

NEWS in Science and Technology



from the

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The following is an Executive Summary of the Academy's quarterly Bulletin (Vol. 25,1) that includes topics and issues in science and technology deemed by the Academy to be both timely and relevant to Connecticut's interests. Each item is briefly summarized from press releases and reports of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. Hyperlinks are included to the original online source, where more detailed information is available.

NOTE: Online versions of this newsletter and the Bulletin are available on the Academy website at www.ctcase.org.

FEATURE ARTICLE

➤ Yale's Steitz Awarded Nobel Prize in Chemistry

Most people would probably agree that when the phone rings in the middle of the night, it is rarely good news. For Thomas A. Steitz; however, it was the call of a lifetime. On the other end of the telephone was the secretary of the Nobel committee of the Royal Swedish Academy of Sciences in Stockholm, Sweden informing Steitz that he was one of three winners of the 2009 Nobel Prize in Chemistry for his work mapping the structure of ribosomes.

About Steitz

Steitz is Sterling Professor of Molecular Biophysics and Biochemistry and a Howard Hughes Medical Institute Investigator at Yale University. He shares the Nobel Prize with two other chemists who have carried out similar research: Venkatraman Ramakrishnan of MRC Laboratory of Molecular Biology in the United Kingdom and Ada E. Yonath of the Weizmann Institute of Science in Israel.

- Born Milwaukee, WI, 1940
- PhD, Molecular Biology and Biochemistry, Harvard University, 1966
- Elected to the National Academy of Sciences, 1990
- Elected, Connecticut Academy of Science & Engineering, 1991
- Received Rosenstiel Award for Distinguished Work in Basic Medical Sciences, 2001, together with CASE member Peter Moore and Harry Noller for their research on the ribosome.

About the Work

Working separately, the three Nobel Laureates mapped the structure of ribosomes at the atomic level and documented their role in translating DNA information into life.

- Using a method called X-ray crystallography, they mapped the position of each of the hundreds of thousands of atoms that comprise the ribosome.
- DNA molecules reside inside every cell in all organisms. They contain the blueprints for how the living organism will look and function. DNA molecules need the ribosome to translate their information delivered by messenger RNA into living matter.
- "Ribosomes make proteins based on the information in DNA," Steitz said. "There are tens of thousands of proteins in the body (including hemoglobin, antibodies of the immune system, hormones and enzymes); they all have different forms and functions and they all build and control life at the chemical level."

"The most exciting thing for me about the ribosome research was seeing its large macromolecular assembly structure for the first time," Steitz

said. "I had no idea what it would look like and I have to say it was the most exciting time in science that I've had by a lot. It was like getting to the top of Mount Everest and seeing the view."

Applications

- Many of today's antibiotics cure various diseases by blocking the function of bacterial ribosomes. Without functional ribosomes, bacteria cannot survive. Thus ribosomes are an important target for new antibiotics.
- The three Nobel Laureates generated three-dimensional models that show how different antibiotics bind to the ribosome.
- Pharmaceutical companies, like Rib-X in New Haven, which Steitz co-founded, are using these models to develop new antibiotics that target

Implications for CT

Because of his experience in both basic and applied research, Steitz has a unique perspective on what Connecticut can do to position itself for biotech success: find ways to support basic research in the state and help facilitate startup companies. "As a state, we need to do a better job of transferring technology from universities into industry, so that we can solve problems and create jobs," Steitz said "Drug companies want to have effective drugs and the public wants that too. The problem right now is that the landscape to get through development is very expensive and complicated. If we make this investment, overcome the hurdles and do it well, everyone wins."

— Excerpted from a CASE Bulletin feature article by Karen Breckbill Cohen, *The Write Stuff, LLC*.

[http://www.ctcase.org/bulletin/25_1/25_1.pdf]

NEWS FROM THE NATIONAL ACADEMIES

The following is excerpted from press releases and other news reports from the National Academies (www.national-academies.org).

➤ Protecting a Critical Resource

The US Environmental Protection Agency estimates more than 60,000 chemicals are in use throughout the United States that could affect drinking water quality. Many of these chemicals have not yet been studied for possible effects in humans and are not regulated by the Safe Drinking Water Act. Even regulated chemicals need to be reassessed periodically. In addition, natural contaminants can also get into drinking water supplies (for ex., microbial pathogens like Giardia, Cryptosporidium and Legionella). The National Academy of Sciences (NAS) has several resources designed to help the general public understand some of the concerns related to the nation's drinking water treatment and distribution system. Reports and an overview of related information

have been collected on the Water Information Page at <http://water.nationalacademies.org/basics.shtml>. Several reports from the NAS Water Science and Technology Board address the issue of drinking water quality, including *Desalination: A National Perspective*; *Drinking Water Distribution Systems: Assessing and Reducing Risks*; and *Classifying Drinking Water Contaminants for Regulatory Consideration*.

<http://dels.nas.edu/wstb/index.shtml>

➤ Actions Needed to Reduce Threats from Hepatitis B and C

Resources and efforts to contain the viruses that cause hepatitis B and C lag behind those directed at other infectious diseases of similar impact to public health, notes a new report from the Institute of Medicine. These diseases cause thousands of cases of liver cancer, liver disease, and death each year, and account for nearly half of the liver transplantations that must be performed annually. The report calls for educational programs and materials that outline risk factors for viral hepatitis and provide information on immunization, prevention, and proper monitoring of infected individuals to be developed and made available to all health professionals and social service providers.

http://www.nap.edu/catalog.php?record_id=12793

➤ 'America's Energy Future' Issues Final Report

Beginning with a summit held in March 2008 and culminating with a 650-page report released this past summer, *America's Energy Future*—a National Academies-wide initiative—brought together 65 experts to provide detailed, technical assessments of energy technologies available to the United States. Issues studied include potential new energy supplies from coal and biomass, renewable resources, nuclear energy, and the potential for energy efficiency savings. Changing the way that the nation uses energy will involve energy efficiency measures such as those adopted in the 1970s, formulation of consistent government policies to drive these changes, and new technologies that can improve the way energy is produced, distributed, and consumed. The America's Energy Future project was launched to provide all the technical information required for an informed debate on the issue of energy in the United States. The report brings together the findings from all of the panels and concludes that with a sustained national commitment, the United States could make substantial improvements to the way it produces and uses energy.

http://sites.nationalacademies.org/Energy/index.htm?infocus_9.2

➤ Air Pollutants Know No National Boundaries

A recent National Research Council report finds that air pollutants can be transported across the Northern Hemisphere to continents that lie downwind. Although air quality is nearly always dominated by local or regional emissions, air pollutants from abroad are a growing concern as emissions from developing countries increase and environmental protection standards tighten in industrialized nations. Distinguishing between domestic and foreign components of air pollution and quantifying how global sources affect air quality and ecosystems is constrained by current modeling and observational capabilities. These increases could potentially be mitigated by progressively more stringent pollution control efforts and international cooperation in developing and deploying pollution control technology. Projected climate change will also likely affect the emissions and travel of pollutants, but predicting the net impact is extremely difficult with present knowledge. The report urges research initiatives such as "fingerprinting" techniques to better identify source-specific pollutant characteristics, atmospheric modeling, ground-based and remote sensing observations, and focused field studies.

http://www.nap.edu/catalog.php?record_id=12743

➤ Reassessing Sale of Nation's Helium Reserve

A new report from the National Research Council finds that selling off the government's helium reserves has had an adverse affect on the nation's scientific, technical, biomedical, and national security users of helium and recommends that the federal government reconsider whether selling the reserves is still in the nation's best interest. Helium is used in applications ranging from medical devices to surveillance balloons and is a derived product of natural gas. Shortly after sources of helium were discovered at the beginning of the last century, the US government recognized helium's potential importance to the nation's interests and placed its production and availability under strict governmental control. Policies in the 1960s resulted in the accumulation of a large reserve of helium owned by the federal government. The Helium Privatization Act of 1996 directed that substantially all of the helium accumulated be sold off by 2015 at prices sufficient to repay the federal government for outlays associated with the helium program.

<http://www.nationalacademies.org/morenews/20100129b.html>

➤ Mapped Genome Shows Corn's Adaptability

After four years, researchers have nearly completed sequencing the B73 corn genome, cataloging over 32,000 genes (more than are in human DNA) and 2.3 billion base nucleotides. Corn is one of the most widely grown grains in the world, and the B73 strain—one of the most common—has the largest genetic blueprint discovered for any plant species mapped to date. The mapping has implications for developing higher yield, disease resistant, drought resistant, and more nutritious crop strains. Study of the corn genome has given scientists a broader understanding of genetic behavior in more than just plants. With the discovery of "jumping genes" or transposons, new possibilities in the study of genetic evolutionary mechanisms opened up. Found in both animals and plants, transposons allow rapid adaptation from generation to generation. Funding for this undertaking was provided through the National Plant Genome Initiative (NPGI), a multi-agency collaborative research program with the goal of understanding the structure and function of genes in plant species that are important to agriculture, environment, energy, and health. In 2008, the Interagency Working Group on Plant Genomes asked the National Research Council to assess NPGI's achievements and recommend its future direction. The conclusions can be found in *Achievements of the National Plant Genome Initiative and New Horizons in Plant Biology*.

<http://www.nationalacademies.org/headlines/20091204.html>

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