

Commencement Address

It is a distinct honor and pleasure to address you today on this momentous occasion. I was actually quite nervous when Dr. Zimmerman asked me to speak at this commencement to my former school. What would I say? I thought there must be some experience I could fall back upon to help me through this. Then I realized there was an experience I could rely upon and by coincidence it happened right here at the University of Illinois. A little over 30 years ago I sat right where you are sitting today and I realized I had absolutely no memory of the commencement address or speaker. Believe me that has taken the pressure off.

So first, let me congratulate the class of 2011! Well done. You know how much hard work and determination went into your presence here today and it is a monumental achievement that you will cherish for the rest of your lives. It was hard work, uncertain from the start, and you set your mind to it and you did it. Bravo!

I loved my time here at the U. of I., it was one of the best times of my life.

I spent two years in the Pennsylvania Avenue Residence halls, then took my Junior year abroad in Southampton, England, then returned for my senior year and lived on High Street. That is not meant as a metaphor, I actually lived in Urbana on the corner of High and Elm in a house with seven guys. It was a little like a cross between Animal House and That 70s Show. From there I went to MIT for Grad school in Molecular Biology, then on to Stanford for post-doctoral work where I met my wife, who was also a scientist and worked in an adjacent building. For me, like for so many scientists who work in the lab a lot, love is a diffusion-limited reaction. And I must say in my case, it was extremely exothermic. And yes, if you must know, it was an SN2 reaction and as you might have guessed, I was not the leaving group. I explained this to my wife. She had no idea we had so much chemistry in our relationship.

We are all here today because we have something in common. You or someone you know at some point fell in love with atoms and molecules. The idea that matter is composed of units with definable properties filled us with delight. The fact that elements fell into the periodic table in a manner where theory could predict their chemical properties and allow their manipulation to create new forms of matter is an amazingly elegant fact of nature that drew us in and continues to astound us even today. Chemistry is the basis of life, it touches all things and tremendously enriches our world.

Science is a continuum, chemistry, biology, physics, mathematics, engineering they are all different facets of the same entity. Science is interdisciplinary. All boundaries are artificial. Science lives and grows through generations as each generation hands off its information to the next generation of scientists. You have been passed the baton and it is up to you to pass it on to future generations. Yes, you are the descendants of the great scientists of the past.

Galileo	Newton	Lebnitz	Oppenheimer
Dalton	Thompsom	Mendeleev	Copernacus
Bohr	Kepler	Maxwell	Heisenberg
Pauling	Schrodinger	Rutherford	Curie
Watson	Crick	Darwin	Einstein

You are their intellectual heirs and, like Newton, “you too will see further because you have stood upon the shoulders of these giants.” You are the future scientists who will carry on their work and some of you may also become giants in your own rights, future Nobel Laureates like Phil Sharp who graduated from here. You will bring realization to the great potential of science and carry it forward to the next generation, making fantastic discoveries along the way.

So you have obtained your degree.....

Now What?

You have now built a foundation through your education, now going forward you will build on that foundation to establish your career. You have now received a driver’s license for the road to true adulthood. You are in the drivers seat. You will set the course and you must determine how you will use your time. You must decide how to spend it wisely. You must decide upon the meaning of life, your life. I often tell my students the story of the man who was searching for the meaning of life. He studied all of the major religions. He sought out all of the wisest clerics to learn from them. Still he was not satisfied. Finally he learned of an ascetic who lived in solitude on a mountain top in Tibet who was regarded as the wisest man on earth who knew the true meaning of life. So he trekked to Tibet and found the mountain and climbed it for days and finally found this wisest of men who was meditating on a rock and asked “Sir, what is the meaning of life”. The wise man looked up from his meditation and paused, then replied, “Life is a river.” The searcher grew visibly upset. He yelled back at the wise man, “Life is a river, that’s all you have, that’s it?” To which the wise man replied, “You mean it’s not a river?”

The reason I tell you this story, is that while you may learn much from many along your journey, no one can tell you what the meaning of your life will be. No one can tell you the path to follow. You will have to figure it out for yourself.

You will have to make decisions with insufficient information. Call it the ambiguity of life. You will have to use your background and intuition to guide you and will make mistakes. Mistakes are a part of being human. Appreciate your mistakes for what they are: precious life lessons that can only be learned the hard way. Unless it's a fatal mistake, of course, and then at least others can learn from it.

I remember sitting in your position as I graduated filled with a mixture of elation over what I had accomplished and anxiety about the future. I really did not know where I might end up. However, let me put one fear to rest. I wondered about how good my education here really was and how I would stack up to students from other schools moving forward. I was moving onto MIT and I thought, that’s the big league and I am going to get killed. What I learned is that I came from the big leagues. My education was equal to or better than that of my fellow students, many from ivy league schools. So, don’t worry about that, you have an extremely solid education upon which to build. You will be fine.

Some of you will join faculties and become teachers and professors, others will join industry to make this nation run, others will start companies we have yet to imagine, still others will change fields and study law, economics, biology, medicine. We need scientists like you in all fields. Some are arguing we train too many scientists, there are not enough jobs and they cannot all be professors as if that were the goal of a science education (it is not). I say non-sense; we need people who are trained in critical thinking in all fields.

This leads me to my final topic, the role of science in our society and your responsibilities moving forward.

As a recent editorial in the journal Science noted: There is an increasing worldwide consensus on the vital importance of science for personal, social, economic, and political development. This has spurred many countries to increase their investments in science and technology. But funding research is not enough: We as a nation must also promote cultures that celebrate science and its values, just as they celebrate the arts and humanities that enrich everyone's lives. Not only formal education but informal outreach is critical in achieving this goal.

You are a scientist but the University of Illinois did not make you into a scientist. You were scientists the day you walked onto this campus. You chose to live in a world based on reason and experimental verification to seek the truth. This is the essence of science and a philosophy to which you ascribed long ago.

Once you have discovered science you think everyone must clearly see how powerful this vision of reality is, how it can reveal the world. Science really is beautiful. But unfortunately, it is a minority who accept science. There is an anti-intellectualism brewing in this country. There are segments of our society that rail against science, they do not want to hear it, see it or let it touch their children. They deny its validity and wish to silence it. Some see this as a fundamental incompatibility between science and religion. I see that as a false dichotomy. I do not believe it matters in this instance whether you believe that DNA is the blueprint by which God created Man, or if you believe that the Bible is the blueprint by which Man created God. This is irrelevant. The friction is not between science and religion, but between those who accept evidence based decision-making processes and those who do not.

Note the efforts to change textbooks to call into question basic facts about which there is really no dispute. They play on words confusing the different meanings of the word "Theory". Evolution is just a theory. Yes, Evolution is a theory like the theory of gravity. When was the last time you dropped something and it did not hit the ground? Some claim global warming is a hoax. While it may not be possible to definitively say what portion of the rise in temperature is due to greenhouse gases, the experimental evidence is overwhelming. The notion that 100s of scientists would collude to promulgate such a hoax is absurd. I know if I proposed an incorrect theory, other scientists would be falling over themselves to upend me. So when someone calls something in science a hoax, the correct reply is to say, "That is interesting. Upon what evidence do you base your opinion?"

This is where your responsibility as a scientist to our society comes in. It is critically important to promote the values of science, the values of reasoning, openness, tolerance, and respect for

evidence. So I am asking you that when you have an opportunity in the future to promote science, to defend science, stand up to that challenge. If that means participating in your local school science fairs, participate. Get to know your children's teachers, help them. When the winds blow against science, write letters to your local newspaper defending science. When neighbors are confused about science, help them understand. When teachers are under siege, defend them. When the darkness of ignorance starts creeping in, shine a light on it. Demand evidence based reasoning from your politicians. Defend science and promote rationality. This is your responsibility to science and society and one I hope you will accept today moving forward. Our common future depends upon it.

I would like to end with a quote from Albert Einstein.

He said:

“One thing I have learned in a long life: That all our science, measured against reality, is primitive and childlike--and yet it is the most precious thing we have. “

Thank you and congratulations.