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Thomas A. Steitz, 78, Dies; Illuminated a Building Block of Life

By Gina Kolata

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Thomas A. Steitz, a towering figure of late-20th-century science who shared a Nobel Prize in Chemistry for figuring out the structure of a huge molecule central to translating the genetic code into the proteins that make up living matter, died on Tuesday at his home in Branford, Conn. He was 78.

The cause was pancreatic cancer, his daughter-in-law Dr. Katherine Van Loon said.

Dr. Steitz was guided by the vision of a grand project to find the structures not just of that molecule but also of all the large molecules involved in translating genetic information into proteins, the so-called central dogma of molecular biology.

His Nobel, awarded in 2009, was for his discovery of the exact size, shape and position of every atom in the ribosome, the large molecule that is the site of such crucial protein synthesis.

One immediate application of the discovery was in understanding how a major set of antibiotics — those that poison bacterial ribosomes — work, thus offering clues to finding antibiotics that can evade drug-resistant bacteria.

He also found the structures of the other molecules that are part of the central dogma.

“He could have been given three Nobels,” Donald M. Engelman, a fellow biophysicist at Yale and a good friend, said in a telephone interview. “Even if he had never done the ribosome, if there was something called the career Nobel Prize he would have been a winner.”

(Dr. Steitz shared the 2009 Nobel with the Indian-born American molecular biologist Venkatraman Ramakrishnan and Ada E. Yonath of the Weizmann Institute of Science in Rehovot, Israel. All were honored for their ribosome research, which they conducted independently of one another.)

Dr. Steitz’s career was a golden one, advanced by what turned out to be the right decisions at every turn. It began with a choice he made in high school, when he seriously considered becoming a professional musician because he so loved playing the saxophone. But he was also drawn to science, and he came to a realization.

“I could do music as a hobby if I went into science,” he wrote in an autobiographical sketch for the Nobel committee, “but could not do science as a hobby if I went into music.”

Setting off on his chosen career path, he was inspired along the way by charismatic teachers and lecturers and by brilliant colleagues. And he quickly displayed a striking ability to plan and execute difficult experiments.

The problems Dr. Steitz solved were “daunting,” said another friend, Thomas R. Cech of the University of Colorado at Boulder, who shared the chemistry Nobel in 1989. Dr. Steitz, he added, had “a talent that is indescribable.”

“It is not just being a great scientist,” he said in an interview. “It is being an artist.”

Dr. Steitz was surrounded by Nobel laureates, as both mentors and friends, throughout his career. He went on annual ski trips with some of the giants of biochemistry and biophysics and their families, an event he named “Riboski” because the participants were studying the biochemistry of ribonucleic acid. Over dinner, they would recall, he would make them groan with bad puns.

Thomas Arthur Steitz was born in Milwaukee on Aug. 23, 1940, the oldest of five children. His father, Arthur, was in charge of personnel at the Milwaukee County Hospital. His mother, Catherine (Brown) Steitz, took care of Tom and his siblings. Until he was 9 his family lived above a paint store. They then moved to a Milwaukee suburb, Wauwatosa, Wis.

Dr. Steitz received a full scholarship to Lawrence College, in Appleton, Wis., where his teacher Robert Rosenberg, a shaping influence on him, introduced him to chemistry.

“I still recall the early lectures in his introductory chemistry course, where he introduced to us the concepts of atomic orbitals and bonding and how studying chemistry at the physical chemical atomic level allowed us to understand the properties of chemicals, such as their color,” Dr. Steitz wrote in his Nobel autobiography. “It was a wonderful revelation to me about how the world around me could be understood.”

Determined to continue his studies, he went to Harvard for graduate school. There, in 1963, he heard a lecture that changed his life.

It was given by Max Perutz, a renowned scientist who had shared the 1962 Nobel Prize in Chemistry with his colleague John Cowdery Kendrew for discovering a way to determine the positions of all the atoms in large protein molecules. It was a major advance, because it allowed scientists to make detailed molecular models of proteins and see which areas were important and why.

The idea was to make crystals out of a molecule and then bombard the crystals with X-rays. The X-rays bounce off the atoms that make up the crystals; by observing the pattern of the reflected X-rays, it is possible to determine the position of each atom.

Dr. Steitz wrote that he was stunned by Dr. Perutz's lecture, which featured a three-dimensional image of a myoglobin molecule that had been produced by Dr. Kendrew.

A friend at Yale, Peter Moore, a chemistry professor, attended the same lecture.

"It was a mind-blowing event," Dr. Moore said in a telephone interview. "It was the first time I ever saw an atomic resolution picture of a protein in three dimensions. The image was in stereo, and it was about the size of a small blimp. Here was this little man standing under this image that seemed to be floating over our heads in the middle of the room."

Dr. Steitz, left, receiving the Nobel Prize in Chemistry from King Carl XVI Gustaf of Sweden in Stockholm in 2009. Pontus Lundahl, Pool/Scanpix, via Associated Press

Dr. Steitz decided then and there to become an X-ray crystallographer. He joined a group led by William N. Lipscomb, the only scientist at Harvard using that technique. Dr. Lipscomb was awarded the chemistry Nobel Prize in 1976.

After Harvard, Dr. Steitz spent three years at the Medical Research Council Laboratory of Molecular Biology in Cambridge, England, where Dr. Perutz, Dr. Kendrew and other giants in molecular biology and biophysics worked. Among them were Francis H. C. Crick, who shared the 1962 Nobel in Medicine or Physiology with James D. Watson; Sydney Brenner, who shared the medicine Nobel in 2002; Frederick Sanger, who won the chemistry Nobel in 1958 and shared that prize in 1980; and Richard Henderson, who shared the chemistry Nobel in 2017.

It was a transforming experience for Dr. Steitz.

He wrote: “Perhaps the most remarkable and unique feature of the laboratory was the canteen located on the top floor which provided coffee in the morning, lunch after midday and tea in the afternoon. The attraction was definitely not the ‘bangers’ or, the ‘toad in the hole’ or other culinary opportunities, but sitting down with a random collection of lab directors, post-docs and graduate students and talking about science.”

He added: “The conversations were always about science and about experiments, never about the movie someone saw the previous night. Everyone contributed suggestions and/or criticisms. Initially I wondered how anyone got any experiments done since they were spending so much time in the canteen, and then I realized that the many discussions reduced the number of unwise or unnecessary experiments that were done and enhanced the good ones.”

Dr. Steitz was in Cambridge when he decided to focus on the central dogma of molecular biology by finding the structures of the relevant molecules.

“He had a vision that was premature,” Dr. Henderson said in an interview. “But he stuck with it, and then all the methods caught up and allowed him to achieve his vision.”

After Cambridge Dr. Steitz began a long career at Yale, which also hired his wife, Joan Argetsinger Steitz, an eminent molecular biologist and recipient this year of a prestigious Lasker special achievement award in medical science.

Dr. Cech, of Colorado, said that as an X-ray crystallographer Dr. Steitz was unmatched, “*the* master of X-ray crystallography in the current era.”

It was at Yale, in 2000, that he figured out the structure of the ribosome, a project that had taken five years.

That was a key discovery, Dr. Moore explained, because knowing what a ribosome looks like tells you how a protein is made. The ribosome converts the DNA sequences of genes into a sequence of amino acids, the building blocks of proteins.

“Once you saw where the atoms are, you could begin to understand how the ribosome does it,” Dr. Moore said.

Understanding the structure of the ribosome had an immediate application to medicine. About half of all antibiotics used clinically act by preventing bacterial ribosomes from working while leaving human ones alone.

“Why do they go after bacterial ribosomes?” Dr. Moore said of these antibiotics. “Your ribosomes are not wildly different from ones in bacteria.”

Once scientists knew how to interpret the pattern of X-rays that bounce off a ribosome crystal, Dr. Moore said, it was easy to figure out where and how antibiotics bind to bacterial ribosomes.

All scientists had to do was add an antibiotic to a ribosome and determine the resulting structure. The technique revealed exactly where the antibiotic binds to a bacterial ribosome, and why it binds more strongly to it, and the results suggested ways to make antibiotics that are effective against drug-resistant bacteria.

In addition to his wife, Dr. Steitz is survived by their son, Jon Glenn Steitz; two grandchildren; and four siblings: Richard, William and Mary Steitz and Sally Honeck.

Dr. Steitz met Joan Argetsinger while they were both graduate students in biochemistry and molecular biology at Harvard.

“I was very, very lucky to have married Tom,” she said in an interview. “He really believed I should have as equal an opportunity to succeed as he.”

Early in their careers, she said, he turned down a job offer from the University of California, Berkeley, after she had inquired about an assistant professorship and was told by the chairman of biochemistry, “All our wives like being research associates.”

Insulted, the couple went instead to Yale, which had offered both of them assistant professorships.

They initially lived in New Haven and then built a home in the Stony Creek section of Branford overlooking Long Island Sound. Dr. Van Loon, their daughter-in-law, said Dr. Joan Steitz and their son Jon were at Dr. Steitz’s side there when he died.

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