

Graduate Commencement Service, 18 December 1998

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President Torgersen, Provost Meszaros, Mr. Rocovich, Candidates for Degrees, Faculty Colleagues, Families and Friends, it is an honor for me to deliver this commencement address.

Thank you Provost Meszaros for those kind words of introduction. Some of you may remember the last time I was introduced to a large crowd. It was in Burruss Auditorium, on Founder's Day, when I was honored to receive the Alumni Research Award. I remember standing on the stage, feeling very proud, as the Chairman of the Alumni Association read the citation, "Dr. Tyson is receiving this award for his distinguished contributions to the mathematical theory of biological orgasms!" That got everyone's attention! After that announcement, graduate students started clamoring to join my research group.

Every one of you graduates has taken a unique and arduous path to this ceremony, but I will single out just one for special recognition, my dear friend Matt. If you don't know Matt, he's the one beginning to turn red around the neck! My wife Linda and I have known Matt for many years, through all the ups and downs of his studies, and through the joyful turmoil of courtship and marriage. We watched him leave Tech to get a job and begin a family. Now he is back today to receive that degree that he worked so hard for, and we rejoice with him. Congratulations, Matt! And congratulations to all you graduates!

This is a time when many words of thanks are in order, between graduates and their families, between faculty and students. But there is one word of thanks that is too often left unexpressed. Virginia Tech is a public institution, which exists by the will and liberality of the People. We, as faculty and administrators at Virginia Tech, are deeply grateful to you people above us, the taxpayers of Virginia and the Nation, for your support of this

Institution, for sending your loved ones here for their graduate education, and, we trust, for supporting a political atmosphere that values higher education. So, faculty and administration, please join me in saying thank you to our employers!

What exactly is it that you pay us to do here? Well, the University has a three-fold mission--Teaching, Research, and Service--and I want to address each briefly.

All of my colleagues can attest that teaching involves much more than standing in front of a class for a few hours each week. To give you some idea of the extra things we do, I think back to exam time in December, about 15 years ago. It was stomach flu season, and my wife and I had been up all night with sick children, emptying buckets, changing sheets, and comforting miserable little kids. Then I trucked off to give an exam at 7:30 the next morning. Now, in any class of 100 students, there is always at least one person who sleeps through the final exam! True to form, about 15 minutes before the end of the period, a very distressed and disheveled young man came into the room.

“Oh, Dr. Tyson, I’m so sorry I’m late. I overslept. I was up all night with stomach flu. I must have fallen asleep early this morning and slept through my alarm. Please, let me take the exam.”

Clearly he wasn’t fabricating this story, because he looked awful! So I took him back to my office and set him up at a desk where I could keep an eye on him. Well, he looked progressively sicker, but I couldn’t tell whether the reason was the flu or my exam. Then I heard the tell-tale sounds, “Aach, Aach!” Leaping from my chair, I grabbed the waste can and shoved it in front of him. I won’t go into further details, but when he was finished, I trotted to the men’s room to clean out my can. When I got back to my office, he looked at me with a smile and said, “I feel soooo much better! Now I can do this exam!” And he did quite well, as I recall.

Although these little things can mean a lot to our students at the time, we put most of our effort into more lofty pursuits. The heart of graduate education is research: the discovery and application of new knowledge about nature and society.

We often distinguish between basic research and applied research. The significance and value of applied research is relatively easy to understand. It puts modern products and services at our disposal every day. Virginia Tech is famous for its work in wireless communication, electrical power grids, polymers and adhesives, seafood processing, genetically engineered animals and plants, and many other remarkable developments.

Basic research and scholarship is more difficult to define and evaluate. Here are the sorts of questions we ask. How does the leopard get its spots? Where is the nearest black hole? Can every even number be written as the sum of two primes? What roles did citizens play in amending the Constitution after the Civil War? Can we piece together the original text of The Canterbury Tales?

Of what possible value is the study of such problems? And why do we ask you to pay for their solutions?

My own research interest is to understand the molecular machinery that controls cell growth and division. This is a hot field right now, with a small army of scientists studying the properties of molecules with esoteric names like Cdc2, cyclin B, and Wee1. It is a time of great optimism and excitement. Now that we have a hand on the control system of cell division, we can begin to design rational strategies to stop the spread of cancer cells, or to coax nerve cells to repair a damaged spinal chord.

Everyone can see the value of such knowledge, but how did we get to this point? Our current understanding has a humble and unexpected origin. I remember well when I caught my first glimpse of the control system of cell division. It was 20-some years ago, when I was a postdoc at the University of Innsbruck.

One day a visitor showed up at the Institute to talk about his research. He was a short, pudgy guy with a broad smile and a delightful accent that betrayed his working-class upbringing in the coal towns of central England. Paul Nurse was a postdoc like myself, a foot soldier in the War on Cancer. His job was to disrupt cell division in yeast by introducing mutations at random in its genes. The idea is simple...known to every child who has disassembled a toy: by breaking something apart you can often learn how it is put together. But to me, Paul's project seemed unlikely to find the control system of the cell cycle. Cell division is a complex process, with many essential steps. Screw it up at any one point, and you're likely to stop cells from dividing, without ever touching the control system, just like there are dozens of ways to lose hot water in your house that have nothing to do with the thermostat.

As expected, Paul showed us lots of unremarkable mutants: yeast cells that grew absurdly large and died because they were unable to divide. Then he showed a mutant that changed my life and changed the course of cell biology. It was not a gigantic dead cell but a healthy midget! It grew and divided merrily, but was only half the size of a normal yeast cell. Paul had found the thermostat of the cell cycle and turned the dial. In this mutant, for the first time, the control system for cell division had been altered.

The next 20 years were a time of great excitement, of brilliant discoveries and false leads, of bewilderment and disputes, of soaring egos and lab intrigues, as teams of researchers identified the molecules and mechanisms that command cell division. We understand today what makes cells divide because, back in the 70's, Paul Nurse had the freedom and opportunity to study unpromising mutants of economically worthless yeast cells.

This sort of fundamental research is a messy business! It is unpredictable, contentious, full of failures as well as triumphs. No act of Congress can legislate its direction. No bureaucrat can chart its future. No scientist can guarantee its success. But in the long run it pays off. It is the only way we know to make progress, to lay the foundations for the

technology and health care of the next generation, to strengthen the principles that make our society stable and just, to create the arts and letters that enrich our lives and motivate us toward the good and beautiful. It is arguably the most unique and important way that a major research University serves the Commonwealth.

“We Serve” is what we do as teachers and scholars, and it is the motto under which you receive your degree. It means that the purpose of your degree is that you may serve the welfare of the nation and the world. But what is the motivation to serve? Is it just an onerous responsibility? I think not. Education is a gift, and the proper response is gratitude and sharing the blessing.

Now maybe it sounds strange to you that I should say education is a gift, on this very day when we celebrate your hard work and accomplishments, not to mention all those tuition payments!

But, think about it ... We are gifted people, you and I. We were born with intelligence, concentration, and ambition that many people lack. We have enjoyed opportunities and freedoms most people can only dream of. We have benefited from the world’s finest educational system and highest standard of living. These are gifts. We didn’t ask for them, we didn’t earn them, we do not deserve them more than someone else. Call it Good Luck, or Providence -- I call it Grace. In any case, these opportunities we have enjoyed are gifts, the very gifts that have made this day possible.

Like all the best gifts of this life, they are not your possessions to hide or to hoard. They serve you best as you give away what you have been given. If you hoard your knowledge, exploit your skills, abuse your privileges, you will find them shallow and unfulfilling. If you share your opportunities, nurture your learning, and use your education in joyful service, you will find them boundless as the sea, unfathomable and inexhaustible.

In many ways great Universities, like Virginia Tech, are in the Gift business. We cultivate the gifts of knowledge and pass them on from one generation to the next. Now these gifts are in your hands. Use them wisely and generously. God bless you all!