

Speech of
PROFESSOR DENNIS PARNELL SULLIVAN
Winner of the 1994 King Faisal International Prize
For
SCIENCE (Mathematics)

Your Royal Highness Prince Abdullah bin Abdul Aziz,
Your Royal Highnesses,
Your Excellencies,
Distinguished Guests,

It is an honor to be recognized by the King Faisal International Prize in this way. I feel very fortunate to be here in Saudi Arabia with my family to celebrate these various categories of constructive and concentrated human activities: Service to Islam, Islamic Studies, Arabia Literature, Medicine and Science.

I also feel fortunate to have grown up in Texas, to have experienced the energy and hubris of that culture, to have soon some of the fabulous oil industry of the fifties and to have experienced in the early sixties some parts of the research and petrochemical industries related to the oil industry.

I feel fortunate to have attended Rice University which produced many good engineers and scientists in geology, geophysics, and chemistry and which became, again helped by the oil industry, a truly excellent undergraduate University as well. During that period at Rice University I began to choose between the fabulous and boisterous external world of Texas oil and the very discreet inner world of pure thought, and the search for historical and scientific understanding. This process converged to an abiding interest in mathematical structures and their study.

I feel fortunate to have attended mathematics graduate school at Princeton University, where Einstein's famous equations were inscribed in beautiful leaden glass windows outside our common room, and where more importantly, the golden age of topology of the late fifties and sixties was in full bloom. My thesis advisor Browder working in parallel with the brilliant topologist from Moscow Novikov were

making breakthroughs. The graduate students at Princeton were the first to know about these breakthroughs and were put in an excellent position to make some rather fabulous conquests on their own.

Since then I have benefitted from excellent research conditions in England, Princeton, Berkeley, MIT in Boston, IHES in France and CUNY in New York. Our generation was fortunate to arrive in the academic market when basic research was fully funded and universities were stimulated to grow. The current generation in the United States and Europe especially Eastern Europe is less fortunate. There are many exquisitely trained and talented people who want to do basic research just as much I did since emerging from Princeton's graduate school and who cannot find the appropriate conditions in universities and research centers to do so. There is thus a great opportunity now to develop academic and research centers in other parts of the world.

A strong and wonderful scientific and intellectual garden with a tight network of vines connecting education and research takes two or three decades or more to develop. It can wither from neglect in less than one decade, I am concerned about this.

While preparing for this trip to Saudi Arabia I was thinking about the crucial contributions of Arab and Muslim scholars and scientists to our present civilization. Six hundred years before Descartes, Averroes and Avicenna imposed the triple axes on space by exporting from the human body the ideas of height, width, and depth. This idea is completely non trivial and has incredible consequences for quantitative science.

For several centuries of Muslim history there was great activity in many areas of science and philosophy and art. This was not an accident. This activity was stimulated by the prosperity and the enlightenment of the great centers of Muslim civilization.

Can some of this glorious history of science happen again in the Muslim world? Some of the elements necessary are present. Besides those elements already mentioned here is another. One may think we live in an age of wonder and invention - almost everything is known or soon will be, and almost anything is possible or soon will be. In this regard one thinks of genetic research on the one hand and computers and electronic devices on the other. However, the situation in basic science is

somewhat like that of medicine - where some diseases are understood and under control and others are not at all understood or controlled.

For example in basic science, did you know it is very difficult to measure accurately how much fluid, say oil, is flowing through a given enclosed pipe? The methods used are costly and awkward because at the very foundations of fluid mechanics there are dark problems about the mysterious, albeit beautiful, quantitative models that are used. Mathematicians love to work on these mysteries and will do it night and day for its own sake given reasonable working conditions.

Did you know that when a shipment of crude oil arrives at a refinery the complex decision for choosing which cracking procedure to use is based on a definite scheme balancing market conditions and scheduling, but that this scheme in mathematical essence is very crude and dubious? It does not benefit from the really profound ideas of statistics, optimization, and dynamical systems, because to be honest we have not yet brought these beautiful theories to a stage sufficient to treat the very complex problem posed by a modern oil refinery.

In other words, I have added to the list of favorable conditions mentioned above - the wealth of available scientific personnel, the resources of the present day Arab world, and the historical precedent of the glorious past - a new item, a motivation based on our need to do basic research in order to solve concrete but profoundly difficult problems, with obvious advantageous returns.

There is however a special difficulty in creating a real garden of scientific and intellectual substance beyond that of providing resources. One has to fight for a high level at all times. There should be no impediments to securing the best people - male or female, young or old, with or without academic credentials, Muslim or Christian or Jew etc. Only some talent and the rarer gifts of curiosity and commitment should be required to these encouraged to tend the garden.

Again, I thank you for the honor of this prize and the chance to visit your world.