Dean Dai, College of Science and Technology faculty, staff and administration, graduates, family and friends, and especially my wife, Debbie, good afternoon!

I am honored and excited to be before you here in Mitten Hall. It would never have occurred to me when I registered for classes in this very room back in 1961 that I would someday be speaking before a group of graduates at such an important event in their lives. I grew up about 20 blocks west of here at 32nd & Montgomery. I was a scholarship student. I have come a long way.

The speaker at my commencement was the newly appointed President of the University of Notre Dame, the Reverend Theodore Hesburgh. Dr. Hesburgh was a world renowned civil rights worker and peace advocate. However, if my memory serves me correctly, he was appointed with the mandate to create a University of which his football team could be proud. I still remember his comment that commencement speakers are much like grandfather clocks, more decorative than useful.

Keeping that in mind, I will take this opportunity to briefly reminisce about Temple, the role of science in society, my own career and the importance of Temple in your lives.

**MY EXPERIENCES AT TEMPLE**

Temple was a different school in the 1960's. It was a commuter school back then, with maybe 100 students living on campus. Many of us scheduled our classes around those of our friends who had cars. What difference did it make if our first class was at 8:30 a.m. and our next class wasn’t until 3:00 p.m. – as long as we had a ride home? We wanted to have classes in the “new” air conditioned Curtiss Hall – which I think was torn down during your time here at Temple.

Mitten Hall was the focal point of student life: It was the center of our social interactions; a place to debate what we learned in classes while doing crossword puzzles and sometimes sleeping on the soft leather furniture. We argued endlessly on whether a young boxer from Kentucky should change his name from Cassius Clay to Mohammed Ali. There were many hours spent glued to the television set in the alcove to my right (there was a “big screen” 21"TV) watching the major events of my era many of which you may have heard of: the Cuban Missile Crisis, the early failures of the American space program, and aftermath of the Kennedy assassination. At pep rallies, an undergraduate named Bill Cosby used to entertain.
These events serve as benchmarks when I reminisce with friends. Similarly, your memories of historic events of your era will serve as benchmarks for you and your friends and be meaningful be for you over the years.

**UNDERGRADUATE LIFE IN THE SCIENCES**

Chemistry was taught in College Hall which is now called Barack Hall. I remember an experiment in Quantitative Analysis in which we observed a color change from blue to green. It didn’t make it any easier that the old building’s walls were a flaking bluish green.

In our first day in freshman chemistry lab, we had to bend glass to make our own wash bottles using rubber stoppers and Erlenmeyer flasks. The most valuable lesson we learned was that hot glass looks exactly like cold glass. Today’s students, who use polyethylene wash bottles, never learn this valuable lesson.

In the beginning of my junior year, we moved into Beury Hall, which was considered state–of–the–art at that time. One day, I tried to figure out why I couldn’t get the new “emergency shower” to work as I gently pulled on the chain. One of the graduate students informed me that if you get acid spilled on you, chances are, you’ll yank the chain with some force. So I yanked the chain. Unfortunately, my advisor happened to be standing beneath the showerhead at the time. At least I proved that it worked using the scientific method. It didn’t get me many points with my advisor.

**THE IMPACT OF GREAT TEACHERS**

You will always remember certain teachers who meant a lot to you. Let me tell you about few of mine. Some of the faculty may actually remember them.

Dr. Hazel Tomlinson taught analytical chemistry. Her labs were a precursor of what we today call competency based learning. You had to get it right before you passed on to the next experiment. 99 percent accuracy meant you got a grade of 60 for the experiment. The techniques were accurate enough, but the thought of losing 4 points from your grade for every tenth of a percent that you were wrong traumatized a lot of students. Those of us who stayed in science, understood that this requirement of accuracy was not unreasonable. For you non-scientists in the audience, think about how much error you are willing to accept when you visit a doctor. You may not focus on whether or not the doctor got a 90 in the course in which he/she learned about what they are treating you for – you assume they know 100% of the subject. Dr. Tomlinson taught us that in certain areas, 90 percent is not an excellent grade and that 99 percent is barely tolerable. It was clear that she loved to teach and demanded excellence.
I met Dr. George Harrington just prior to registering for classes at the beginning of my freshman year. All freshmen met with an “advisor” to review what courses to take before coming over to Mitten Hall to actual sign up for classes. We reviewed the course requirements of the day and he suggested that I take history. I told him I read a lot of history on my own and that I’d rather study something new for me. He encouraged me to take sociology. Then he asked me what I wanted to be, and I said a chemist (not really sure at that point what being a chemist meant).

Dr. Harrington placed me in his advanced freshman chemistry class. Instead of being in a freshman lecture of 200 students, I found myself in a class of 25. This was serendipitous. He made chemistry fun to learn and changed my life. He also gave me a job working for him as a lab assistant, and guided me through my four years at Temple. Yes, he was the same person who got caught under the shower.

Dr. Bob Salomon, who many of you know, had the deserved reputation of being a super bright guy who taught his classes without any notes. In my senior year, he allowed me to take his Saturday morning graduate class in statistical thermodynamics. You could always tell who had been out late the night before – they were the ones sleeping behind their sunglasses.

Bob taught us not to get hung up with labels and to break problems down into basics and solve them piecemeal – tools I find applicable in situations in everyday life.

There were other teachers I remember fondly who taught me sociology, philosophy, German and math. In German literature, we read Faust. The theme of Faust – to constantly strive and not rest on the past or your laurels - is one that has carried me throughout my life. The phrase, “wer immer strebend sich bemuht, den konnen wir erlosen” – “whoever strives untiringly, he can be saved” appears as the frontispiece of my own doctoral dissertation.

**THE VALUE OF SCIENTIFIC TRAINING**

Scientific training has been an important part in the growth of most societies. To say that advances in science and technology have been an important part of world history is, of course, a given. I run through some highlights now.

The ancient Egyptians made significant advances in astronomy, medicine and mathematics.

The Greco-Romans gave us the Socratic Method and made great advances in geometry, logic, and the natural sciences. The work that Euclid did in laying down the foundation of mathematical rigor and of Archimedes in giving us the foundations of hydrostatics and the principal of the lever are well documented.

Ancient India was an early leader in the field of metallurgy. The Indians made major advances in astronomy and mathematics.
The invention in China of gunpowder, the compass, and printing changed the world.

In the Muslim world, ibn al-Haytham was a pioneer in developing the scientific method, i.e. using experiments as the norm of proof. He did a lot of the early work in Optics.

The Persian mathematician ibn Musa al-Khwarizmi gave his name to the concept of the algorithm. The term algebra is derived from the title of one of his publications.

The further development of science in Europe and the West has led us to the world of today. Can you imagine our world without the discoveries of Newton, Descartes, Pasteur, Einstein, and John Kemeny. In case the name Kemeny doesn’t immediately strike a bell with you, he was the co-inventor of the BASIC computer language which probably made it possible for us all to have PCs.

What we see is that the history of science and thus the world is marked by international advances in technology and knowledge that complement each other.

You are the natural successors to all the great scientists who have come before you. Your training is in science, and as a result, you have a unique skill set that will be important to you as an individual and to society as a whole. You should think of yourselves not just as practitioners but as ambassadors of science to the non-scientific community. You should never underestimate what the value of that training has been.

Some of you will be going to medical school, some to graduate school, and some of you will head into the work force. Many of you will build on your scientific background to go into business.

My own experiences say that you cannot predict how valuable one’s scientific training will be and how it will be put to use. No matter what your major was, you need to keep your horizons broad. I was a chemistry major at Temple. Because of my own accomplishments, and because of the reputation of Temple, I went on to Princeton where I received my doctorate in an area of research that overlapped nuclear chemistry and solid state physics.

After I received my doctorate, I went to work in the central office of the City University of New York. I thought my career was headed in the direction of academic administration with a goal to become a college president some day. I took some courses in business because I thought college presidents should know about finance. Serendipity came about again because of the fiscal crisis in NYC in 1975. I left the City University to work for a metals trading company which was the largest gold and silver dealer in the world. The Chairman of this company, who’s own background was in psycho-pharmacology before going into business, very early on saw the value of people with a math and science backgrounds to serve as administrators and to do research in the financial area. This March will mark my 34th anniversary working for the principle of that company.
We hired the first so-called “rocket scientists” of Wall Street. My technical background made me the right person at the right time for the job. There have been many problems that have come up over the years that were easier to solve because of my analytical and mathematical training. I serve on the Board of one of our companies that tests and develops drugs to treat central nervous system disorders. I am not involved in their scientific work but it is valuable from a business perspective to understand on a basic level the chemistry that is involved.

I tell you this to emphasize that it will be hard to predict how valuable your background will be in whatever field you choose. And I am not unique.

I have a friend who is a lawyer who went to work for a chemical company, and was assigned to their asbestos litigation team. She came to me for guidance and spent hours with me as she learned the chemistry she needed to know for her litigation work.

Another friend was a French major in college and she went to work for a consulting company working in technical fields. She’s working as an oil analyst for Morgan Stanley today, but she’s often said it would have helped to have had formal scientific training.

**THE POWER OF SCIENTIFIC DISCOVERY**

Let me tell you about three scientists who’s work has inspired me over the years.

Some of you may have heard of Professor Edward Taylor who spent 20 years working on a folic acid derivative that led to the discovery of the drug Alimta. Taylor, by the way, synthesized marijuana in the 1960’s. Alimta has been approved for use to treat mesothelioma and it is expected that it will be approved for the treatment of other cancers. Alimta was a long working partnership between Taylor and Eli Lilly. Lilly is now using their experience in working with Professor Taylor as a model for collaboration with other academic scientists in the drug discovery process. By, the way, the sales volume for Alimta in 2007, its third year on the market, was greater than $800 million. I last spoke to Dr. Taylor about 5 years ago just before the FDA approved the drug. I'll never forget his comment at dinner “look at how many people I have and will have helped.” What a legacy he created!

Richard Feynman is a hero of mine. There are numerous examples of his insatiable curiosity, intellect and quirkiness that regale anyone who knew him or has read about him. By knowing the right questions to ask, he was able to determine the cause of the space shuttle Challenger explosion in the mid-eighties.

As an 18-year-old in Far Rockaway, NY, Feynman knew what questions to ask to come up with a tuberculosis diagnosis on a patient before the doctors did. He was a great teacher, and encouraged his students to come up with innovative ways to solve problems. Just for fun, he used to crack safes at Los Alamos where he was working on the Manhattan Project.

While serving on a California school board, Feynman was constantly fighting the traditionalists who said it was the method of solving problems that counted, not the answer. And remember it
was the development of his own mathematics, known as Feynman Diagrams, which helped him in the development of the field known as Quantum Electro-Dynamics for which he won the Nobel Prize.

I tell you these stories to emphasize that the role of a scientist is knowing what questions to ask. You may all have heard of the phrase that says “even if someone were to come along today who had the answers to all the problems in the world, that person would be useless to us unless we knew what questions to ask.”

A number of years ago, I met Stephen Weinberg, who received the Nobel Prize for his work in field theory. He said that one of the most valuable things he learned in graduate school was how to make the transition from being a student to being a scholar. To change from answering other people’s questions to asking your own. I heard him speak recently and was impressed with how he incorporated his knowledge of other disciplines into his thinking. He gave those of us involved in estate planning some guidance: He said that it was just not necessary to plan beyond 10 billion years since the world would not be here then. In addition to his traditional scientific work, Weinberg has been a prominent public spokesman for science: testifying before Congress, writing articles for the New York Review of Books and serving on the Council on Foreign Relations.

One of the things that all the great scientists have in common is that they have a broad range of interests. As an example, Dean Dai, whom you all know, is really a symphonic conductor posing as a distinguished scientist and administrator.

Great discoveries in sciences often happen serendipitously. A former professor of mine used to give a lecture called “Lucky Accidents, Great Discoveries, and the Prepared Mind.” Scientific discoveries over the years have shown that observations made by people who were well trained and ready to observe the phenomena around them without prejudice can lead to great discoveries. Some of the more obvious examples are Alexander Fleming’s discovery of penicillin and Roy Plunkett’s discovery of Teflon.

My scientific training and skills serve me every day. My training has given me an analytical framework in which to approach problems, and the logical framework in which to solve them.

My advice to you is don’t be afraid to explore opportunities. Don’t lock yourself into traditional career paths. Let the opportunities take you where they may. The best is yet to come and this country is open to change.

THE CORRELATION BACK TO TEMPLE

You are about be graduated from Temple — a University of which you can be very proud. There’s an excitement in the air as you walk about the campus. As a University, we have recently seen an influx of talented leadership on both the administrative and academic fronts. President Hart is building a university of which all of us — students, faculty and alumni, can be very proud and she understands the value of science in making a great university.

Dean Dai is making strides in bringing additional distinguished faculty to the College, as well as
improving our facilities. He has also been integral in ensuring that students with degrees in the sciences enhance the quality of education throughout the Philadelphia area. A new program called *TUteach*, under Dean Dai’s leadership, just received a $2.4 million grant from the National Math and Science Initiative. This program offers Temple students majoring in science the opportunity to teach in the school system and receive a teacher’s certification at graduation. My high school had six science teachers. I am told that the average number of science teachers in our junior and senior high schools in Philadelphia is less than two. This is absolutely unacceptable in a world in which since is needed more and more for our survival.

*TUteach* addresses the shortage of math and science teachers in our region and nation, but approaches it differently. It attempts to change the way we teach math and science. Thomas Friedman in his book *The World is Flat*, writes about the lack of a strong commitment in the United States to the study of science. In the 1950's and 60's, kids (inspired by the space program) would say they wanted to grow up and be scientists. You don't see as much of that today but it is more and more necessary to have a scientifically literate populace.

Friedman writes that when Bill Gates speaks in Asia, he is considered a superstar along the proportions of a Brittany Spears. In the United States, Brittany Spears is a superstar along the proportions of a Brittany Spears. So you see, it is crucial that we make science fun again, and understandable to the masses so all can appreciate it and some of today’s kids can aspire to careers in science.

I frequently hear people say that they hated high school science and they weren’t very good at it. To me, that means that their teachers weren’t very good. Science teaching should make the subject matter exciting so that even people who are not science majors can appreciate science’s contribution to their lives. We know that all of science is critical to everything we do in life. Scientific discoveries determine what we eat, what we wear, the drugs we take, the furniture we sit on, the quality of the air we breathe, and so on. Everything we touch is made through chemistry.

The recruitment of new faculty, the improvement in academic programs, the effort to attract top students and the improvement of our physical plant are just some of the areas of emphasis by Temple’s leadership and Temple is becoming a destination school for the best and brightest students across the country.

You might ask what this means to you, now that you are about to graduate. That’s an easy question…it means that the value of your diploma continues to grow as the years go by. And that’s something in which we can all take great pride.

Think back on the time you’ve now spent at Temple and what it has meant to you, because you will have a relationship with Temple in varying ways throughout your life. Your most enduring love affair should be with Temple. Don’t worry about your future spouse’s college, it’s Temple
that matters. For Temple is a place that truly has transformed your life.

I encourage you to stay involved with Temple. Never be too busy to be a mentor to students who will be looking to alumni for advice. Join our national alumni groups. Come back to campus as often as possible. Serve on boards, and attend events like basketball games or the Temple Orchestra when it’s in your part of the country.

And if you have the means, remember to give back to Temple. My wife Debbie and I have been fortunate enough to fund two important things at Temple. We established a fund for a separate class of Intellectual Heritage for science majors.

We also established a fellowship for Dr. Kathy Hirsh-Pasek to further her ground-breaking research in early childhood development. I met Kathy at a conference several years ago and was so energized and excited by hearing her speak about her work that we wanted to help fund a part of her work.

Kathy’s nationally-renowned research is an inspiration to me and she has touched the lives of countless Temple students in the process. Kathy happens to be one of the outstanding teachers here at Temple.

I encourage you to think about the various types of financial aid and scholarships you may have received while you were here. Chances are you have been the beneficiary of the many donors to the University. So, when you have the chance, give back to the university. Give back to help provide Access to Excellence and to ensure that future generations of students can aspire to make significant contributions in the sciences.

Never forget your Temple pride! Be a Temple ambassador to all who cross your path. I wear my Temple Hat all the time. You will find that Temple Owls are everywhere.

I thank you for the honor of speaking to you this afternoon, and I wish you, the Class of 2009, all the very best! Make Temple proud!