by Shull and Brockhouse to study materials ranging from polymers to superconductors. — *I. Peterson*

Hydrocarbon research garners Nobel prize

For his studies of fleeting hydrocarbon reactions, organic chemist George A. Olah of the University of Southern California (USC) in Los Angeles has won this year's Nobel Prize in Chemistry.

While working at Dow Chemical Co. in 1962, Olah discovered that powerful superacids, trillions of times stronger than pure sulfuric acid, could capture fast-disappearing "carbocations" and stabilize them for hours. Normally existing for less than one-millionth of a second as "reaction intermediates" generated during the breakup of hydrocarbon molecules, the positively charged carbocations could, under the superacid's influence, be observed and analyzed in a way previously impossible.

As a result, researchers could do hydrocarbon chemistry with unprecedented precision and develop new classes of compounds, from leadfree gasolines to extra-strong plastics. "Olah's discovery completely transformed the scientific study of the elusive carbocations," the Royal Swedish Academy of Sciences stated in announcing the award.

Prior to Olah's work, chemists had only postulated that carbon cations (positively charged ions) existed during hydrocarbon reactions. Olah's experiments showed a way to stop the action, so to speak, during the chemical transformations and observe step-by-step changes in detail.

Olah obtained his first results by mixing hydrogen fluoride with antimony pentafluoride to produce a superacid so strong it could pluck atoms from hydrocarbon molecules, leaving behind an alkyl cation — a molecule normally too unstable to be studied. Using spectrometers and other analytical equipment, chemists not only confirmed its existence but studied in extensive detail its structure and ability to form bonds.

From his work, new varieties of hydrocarbon synthesis mushroomed. For instance, scientists learned to convert combustion-poor straight-chain hydrocarbons into cleaner-burning, high-octane branched hydrocarbon fuels. Superacid catalysis enabled chemists to "crack heavy oils and to liquefy coal under surprisingly mild conditions," the Nobel committee said.

Many recent efforts to produce more environmentally friendly fuels and plastics stem from Olah's research.

The Hungarian-born scientist, now 67, came to North America from Budapest in 1957 to become a senior researcher at Dow Chemical in Sarnia, Ontario. From 1965 to 1977, he taught at Case Western Reserve University in Cleveland, then moved to USC. — *R. Lipkin*

Study links smoking, pancreatic cancer

The numbers tell a grim story: Fewer than half of all people diagnosed with cancer of the pancreas survive more than a year; fewer than 5 percent live 5 years. The disease occurs almost 50 percent more frequently among blacks than whites and affects more men than women. It kills approximately 25,000 people in the United States each year — making it the fifth leading cause of death from cancer.

Now, researchers have found a way to reduce those numbers with just two words: Stop smoking.

A new report warns that cigarette smoking increases the risk of developing pancreatic cancer by 70 percent and that the longer the smoker continues, the greater the risk. But smokers can reduce those odds by 30 percent if they quit for 11 years or more, says Debra T. Silverman of the National Cancer Institute in Bethesda, Md., who led a team that examined the smoking-pancreatic cancer link. Its findings appear in the Oct. 19 JOURNAL OF THE NATIONAL CANCER INSTITUTE.

Silverman and her colleagues conducted a 3-year study of 526 smokers with pancreatic cancer and 2,153 randomly selected volunteers, who served as a control group. Looking for risk factors, the team recorded the smoking, dietary, medical, and occupational histories of participants in the study, the first of its kind to interview pancreatic cancer patients directly.

The researchers conclude that cigarette smoking may account for approximately 27 percent of the pancreatic cancers in the United States and that switching from filtered to nonfiltered cigarettes has little impact on a smoker's risk of developing the disease.

"This study documents the link between cigarette smoking and pancreatic cancer," says Robert C. Kurtz of Memorial Sloan-Kettering Cancer Center in New York City. It shows that if you stop smoking, "the risk decreases."

The study failed to uncover why blacks develop pancreatic cancer at a higher rate than whites. Silverman's team selected the 2,153 black and white volunteers in proportion to their numbers among the 526 smokers to see if cigarette smoking causes the higher risk for blacks. The researchers found no link. The results show a virtual dead heat, with smoking accounting for the cancer in 29 percent of the blacks and 26 percent of the whites.

"Although we don't have all the answers, the long-term implications of this study suggest that by eliminating cigarette smoking, eventually we could save 6,750 lives each year," Silverman says. — *A.C. Brooks*