Speech by Dr. Mario R. Capecchi given at the
109th Annual Commencement of Southern Utah University
on May 3, 2008

I want to begin by congratulating the students, congratulating you for earning your bachelor of arts or science degree, or a graduate degree. I know it was a lot of work, but it is well worth it. I also want to congratulate the proud, the relieved, and hopefully the not-too-debt-ridden parents. This is also your day for celebration.

Earning your degree is a milestone, a turning point—a point of demarcation between adolescence and adulthood. Amid the joy, I am also sure that there is a measure of anxiety about what is coming next. My daughter Misha also just graduated from college this spring with a bachelor's degree in art. She is a very talented artist, but is nevertheless anxious. Will she be able to support herself doing what she loves, art? I urge each of you to find what you love and pursue your passions. Be creative and bold in your pursuits. None of us can foretell the future, so you will have to rely on your instincts, your gut to guide you along your paths. In retrospect, you will be able to see which decisions, which choices were critical for guiding your paths. Your work is going to fill a large part of your lives. So seek a vocation that you love.

I was raised on a Quaker commune in Bucks County Pennsylvania. It was a marvelous place for children to grow up because there were so many activities. My aunt and uncle raised me. He was a physicist, she was a political activist. I arrived from war-torn Italy at the age of 9, not speaking a word of English. In the streets of Italy, from age 4 ½ to 9, I had lived a very solitary life, where my only daily concern was survival: procurement of food and shelter. In America, I fell into the opposite—an extremely social environment. The contrast was unbelievable. My aunt and uncle took on the responsibility to convert me into a social being. I am sure that it was an enormous challenge for them. My aunt's favorite saying, which I heard over a thousand times.

"The difficult we do right away; the impossible takes a little longer."

I think she was referring to the task of civilizing me.

But, all my life I have taken that saying to heart. She was telling me not to limit myself by what others say you can or cannot achieve. In elementary school, one of my teachers advised my aunt and uncle that I was not likely to be college material. I did go on to college, majored in physics and chemistry and minored in mathematics. Stretch yourselves. In the process you are likely to encounter some failures. But remember that your character will not be measured by your successes, of which there will be many, but by how you handle your failures of which there are also likely to be many, especially if you make bold moves, which I hope you do. So believe in yourselves, and persevere.

Just a week ago a graduate student in my laboratory, on completing his requirements for a PhD came into my office to ask for advice about the next step in his career. My advice was simple. Work harder. No matter how talented you are, success requires very hard work. Even after you have worked hard, you can always work harder.

On the news you will see the final glory of an athletic victory. However you will not see the years it took to develop the strength, the skills, and the endurance needed to achieve that victory. Work hard.

There are enormous inequities in our world with respect to opportunities, education, health, and wealth. The extent of these inequities is not getting smaller, but rather is increasing. This is true whether we are discussing the global condition or restricting the discussion to our own country. As graduates of an excellent University you are already in a privileged position. Learn to be generous. Security is an enormous concern within our nation, particularly since 9/11. We cannot have a secure world unless some of the enormous existing disparities of wealth and opportunities are reduced. You are aware of the many of the problems resulting from these inequities: starvation, AIDS, genocide, to mention just a few. These problems arise not from people not caring, though increased awareness of the problems is a necessary first step toward finding workable solutions. A main problem is often just not knowing what to do. Finding solutions is likely to be very complex. But our ability to handle complex problems involving many variables is increasing at a very rapid rate, largely as a consequence of the accelerating rate of growth of computer technology. Further, the ability to handle very large data sets allows us also to evaluate more effectively the consequences of newly implemented policies to ameliorate given problems, with the hope of effecting quick corrections as needed. You are graduating at a time of transitions into a new universe, whose boundaries are yet to be determined. Embrace the change and embrace it with generosity. Find a problem that you would like to work on and help solve. The possibilities are vast.

But what I would like to turn to next is discussion of a particular problem you and all of us face, and that we can and should insist on doing something about—the climate crisis. At the outset I want to acknowledge that the principal sources used to develop my discussion of global warming are, first, the very recent report by the IPCC, the Intergovernmental Panel on Climate Change, which is a very large consortium of scientists from all over the world, including our own country, who have been gathering world-wide data on climate change for many decades, and second, lectures given by Al Gore and Dr. Rajendra Pachauri, current president of the IPCC. Both were recipients of the 2007 Nobel Peace Prize.

One reason that we have not faced the climate crisis is that it is not readily apparent to us from day-to-day observations. It is not in our faces. Atmospheric carbon dioxide or CO_2, the culprit, is invisible, tasteless and odorless to our senses. This makes it easier to keep the climate crisis out of sight and out of mind.

Today we will dump more than 70 million tons of CO_2 into our atmosphere. And tomorrow we will dump a bit more than that and the next day more still, and everyday thereafter until we come to our senses and stop this madness.

Let me describe to you two closely related planets, Earth and Venus. They are very similar in size. Their diameters differ by no more than 180 miles. Both Earth and Venus have the same quantity of carbon; the difference is that on Earth, life, in particular plants, diatoms, and unicellular photosynthetic organisms, has converted atmospheric CO_2 into larger carbon products over a period of hundreds of millions of years. As a consequence the majority of our CO_2 has

been taken out of our atmosphere and buried in the ground in the form of coal, oil, natural gas, and other carbon forms. On Venus this process has not occurred and the majority of CO_2 is still in its atmosphere. What difference does this make? The average annual temperature on Earth is 59^oF, about that of a pleasant spring day in Utah; on Venus, the average annual temperature is 851^oF, high enough to melt lead, tin, or zinc. This enormous difference in temperature is not the result of Venus being closer to the sun than Earth. Mercury is much closer to the sun than Venus and its average annual temperature is 3x lower than that of Venus. The important parameter responsible for the enormous difference in the annual surface temperature of Earth and Venus is the difference in the amount of CO_2 in their atmospheres, that traps more heat from the sun on Venus.

This is why the current global policy of burning as much coal, oil, and gas as quickly as possible, and releasing the resulting CO_2 into our atmosphere is such a disaster. Our earth has a fever and the fever is going up.

As I just indicated the Fourth Assessment of the IPCC—the Intergovernmental Panel on Climate Change has just come out. Many, many scientists from all over the world have used a very broad range of metrics to measure climate change in our world including global average air and ocean temperature, the melting of snow and ice, and the rise of global average sea level, as well as charting the rise in atmospheric CO_2 over the entire world, and where it is occurring. These results have unequivocally demonstrated that global warming is a real phenomenon, and that human production of CO_2 is a very significant contributor to this problem.

Let's look at some of the consequences of global warming. The entire North Polar ice cap may completely disappear during the summer months in as little as five to seven years. The climate crisis is not just going to affect our grandchildren. It is going to affect us. And its consequences will get steadily worse until we start to do something about it.

Presently, the polar ice cap bounces 90 percent of the incoming solar energy back into space. When it is gone, the dark ocean that is left in its place will absorb 90 percent of the incoming solar energy. The transfer of heat energy to Greenland will in turn, accelerate the melting process of its enormous ice fields that is already underway there.

Recent studies in Greenland show that underneath the massive ice fields deep fjords are being cut into the rock, channels through which the ice when it begins to break up in Greenland can migrate quickly into the sea. If the ice in Greenland melts it would result in an 18 foot rise in the sea level worldwide. Melting of the ice in west Antarctica, the South Pole, which is considered more stable than Greenland, would account for an additional 18 foot rise in sea level. An only three foot rise in sea level would result in 100 million climate refugees. The 18 foot rise in the sea level from melting of snow and ice just in Greenland would lead to 450 million climate refugees.

Not long ago the floods in New Orleans caused 100,000 climate refugees. The devastating results from that flood have still not been corrected. Our shameful handling of that crisis still plagues us today. What would the world do with 100 million or 450 million climate refugees?

Why do we have only a short time to react to the increased rate of CO_2 production? Because it is an accelerating process. There are on our Earth areas known as sinks that normally absorb extra atmospheric CO_2. However, these regions of our Earth appear to be becoming saturated. In addition, in the permafrost of our far north, Canada, Europe, Russia, China and our polar region, the amount of frozen carbon is equal to the entire amount of carbon already present in our atmosphere. If this carbon is released as a result of melting, it will double the amount of atmospheric CO_2 in a very short period of time, making our problem of reducing atmospheric CO_2 twice as hard.

The problem is in front of us. The challenge is to do something about it. And we can. The good news is that it is not too late. The current trend can be reversed, but we must take action now. The sooner we start, the easier it will be. It will take coordinated efforts by all countries of the world. But since we are a major contributor to this problem we should be taking a leadership role in solving this problem, rather than lagging behind others.

What I am talking about are not programs of generosity, but are programs that are in our own best interest and in the interest of our great nation. It will take moral courage. I hope that future generations will look back on us and be proud that we had the moral courage to act. Past generations have done it for us, in two world wars for example, and the stakes are just as high now. However, now it has become a global issue.

The reason for discussing important issues such as global warming, is to encourage you to become concerned citizens. To have a well functioning democracy depends upon an informed and concerned citizenry. Education is a continuous process. Having just completed your requirements for a degree, whether a bachelor's degree or PhD, you are appreciative of the effort it takes to become informed on one topic. I encourage you to be active rather than passive citizens, at every level, from community, to state, to nation and now as a world citizen. It is not enough to vote, your voice needs to be heard, but you must also learn to listen and evaluate. Our political system often addresses short term concerns adequately, those that can be addressed within a voting cycle. But our government has more difficulties in addressing more complex problems that require more sustained efforts beyond one voting cycle and problems requiring cooperation between nations are even more challenging. However, as I have already pointed out because of the increased capabilities of our computer technology we can handle much more complex problems, even those involving multiple nations. Through the use of the Internet, the distances between people from different nations has decreased enormously.

We have not yet learned to be good stewards of our fragile earth. Future generations will be dependent on our actions or lack of action. When a crisis arises, I am always amazed at the ingenuity, generosity, and energy exemplified by humans. With the climate crisis we do not want to wait for the disasters to accumulate, by then it may be too late.

In summary, the advice that I want to extend to you is the same as I have given my daughter, Misha.

1. Find what you love, pursue it, and make it part of your vocation.

2. Work very hard; talent alone is not enough. Stretch yourselves, be bold in your pursuits.

3. Be generous. What you will cherish most throughout your lives are the interactions with your family and friends.

4. Be an active and informed citizen. Because of our ingenuity we have become the stewards of our planet. However, our resources are not infinite, our planet is fragile, and we have to learn to become good stewards of the planet and to live in harmony with it.

I believe that our problems can be solved and that your generation will help solve them.

But again congratulations to all of you, students and families alike. Thank you for having me as your commencement speaker. It is an honor. Good luck and my best wishes for a wonderful life.