SOUTHWESTERN NEWS

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NEW CRYO-ELECTRON MICROSCOPE PUTS UT SOUTHWESTERN AMONG NATION'S ELITE IN UNDERSTANDING MECHANICS OF HUMAN CELLS

DALLAS – Aug. 27, 2003 – There's a powerful new way of looking at disease at UT Southwestern Medical Center at Dallas.

It's called the cryo-electron microscope, or cryo-EM.

So powerful is the cryo-EM that at maximum one-million-time magnification power, it could, proportionally speaking, make a dime appear nearly 12 miles wide. By comparison, a common store-bought microscope with 1,000-time magnification would make that same coin appear a mere 62.5 feet across.

So sensitive is the microscope that it requires its own specially designed room – shielding it from noise and electronic or magnetic interference. The slightest vibration – a passing car, an electrical power surge – can corrupt its highly magnified pictures, which are vacuum-suspended and, to prevent distortion, frozen at minus 182 Celsius, or 295.6 below zero Fahrenheit.

And so rare is this latest model of the cryo-EM microscope that only one other exists in the United States (at an IBM facility in Vermont); three are in Japan, where UT Southwestern's cryo-EM was constructed. Earlier models can be found at a handful of U.S. universities, including Harvard, Yale and Stanford.

The complete cryo-EM system, roughly the size of a Volkswagen Beetle, took years to design, cost $1.6 million and took 18 months to build. It went into operation Aug. 14 after a three-and-a-half-month installation.

What cryo-EM brings to UT Southwestern is an unprecedented opportunity for scientific exploration in such areas as basic cell biology, cellular aging and death, Alzheimer's disease, spinal-cord injuries, cancer, diabetes, obesity and cholesterol metabolism.

Specifically, scientists can learn how viruses like herpes simplex virus type I (which causes cold sores) infect cells, as well as continue their detailed study of the human genome.

"This is a state-of-the-art instrument that will dramatically expand the electron microscope capabilities on our campus," said Dr. Richard Anderson, chairman of cell biology.

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The cryo-EM offers the ability to view, analyze and computer-simulate individual molecules, clusters of molecules and other sub-cellular structures within a cell. Resolution is more than three times the whole-cell magnification now possible with standard electron microscopes, which typically focus down to about three nanometers, or three-billionths of a meter - 705,000 times smaller than a pinhead. The new instrument can focus on cell components of less than one-billionth of a meter in size - 2.1 million times smaller than a pinhead.

The cryo-EM – paid for through the Texas Permanent University Fund – is housed in the Imaging Core Facility of the Philip R. Jonsson Basic Science Research Building. It is operated jointly by Dr. Christopher J. Gilpin, assistant professor of cell biology and director of the molecular and cellular imaging facility, and Dr. Masahide Kikkawa, assistant professor of cell biology. Dr. Kikkawa was recruited to UT Southwestern from the University of Tokyo's Graduate School of Medicine partially because of his expertise in using the instrument.

"Cellular machineries are usually composed of large molecular complexes that are often too difficult to be analyzed by X-ray crystallography and nuclear magnetic resonance spectroscopy," Dr. Kikkawa said. "The new cryo-EM will fill the gap between such atomic-level understanding of these molecules and cellular-level activities."

Similar to a patient having a magnetic resonance imaging (MRI) or computed tomography (CT) scan, minute biological samples can be imaged from different angles and a three-dimensional view obtained on the cryo-EM via specialized computer software, Dr. Gilpin said.

Said Dr. Anderson: "This cryo-EM is specialized for obtaining high resolution, 3-D information about the structure of macromolecular complexes like biological motors and ribosomes. I anticipate the structure of many important complexes will be solved, and many collaborations will develop between the cryo-EM specialists and the X-ray crystallographers on campus."

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