



46TH CONVOCATION

JUNE 18, 2014, WEDNESDAY

INDIAN INSTITUTE OF TECHNOLOGY KANPUR

P.G. Convocation Address at IIT Kanpur

BY

J. GEORG BEDNORZ

Nobel Prize Winner (Physics, 1987)

IBM Fellow Emeritus

IBM Research Laboratory

CH 8803 Rueschlikon, Switzerland

on

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Dear graduates and parents, faculty members and staff of the IIT Kanpur, dear students, ladies and gentlemen, the convocation ceremony represents a landmark, a highlight, not only in the education process of young women and men but also in the academic year of the respective institution. Today at the 46th convocation, the IIT Kanpur and its teachers are proud to celebrate this convocation with you all, who successfully finished your studies and received your degrees. You have delivered your masterpieces in the form of a master or PhD thesis in different disciplines out of the field of Science, Engineering, Humanities and Management. I am happy to share with you this exciting moment. My heartiest congratulations, for your great achievements, the successful termination of your studies. I am wishing you all the best for a good start into your future career.

In the past years there might have been moments where some of you might have experienced difficulties to deliver the required performance, causing doubts whether you would ever succeed. From my own experience during my high-school and university times I know how one feels in the moment of failing an examination. How it feels if one is afraid to disappoint teachers and even more fail to fulfill the hopes of parents, who sometimes may have to spend an enormous effort for years of support. So much the more it creates great satisfaction when one is able to show that with strong persistence these hurdles can be taken.

Today you see your parents happy and proud to be with you in this hall, they are glad to see their support did pay off. It is you, who made their dreams become true and hopes fulfilled. However you can be sure, their expectations will continue and even might grow more ambitious.

You also should be aware, you had the great privilege to perform your studies at one of the premier institutions of your country and

you are now joining the group of thousands of alumni who have graduated from the IIT Kanpur in its 55 year history and who are spread over the whole world. Be aware that also their expectations are high, that you will, like your fellow predecessors, contribute to the high reputation of your home institution.

So far you did stay in a well protected environment with your fellow student colleagues, where your teachers provided guidance and did equip you with the right tools to grow your skills. When from tomorrow on, you will leave the environment of your home institution, it will be mainly (only) you yourself, who determines how to apply and grow your skills and in which direction you turn your activities. With an excellent education gained at IIT Kanpur you can look into the future with strong self-confidence. But in whatever discipline you graduated from, you will realize that the learning process will never end. Whether in academic or industrial research, in engineering, management, public service or politics, in each area there will be a need to make important decisions. Since nobody is free from making mistakes, some of these decisions may turn out to be wrong. Making mistakes may be forgivable, as long as one makes the same mistake only once. Making mistakes and realizing that one is able to learn from those mistakes, can create self-confidence and will help to lose the fear from diving into the unknown. The absence of this fear and an enormous curiosity and creativity is characteristic for the first years of our childhood where we did learn from experience. As a child, being told by our parents –“Do not touch the hot plate” we did not follow the advice until we had made our own painful experience. But we kept on discovering other fields of our environment. Lucky are those, who can preserve this creativity and curiosity and the attitude of putting statements which appear to be doubtful into question. In that case it may be, they belong to those people mentioned in the quote from Justus Liebig, a German chemist

who made major contributions to agricultural and biological chemistry and worked on the organization of organic chemistry. "The secret of all those who make discoveries is that they regard nothing as impossible." This sounds pretty arrogant but it reflects the attitude of some people to constantly ask "Why, or why not?"

Whether curiosity driven or inspired by limits of technology, breakthroughs in science and technology are frequently achieved by those people who have the ability to look at the same thing as everyone else but think something different. This imagination or - should we call it ability to dream - can lead to completely new revolutionary concepts which others may regard as unrealistic or even foolish. To follow those dreams can be very hard and would need a strong dedication and persistence in case of missing progress. Let me give you two examples which were the results of dreams and unconventional ideas:

In the Physics department of the IBM Research Laboratory in Switzerland there were two colleagues of mine who in the 1980-ies had a dream that they could develop an instrument which would allow them to "see" single atoms on the surface of semiconductors and metals and to possibly study chemical reactions. They developed a concept, which nobody, except them, would have thought to be realistic approach.

The instrument consisted of a needle which is guided along the surface of single crystals or thin films. If the needle is very close to the surface-the distance was smaller than the diameter of an atom-and a voltage is applied between the needle and the metal, there will be a current flowing between the metal surface and the needle. This current is very sensitive to the distance between the object and the needle.

So, if the needle is scanned very close to the surface, at a constant distance also the current is constant. As soon as the needle approaches a step, the current increases and a feedback mechanism will cause the needle to retract in order to decrease the current to its original value. This movement is recorded and indicates, aha!, here is a step. The sensitivity was shown to be so high that even single atoms could be detected. The development of this instrument called Scanning Tunneling Microscope (STM) created a big excitement in the laboratory, later also in the whole scientific world and in 1986 my colleagues Gerd Binnig and Heini Rohrer were awarded the Nobel Prize in Physics.

With their imagination which led to a new concept- regarded as unrealistic by many others – and a strong dedication to solve a specific problem (vibrations being bigger than the distance between needle and surface) this pure science has led to technological impacts which surpassed even boldest dreams. From the desire to see individual atoms emerged the field of nanoscience, science on the atomic scale, with the possibility to manipulate and modify single atoms and molecules. This has opened an exciting perspective for a completely new technology which is today known as Nanotechnology.

Let me go to the second example. In the 80ies, after 70 years of research on superconductivity, the desire to apply the technology on a large scale to transport electricity without resistance could not be realized because the phenomenon was restricted to very low temperatures. This changed dramatically when my colleague Alex Mueller and I were applying a drastically new concept in the search for super conductors with higher transition temperatures. Against the experts common understanding, we involved a new class of materials and discovered that these were indeed surpassing any

other super conductor. This discovery has been awarded with the 1987 Nobel Prize in Physics. The surprise was that up to that time these materials had never been considered to be a conductor of electrons. Today the superconducting state is achieved in an easily accessible temperature range and will have not only economical but also environmental impact. These successes in the field of science result from an education to dedication, fostering inspiration and creativity and giving the freedom of pursuing unconventional ideas. Isn't it wonderful that in the field of exact and precise science there is room for dreaming?

And is it an accident or an ingredient, that in the two teams one of the partners was a senior experienced person and the second a young scientist. In both case these partners were also quite different in their style of working and character, but very efficient in complementing each other. But the most important fact was that they were able to share their dreams, hopes and also the difficult times of disappointment, where success was not apparent.

Today we are here with a group displaying a great diversity in education and talent, to celebrate the farewell of hundreds of young bright students who are released into their professional life. Dear graduates, in your eyes we can see your optimism and excitement and the desire to take the lead in shaping the future of your country by creating your own visions. Be adventurous and creative in finding solutions for the benefit of your country, be it as a scientist, engineer, businessman or politician. Be on the alert, if you hear that a deviation from a standard solution is impossible, and please ask "Why?"

You had the privilege of being educated to build the elite of your country, and you are obliged to take responsibilities wherever your

leadership is required. "Try to leave the Earth a better place, than when you arrived" these words of Sidney Sheldon, an American writer can serve you as guidance in all of your activities. You will experience the feeling of great satisfaction if you achieve a change, and will receive the recognition through the appreciation by fellow colleagues and the society. The appreciation of your work by the community should be the first goal you should aim at, and it will be the highest reward if this work will create numerous excited followers.

If for your professional development it might be necessary to leave your country, you will meet with different nationalities, cultures and religions and you may change your way of working and thinking. And you will learn that some tasks can be approached from a point of view which is different from yours. You may face professional problems or conflicts when different opinions exist. If you will pursue your respective profession with dedication and passion you will make yourself respected and your excellent education will help to successfully handle a discourse. Sometimes it may be necessary to find a compromise but never agree to a solution which is against common sense or your conviction. For your country, India, the experience gained from abroad will bring a valuable profit when upon returning you will apply new ideas to foster the technological progress. You will be able to implement new ideas to address problems in technology, energy supply, environment, agriculture and new models (social issues) of the society. And maybe you will establish new international collaborations too with mutual inspiration.

The majority of you, however, will remain in the country and there is urgent need for your engagement in all aspects of a society like India,

which is growing at an enormous speed. In addition to your leadership in professional support in the respective disciplines you will need to take the role as a shining example and set new standards in human relations. This will be a major challenge in a country like India with several burning cultural and social issues. I wish you will be adventurous and find creative solutions to discover a way out of a human dilemma.

Like the discoverer of vitamin C (Albert Szent-Gyorgi) said “A discovery is a lucky event meeting a prepared mind”. I think this is true not only for scientific or technical aspects. Preparing minds or creating awareness by spreading knowledge also about the global challenges in culture, society, environment and technology is necessary to discover solutions to overcome barriers. Tearing down these barriers, which sometimes only exist in our minds will make the impossible possible. Dreams are needed and will help to make this world a better one. When Mahatma Gandhi came back to India more than 100 years ago, he was not only fighting for the independence of his country, but also for human rights for all members of the society. The independence has become true, but how about his dream that all individuals are treated with the same respect?

Mahatma Gandhi has left us with an important advice. “You must be the change you wish to see in the world.” Continue to dream his dream, follow the motto “Respect for the individual” which is important for every interaction with humans, in all aspects of life, and you can be sure you will make a change.

Go and make this world a different world, you can do it. Good luck to all of you.