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Dr. Susan Lindquist, Professor of Biology at MIT

In the spring semester of 2007, the honor of the 21st Annual Volwiler Lecture was given to Massachusetts Institute of Technology (MIT) professor of biology and investigator of the Howard Hughes Medical Institute, Susan Lindquist. She is a distinguished scientist in the field of biomedical research. Her study is on protein folding, a basic and essential function carried out by living cells. Interestingly, her research overlaps with studies on evolution, neurological diseases, and cancer, all of which impact society greatly. Chicago is a second home to Dr. Lindquist, as she taught from 1977 to 2001 as a professor in the Department of Molecular Biology at University of Chicago. Dr. Lindquist is a former director (2001-2004) of the Whitehead Institute at MIT. *Discover* magazine's 2002 listed Dr. Lindquist as one of the top 50 women scientists.

Before the Volwiler lecture began, Dr. Lindquist led a small forum discussion to excite students on the topic of modern science. Dr. Lindquist believes that many interesting scientific questions will be tackled in the decades to come. She began with a question of how humans evolved to be such complex species. Her second question asked the audience how the brain works. She spoke of the brain's complex neurocircuitry and the way in which it produces the capacity for learning, cognition, memory, and emotion. Dr. Lindquist explained that the complexity stems from each neuron having the ability to make thousands of connection with other neurons.

Next, she considered the greatest problems that humans face today. Illnesses, like HIV and AIDS, have become a global pandemic concern. Global climate changes have also become areas of large concern. Today, scientists of the world see global warming as being caused by humans. Many students were surprised by the examples Dr. Lindquist cited. For example, five thousand years ago, the Sahara dessert was a tropical Forest, and Lake Michigan was covered with glaciers.

From questions and problems in the field of biology, Dr. Lindquist transitioned into the topic of students' future careers. Dr. Lindquist believes that the American educational system needs much improvement, and that it should be modeled after the systems of some Asian countries, such as Singapore, that devote much of their national funding to childhood education. Dr. Lindquist asserted that Singapore currently has the best kindergarten through eighth grade education in the world. In addition, she encouraged students to pursue their interests and described the fact that her personal passion for laboratory research led her to pursue a Ph.D.

After the forum, the rest of the audience settled into the chapel. Dr. Lindquist launched into her lecture, beginning with a PowerPoint slide that projected the word "LIFE" across the screen. She explained, "I have been working on this—LIFE—my entire career. It is just simply amazing what is going on in the biological science over the last 25 years. We have actually started to understand what life is really like. I am grateful to be here at this particular time in human history and doing this particular thing." Her excitement about science was truly genuine. Afterwards, she described her research on protein folding and the problems that can occur during this process. Dr. Lindquist suggested that the internal environment of cells makes protein misfolding a probable event because proteins must fold into shape while being bombarded with millions of other molecules. Thus, protein misfolding is a fundamental problem shared by all species on Earth. Dr. Lindquist has been working on the solution to this problem by studying yeast, a simple, unicellular fungus.

Dr. Lindquist is a big fan of using yeast as a model organism. Evolutionarily, humans and yeast are separated by at least billion years. However, the conserved cellular protein machinery between the two organisms enables scientists to study in yeast the diseases of protein misfolding that affect humans. At the Volwiler Lecture, Dr. Lindquist focused on two brain diseases where proteins misfold: Prion diseases and Parkinson's disease. Prion diseases are always fatal and extremely progressive in an infected patient's brain. The causative agent is an abnormally-shaped prion protein that eventually induces abnormal folding in normal cellular prion proteins. The consequence of this event is the impairment of normal function of the cell and, eventually, neuronal death. Parkinson's Disease (PD) is also a central nervous system disease; however, it is distinct from prion diseases in the fact that it impairs the patient's motor skills. The lost brain cells of PD patients consist of abnormal accumulations of the protein alpha-synuclein. Such misfolded forms of alpha-synuclein cannot be directed towards cellular degradation. Dr. Lindquist's lab has investigated the causes of protein misfolding, as well as its cellular and physiological effects.

The lesson that many students took away from Dr. Lindquist's lecture is the fact that, while human diseases may be incredibly complex, the model used to study such diseases need not be nearly as intricate.