Harnessing the Uncertainty in Life

Good morning! Dr. Darrell Kirch, Dean Souba, Dean Pogue, members of the faculty, distinguished guests, family, and friends – thank you all for being here today to celebrate a great milestone in our training and careers. To the Dartmouth Medical School Classes of 2011, congratulations! I’m honored and excited to address you all today on behalf of the graduate students. After much time in the classroom, in the laboratory, and at the computer, we’ve reached this moment where we can celebrate our accomplishments and reflect on the journey that brought us here.

As graduate students, our work has been to learn scientific research, the pursuit of new knowledge. Many of us entered science inspired by stories of the excitement of previous discoveries, and motivated by the desire to add to the fountain of human knowledge. While lecture halls and textbooks gave us an idea of the framework created by previous discoveries, we found the reality of probing nature’s unknowns to be quite messy. The organized pieces of information, lists, and neat diagrams of textbooks suggest that science is a discipline of certainty. In general society, we might think of science as a system of strict and established facts: the double helical structure of DNA, a drug’s effect on a disease, or the movements of planets in the solar system. Entering science, I was excited to try to expand these known facts, to place a brick in the growing cobblestone path of knowledge.

However, what I have learned and what I think many of you would agree with me on is that, below the cobblestone surface we view as scientific knowledge, the endeavor we know as scientific research involves a great deal of uncertainty. The foundation is not made of concrete, but of sand that can shift beneath our feet. Indeed, this endeavor is not a linear path, but a very dynamic stream of ideas, questions, and experiments to hopefully yield some answers. Our reality is that accepted facts, as we see them in textbooks, can be viewed as mere starting points. When probed deeply with experiments, many of these facts prove inadequate to fully describe nature. For a new person entering science, this uncertainty can be very destabilizing, and even frightening. How can a fact printed in a textbook be wrong? How can a new discovery, reported in a prestigious scientific journal and even perhaps announced in the general news media, not be a solid new brick on the path of our understanding of nature?

I have struggled to understand this process and make sense of science. How does science advance when the habit of scientists is to be skeptical of and possibly uproot previously developed scientific knowledge? What I have come to realize is that, at its core, uncertainty is a fundamental element that drives scientific and medical research. Indeed, a core part of our learning that we celebrate here today is the development of skills to work with the dynamic and evolving body of knowledge, to harness the uncertainty.

During this experience to learn science and examine the uncertainties, I’ve found that relationships with others have been essential. Indeed, my research mentor, Surachai Supattapone, commonly advised me that my path to earning the Ph.D. would require becoming comfortable with uncertainty. At times, this confused me. I was trying to learn how to expand knowledge, to enhance certainty. Why would I include uncertainty
in this important picture? However, over time and aided by the inspiration of others, I started to understand Surachai’s perspective.

Researchers before us have encountered many problems that appeared certain. By viewing them through a different light, and looking for gaps in the supposed certainty, they have ushered in new ways of understanding, in some cases providing a dramatically new path forward. My graduate research has been on prions, a group of unique infectious agents that cause fatal brain diseases in humans and other animals. Thirty years ago, the word “prion” did not exist to describe these pathogens, which cause mad cow disease. It took the efforts of Stanley Prusiner, a researcher in San Francisco, who questioned the established fact that a virus was to blame. He showed that prions are different than other infectious agents, and contain a protein that is folded improperly. This created a new paradigm, which expanded our knowledge of diseases like mad cow. Also, it brought us to see proteins and the way they fold in a whole new light, throwing light on the workings of Alzheimer’s disease as well.

You may be more familiar with the work of Jack Wennberg, a physician here at Dartmouth, who applied a similar process to the matter of how healthcare is delivered. Contradicting accepted conventional wisdom at the time, Wennberg suggested that greater spending did not always give better health outcomes. He found that some geographic areas spent less and had better outcomes, while other areas showed the opposite. By permitting himself to view the established ideas as uncertain, he facilitated a new understanding of the complex process that affects the quality of healthcare outcomes.

As we move on to the next step of our careers, let us each think about our own experiences in taking on uncertainty. Whether in academic science, applied science in industry, consulting to help others solve problems, or teaching, the skills we have learned here have prepared us well for many future endeavors in an uncertain world. I urge each of you to find your own balance between confidence, gained from your knowledge and experience, and uncertainty, to allow new ideas and observations to inform your approach. You have developed the skills to examine the uncertainty before you and to harness it, adding your own bricks to the dynamic path of human understanding.

Congratulations to all, and good luck!