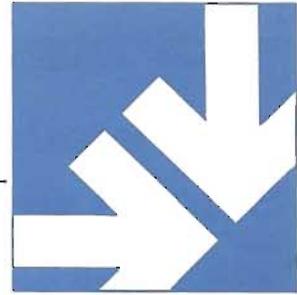


SEARCH

Scientists Who Serve God



Biochemist Known for "Humanity, Scholarship, Research"



Gordon C. Mills is Emeritus Professor of Human Biological Chemistry and Genetics at the University of Texas Medical Branch (UTMB) at Galveston. Before "hanging up his lab coat" in 1989, Mills had published some 70 research papers, taught thousands of medical students, and guided a number of young biochemists toward their M.A. and Ph.D. degrees. In 1987 he received the annual John G. Sinclair Award of UTMB's chapter of Sigma Xi, a national organization promoting scientific research. The award honored Mills for his contributions to "Humanity, Scholarship, and Research."

From Milking Cows in Nevada to a Ph.D. in Michigan

Born in 1924, Gordon Mills grew up on a farm his father had homesteaded near Fallon, Nevada. The 80 acres Percy Mills leveled and planted in alfalfa around 1920 were part of the first reclamation project to use irrigation water from the Sierra Nevada mountains. Both of Gordon's parental families had come from the east coast via the midwest, and, like earlier pioneers, brought with them strong family traditions. Gordon and his siblings heard a lot about education from his school teacher mother and aunt. The children absorbed a love of plants and animals from grandparents and other kinfolk. Gordon followed his older brother Al in work on the farm, in athletics, and then to the University of Nevada at Reno.

After his brother majored in chemistry at the university and liked it, Gordon chose chemistry too. A bad farm accident two days after high school graduation put Gordon in the hospital and into contact with interns and residents. He began to consider a medically oriented career, so he sandwiched some biology courses into his crowded chemistry curriculum. After receiving a B.A. in 1946, he began graduate work in biochemistry at the U. of Michigan, where he earned both M.S. and Ph.D. degrees.

The Human Side of a Scientific Career

Hard work on the family farm was good preparation for graduate school. Gordon assisted in the medical student laboratory (under fellow student Stanley Cohen, who later won a Nobel Prize), studied for qualifying exams in various branches of chemistry (plus French and German), took biochemistry graduate courses, and began his own studies of hemoglobin catabolism. After receiving his doctorate in 1951, he became a research associate at the U. of Tennessee Medical School in Memphis, where he stayed until joining the UTMB faculty in 1955.

Mills has always found time for outside activities. On his way to Michigan the professor who offered him a ride impressed him by reading a chapter from the Bible each night in the motel. Mills feels that participating in various Christian groups as a student contributed to his personal and spiritual growth. At the Michigan Christian Fellowship he met a charming young woman named Mary Jane Medlin. They married in June 1947, at a time when housing for married couples was extremely scarce in Ann Arbor in the post-WWII era. They moved to Memphis in 1950 with a 2-month-old son, and had another son and daughter by the time they moved to Galveston.

Besides raising a family, Gordon and Mary Jane have found time to teach Sunday school classes and to invite students into their home. It is fitting that Professor Mills has been honored not only for his scholarship and research but also for being a well-rounded human being. Ω

Scientific Investigation

Biochemical Studies of Disease

INFORMATION ON UTMB

In 1991 the University of Texas Medical Branch (UTMB) at Galveston celebrates its centennial year as the oldest state medical school in Texas. Texas now boasts a half-dozen medical schools, but in 1891 the university's sole "Medical Department" began with 13 faculty members and 23 students.

Today, its 64 acres house 71 buildings (including seven hospitals), with more than 2,000 students enrolled in UTMB's four schools and two institutes. With an annual budget in excess of \$388 million, UTMB is the fourth largest public employer in the whole Houston-Galveston area (which includes NASA's Lyndon B. Johnson Space Center between the two cities).

Galveston, a barrier reef island discovered in 1528 by shipwrecked explorer Cabeza de Vaca, gets its name from Count Bernardo de Gálvez, Viceroy of Mexico in the 1700s. It is famous for sandy beaches, sea breezes, and history—from the days of pirate Jean LaFitte (who built a mansion there), the Civil War (which left some cannonade scars still visible), and a disastrous 1900 hurricane.

The city of Galveston is a busy port from which cotton, cereal grains, and sulfur are shipped around the world. From UTMB one can look out across the Strand toward the docks where trawlers of the Mosquito Fleet unload their daily catch of shrimp.

Blood is red because certain cells (erythrocytes) have an oxygen-carrying pigment called hemoglobin. When the protein "globin" part breaks down, the "heme" part is converted to bilirubin, a yellow pigment found in bile. As a graduate student, Gordon Mills searched for the enzymes that catalyze such reactions. He didn't find them, but he did find in red blood cells a protein called "EF" (for "erythrocyte factor") that could *prevent* the oxidative breakdown of hemoglobin. To carry out its protective action, EF required a small sulfur-containing tripeptide known as glutathione.

"Serendipity": Finding What You're Not Looking For

At Tennessee, Mills worked with John L. Wood on the fate of various "aromatic hydrocarbons" in the animal body, an important topic because some such compounds were known to cause cancer. Using radioactive sulfur (chemical symbol S), he traced the linkage of a particular aromatic compound to the S-containing amino acid cysteine. Later, other investigators found that the enzyme responsible for that reaction made use of Gordon's old friend, glutathione (which contains cysteine).

At UTMB Mills returned to his studies on EF with a grant from the National Institutes of Health. Discovering that EF was a unique enzyme catalyzing the reaction of glutathione with hydrogen peroxide, he renamed it glutathione peroxidase. Today (30 years later), several books and hundreds of papers have been written about that enzyme, which led to the study of other protective enzymes. To almost everyone's surprise, glutathione peroxidase was found to contain the element selenium (Se), the toxic principle of "loco weed" but now recognized as an "essential trace element" in nutrition.

Blood Chemistry and Genetic Disorders

In the 1960s and early '70s, Gordon Mills turned his attention to other metabolic processes in red blood cells. He separated and determined phosphate esters by chromatography on the newly available synthetic ion exchange resins. His studies contributed to better procedures for storing human blood, which had been based largely on trial and error before that time.

Working with UTMB hematologists, Mills studied erythrocytes from patients with a wide variety of genetic blood disorders. For example, a patient with a rare abnormal hemoglobin (Hb Sabine) suffered rapid erythrocyte breakdown. Patients with a deficiency of the enzyme glucose-6-phosphate dehydrogenase (G6PD) often showed hemolytic anemia on treatment with various medications, sometimes losing half of their red cells in a week. Mills was able to identify the abnormal enzyme in four new genetic variants of that disease. His earlier work on glutathione peroxidase helped him show that the anemias resulted from inability of G6PD-deficient erythrocytes to detoxify hydrogen peroxide. The peroxide was produced when the medications were oxidized.

Mills was also able to do metabolic studies on a number of children afflicted with severe combined immuno-deficiency (SCID), including David, the famous "Bubble Boy" in Houston, who was kept alive to age 13 in a sterile environment. Gordon Mills is glad to have contributed to the understanding of SCID, the first genetic disorder for which approval has recently been given for treatment by gene transplantation. Ω



Left: Entrance to the UTMB campus. Right: From the Medical Branch one can see the docks where Galveston's colorful Mosquito Fleet ties up.

Professor Mills sometimes jokes about how much has changed during his 34 years at the U. of Texas Medical Branch—including the name of his department (formerly Dept. of Biochemistry & Nutrition) and the names of its faculty. (He denies a rumor that Jean LaFitte was department head when he arrived.)

Faithfulness on the Job

Doing research in academia includes applying for funds from government agencies like N.I.H. or private agencies like the National Foundation-March of Dimes, both supporters of Gordon's work at one time or another. Grant funds must be accounted for and regular progress reports written. Scientists must keep up with the current literature to be sure they're using the best techniques and not needlessly duplicating the work of others. It takes time to advise grad students and guide them through the academic bureaucracy, then to write letters of reference when they're ready to move on.



Using an ion exchange column and fraction collector to separate metabolites from human erythrocytes.

Teaching means more than preparing lectures and lab sessions, and grading papers—though those are time-consuming tasks. Mills served on departmental committees dealing with curriculum, policy matters, selection of new faculty, promotion & tenure, faculty travel, safety, and what-have-you, besides some 30 individual graduate student committees. For the Medical Branch as a whole, he shared responsibilities for grading & promotion evaluation, animal care, and supervision of an interfunctional laboratory for teaching basic medical sciences to both med students and grad students. He also gave special lectures to interns and students in blood banking and other health-related curricula.

Faithfulness in Many Other Matters

Senior scientists serve their profession by refereeing manuscripts for publication, by reviewing technical books, and in other ways. Christians in science generally bear other responsibilities as well. For example, Mills has been a faculty advisor for chapters of the Baptist Student Union and Christian Medical & Dental Society at UTMB.

Gordon Mills has also brought his professional expertise to bear on some questions he cares about as a Christian. In *Perspectives on Science & Christian Faith* (formerly *Journal of the American Scientific Affiliation*), he has written about the evolutionary significance of species variation in cytochrome c structure (1968), the significance of the synthesis of biologically active DNA (1968), hemoglobin structure and the biogenesis of proteins (1975), chemical evolution (1979), and presuppositions of science as related to origins (1990).

In those papers, Mills contends that the whole macro-evolutionary scheme goes far beyond the evidence. He cites a statement about that scheme by Nobelist Hans Krebs: "It is based upon acceptance by faith of fundamental presuppositions." Krebs, the biochemist who worked out the famous metabolic cycle bearing his name, insisted that "Hypotheses must not move very far from the facts." Mills agrees.

In many passages, the New Testament encourages Christians to "hang in there," to be faithful and steadfast because "you know that in the Lord your labor is not in vain" (1 Corinthians 15:58). Gordon Mills has been a faithful servant to his institution, to his profession, and to his Lord. Ω

Hanging in There

INFORMATION ON DNA

At a conference on "Information Content of DNA" held in Tacoma, Washington, in 1988, and at the 1990 ASA Annual Meeting, Gordon Mills described the structural complexity of the widely occurring and relatively simple molecule, cytochrome c (like hemoglobin, a "heme"-containing protein), and hence of the DNA in any gene that "codes" for it. But for that structural information to be "translated" from DNA to the protein requires a far more complicated system of RNA molecules and some 200 other protein molecules—with exact structures which also must be encoded on DNA.

Species-specific variations in cytochrome c structure are frequently cited as evidence of evolutionary changes from a "primitive" cytochrome in a microorganism ancestral to both yeast and humans. Yet the system that produces cytochrome c seems to be no less intricate in "simple" yeast cells than in the human body.

Such amazing complexity in the most basic life processes has led Mills to take issue with the common mechanistic assumption that "Everything can be explained by natural processes." Many things can be explained that way, of course, as science has been doing for the past 300 years.

But for Gordon Mills, at present the bottom line is best expressed this way: "An intelligent cause was involved in cosmological and biological origins; nearly everything else can be explained in terms of natural processes."

One would never know from reading about Dr. Mills's accomplishments that he has any physical limitations. But at age 17 he suffered an injury that affected the course of his life. He was driving a farm wagon when something spooked the horses. Gordon was thrown from the seat and his back was broken.

At first Gordon was totally paralyzed from the waist down, but sensation returned in the upper parts of his legs. Five months after the accident, he began to walk shakily on crutches. Because the muscles below his knees atrophied, he was fitted with leg braces like those he still wears. Now he walks with a cane, adroitly hiding it from any but the fastest snapshot.



Camera catches Mills with his cane at a Galveston seafood restaurant.

Helping Others with Limitations

Gordon could no longer play basketball and tennis, which he loved. Without the protection of pain in his lower legs he must check for slight injuries that might become infected. Several burn scars on his legs show that he can't tell when a hot-water bottle is too hot.

Of advice to the handicapped that "You can do anything you put your mind to," Gordon says, "Bunk." During a summer job in his college years he went out on a lonely road and tried to jog. With no muscles to cushion them, his feet developed ulcers so severe that he had to leave his job. Better advice: "Develop the capacities and abilities you still have, to the maximum."

Gordon does not consider himself an activist for "rights" of the handicapped, but he's concerned about providing "opportunities" for others like himself. In 1979 he participated in a National Science Foundation conference at the U. of Maine on "The Physically Handicapped Person in the Sciences." Several scientific societies have developed programs to make study and employment in science more accessible to individuals with disabilities. The American Chemical Society's Committee on the Handicapped has produced a manual on teaching chemistry to physically handicapped students.

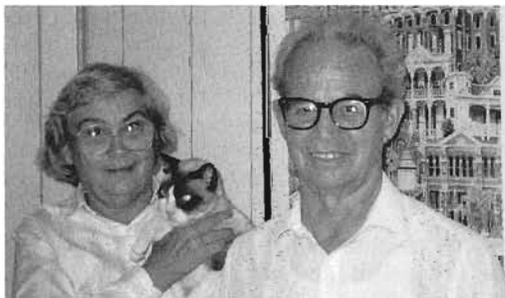
Receiving Help from Others

Initially, Gordon occasionally got depressed enough to ask, "Why me?" but because his accident happened in June 1941, that question was easily turned around. After Pearl Harbor, many of his classmates went overseas and some were killed or wounded. Then the question became, "Why them and not me?" With his braces, at least he never had to explain his 4-F draft classification.

Parents and relatives provided positive encouragement. Gordon knew that God had given him a good mind and expected him to use it, along with his remaining physical abilities. As a university student Gordon worked at a number of jobs, sometimes to the detriment of his studies. He learned from that experience that many people would be patient with him, and also that he might do better at science than in business.

Six years after the accident he married Mary Jane, who has been a great help, of course—but that works both ways. Gordon has supported her interests in ancient history and archaeology (she has an M.A. in history). Together they have raised three grown children: David, a lawyer; John, with advanced degrees in pharmacology and biophysics; and Melinda, an artist who works in a hospital public relations department.

Gordon Mills is grateful to God for the full life he has been able to lead. Ω



Mary Jane and Gordon Mills. Mary Jane is holding Smoky, their 18-year-old Siamese. Gordon is standing in front of a montage of Galveston's Victorian architecture, presented by UTMB on his retirement in 1989.

Thoughtful Worship

Overcoming Obstacles

SEARCH

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