

## **A case for diversity - after dinner talk to the final dinner for the PRISE/BLISS/PRIMO programs - summer of 2012**

It has been a wonderful but long evening, and I don't want to keep you. But I did want to try to say why I think that the Summer Undergraduate Research Village is so important for the future of science, and to send you off with a little practical advice. In my long career, I have not only done a lot of physics -- I have also been fortunate to work with and really get to know many extraordinary particle physicists, from the giants of the previous generation like Richard Feynman and Murray Gell-Mann to the leaders of the next generation like Lisa Randall. What I find most striking about them is how different each individual great physicist is from every other. All of these people are amazing. They have talents and abilities that are so far above average that they are completely off the charts. But what you see if you are lucky enough to get to know many such people is that each is off the charts in a different way. My observations convince me that the number of ways of being a great scientist is at least as large as the number of great scientists. Because of these observations, I strongly suspect that there are many other ways of being a great scientist that we have not yet seen. One of my hopes for these programs is that they will inspire young scientists with talents and backgrounds very different from those that are already well-represented in the scientific community. Some of these people may grow into scientists who are great in new ways. And I also think that the Summer Research Village is important because it gives each of you the opportunity to make such observations for yourself. You should all know better now how silly it is to rank scientists (or students for that matter) by any small number of measures. For example, it makes no sense to say that Feynman is better than Randall who is better than Gell-Mann, because they are so different --- much more different than apples and oranges.

These observations have some practical corollaries. The most important thing you can learn, I believe, is the joy of doing something really well, even if it seems small and uninteresting or even boring to everyone but you. As you grow as a scientist, you should spend a little time thinking about your own unique core abilities. Of course, these will not be static. You will develop new skills as you continue your education and your career. But I think that you will find that the process works best if you have a personal style that you can use as a base camp for exploring and learning new things. One of the fun things about getting to know Richard Feynman was to see how hard he struggled to fit interesting things that I told him into his own language and his own way of understanding things. It was particularly obvious in his case, but this is a good general strategy. Learning is ultimately a process of understanding things in your own way. If you are lucky, you will end up with a unique cocktail of skills that you do really well and really enjoy doing well. These are the things that keep you going. I hope that many of you will be lucky enough to make some great discoveries. But it is not the great discoveries that get you up in the morning and make you a happy person as you go back and forth from the lab. It is the joy of the little things. I wish you all that joy in science.

I hope that you have all managed to get out of the lab for a few hours and watch a little bit of the Olympics. The Olympics reminds us of the remarkable physical feats that humans can perform. It shows how far above average some people can be in physical skill. We see even more diversity in scientists, because intellectual prowess is not so constrained by the mechanical limits of the human body. And unlike sport, science is not divided into neat events. There are broad divisions of course. Physics and

molecular biology and the social sciences each have their own metaphors and guiding principles. But there are no sharp boundaries, and certainly no precise definitions of what it means to do a science well. There is no international commission of biology that decides who runs the best gels! Science is a continuing interchange between the scientific community and reality, which is the ultimate and impartial international commission for all of science. We don't have individual events because scientific questions are too interesting. The great scientific questions are so deep and beautiful that no small number of skills is ever enough to answer them. To address the most interesting questions, we need to bring to bear all the possible dimensions of human intelligence --- not just those dimensions that we see in the scientific community today, but those that are dormant in people who have never considered science as something that they can do. The Summer Undergraduate Research Village is so important to me both because some of you were such people, **and** because all of you now have seen the diversity of the scientific community in action and it is your duty and your privilege to pass on this message to future generations. Good night, and go to it!