

The 54th Convocation Address
by Prof. Joachim Frank, Nobel Laureate,
Columbia University, USA
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at Indian Statistical Institute, Kolkata

Respected President, dear members of the Faculty, dear Students and Guests:

As student and later as faculty member I have attended numerous convocations, and listened to numerous convocation speeches. Inevitably more than once the question arose in my wandering mind what I would say at such august occasion to a large audience of new graduates if I were ever invited to stand on this podium. Miraculously, through the powers of the Nobel Foundation, I have now been handed the megaphone to talk about anything -- be it related or unrelated to the narrow field of my study.

First of all, why would a **physicist** working in **Biology**, after winning a Nobel Prize in **Chemistry**, be invited to talk to the Indian **Statistical** Institute? Well, I can only guess, but the story starts more than 40 years ago. As I was trying to develop methods to reconstruct biological molecules from thousands of individual projections deeply buried in noise, I was forced to deal with a lot of areas related to Statistics: correlation functions, multivariate statistical analysis, pattern recognition, three-dimensional Fourier transforms, statistical optics, and what would now be called Deep Data Analysis. So with some justification I can consider myself part of the community of scholars in Applied Statistics, in an application that, through a quirk of fate, has become a major tool of Structural Biology, by now paralleling X-ray crystallography.

My day-to-day activity in those days – I'm talking about the nineteen-seventies and eighties -- was programming, being completely oblivious to where I was and what time it was. I was using computers that had just a small fraction of the capacity of today's cell phone but still enough memory to get lost. When I think back to this time of total immersion in the code I was developing, I think of the exhilarating experience of living in a world I created all on my own. The functionality and formal beauty of that world, along with its faults, were entirely of my own doing. Essentially I was an architect living in the building I created and, when something was amiss, I was at liberty to change it on the spot. A crack in the ceiling? No problem – a new ceiling was put in place within minutes. A room too small? No problem – the walls could be moved with the flick of my fingers.

When I think back to that time I realize that part of the experience was the secret hope, if not expectation, that the real world might be able to be controlled in a similar manner. If the minds of responsible smart people could be harnessed together, then the combined competence from each ever-so-small area of science and technology might contribute to the solution of the world's problems.

This is where the naivety of a young student clashes with the reality he or she is surrounded with. The world we live in is far more complex, and insufficiently modeled, to lend itself to deterministic analysis. This world is chaotic, nonlinear, full of hidden variables. But what is still true is that the rational, critical approach to problem solving, the Scientific Approach that we learn at universities and other institutions of higher education, is unsurpassed in guiding us in that world. And this brings me to the other part of my speech.

Right off the bat I have to dispel the idea that I have a recipe for how to launch your career, how to be successful, or how to deal with today's world. Everyone's situation is different, shaped by your unique personal experience, place, and historical constellation. I think the best advice is that you follow your own compass which parents and teachers have implanted in you as you grew up. So instead of giving you a recipe, I will tell you about my own experience at a different place and time.

My own graduation was back in 1967 from the University of Freiburg, where I did my *Vordiplom*, or Bachelor of Science. But it's more to the point that I should speak of the other graduation three years later, in 1970 from the Technical University of Munich, where I did my Ph.D. defense. So we are talking almost precisely half a century ago.

I had little confidence in myself and my abilities, and the world seemed a scary place. Worse than that, the whole world seemed in upheaval – the Vietnam War was still going on, bringing protests to many countries. In Germany, during the whole time I spent in Munich, another cause brought widespread discontent: thousands were on the street protesting the Shah of Persia's visit to Germany and the excessive German police force protecting him.

Germany, just 25 years after World War II ended, was still recovering from the inhuman onslaught of the Nazi regime and the marks that hate speech had left in the psyche, language and culture of the country I grew up in. Adolf Hitler had rallied people around causes of attaining racial and ethnic purity, demonizing "otherness" in Jews, Roma, and Homosexuals, and paving the way to the Holocaust. It was widely recognized that part of the reason why Hitler could come to power so easily was the reflexive trust in authority, which was deeply ingrained in German society.

World War II was followed by some type of collective amnesia, which lasted for a decade at least. Then, in the late 1960s (when I was a student working on my dissertation), in the wake of the protests fanned by the visit of the Shah of Persia, the very legitimacy of civic and government authorities in Germany to make rules was questioned: rules about whether it was allowed to step on a public lawn, rules on how to dress, and ancient rules about protocol at formal university events. Under student pressure, medieval costumes associated with university events were

discarded for good. “Unter den Talaren – der Muff von Tausend Jahren” – was the battle cry: *“Under the gowns / Is the musty odour of a thousand years.”*

Looking back to those years, I’m still proud of having made my voice heard and having kept a cool head in all the turbulence. Voices of fellow students, like mine, contributed in the end to the re-molding of Germany, into a country that was more egalitarian than before, more tolerant, more open to acceptance of people with different creeds and backgrounds.

If anything, today’s world is even more complex and poses more challenges than the world I experienced as a student. The steady progress in international cooperation after the end of the Cold War has given way to a dismal chaotic strife, almost reminding us of the state of affairs in the Middle Ages, before Enlightenment. Instead of looking for commonality and shared objectives, leaders of many countries are focusing on attributes that divide us. This is a tragic development since it happens just at the time when we need unity more than ever, as we all search for solutions in the galloping Global Warming crisis. Not too far away from here, an entire continent is in flames.

Fortunately, each generation brings in new energy, new ideas. Long-standing problems are re-framed by new inquisitive minds, often with surprising results. For many young students used to surf the internet and communicate over long distances, the boundaries of countries, bureaucratic regulations governing travel and citizenship seem completely antiquated, a thing of the past. To quote Joyce Carol Oates, “In matters of morality and behavior, it is rare that an ‘older generation’ will change. Rather, life simply moves on, the ‘older generation’ dies off, and a new generation with new concerns takes its place in something like a bloodless coup.”

If there is hope for the future, in other words, then the hope is with the new generation, with you!

With this I would like to one of the first to congratulate you and your parents and extended family for graduating from the Indian Institute of Statistics, for a job well done!