

TWENTY SIXTH T.A. PAI MEMORIAL LECTURE



**RESEARCH AND HIGHER EDUCATION:
INDIAN CHALLENGES?**

Delivered by

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RESEARCH AND HIGHER EDUCATION: INDIAN CHALLENGES?

Dr H S Ballal, my colleagues on the Dias, ladies and gentlemen, first of all let me share that it is a great privilege for me to come here to deliver this memorial lecture honoring Mr T A Pai. I would also like to take this opportunity tribute to Mr K K Pai who did write to me inviting me to come and deliver this lecture but unfortunately passed away.

Manipal has been so widely known because of their efforts in making this a Centre for Education. When I was asked to deliver this lecture, I wonder what is it that I could say here and I must tell you a little bit about my own background. I am a Laboratory Scientist and what I do is usually somewhat distant from what bothers most people every day. It is not easily understandable but it is something that keeps me and my students deeply engaged and active. I am usually used to giving talks on my own research and I do this with the help of slides so when I was asked to give a more general lecture, I of course have to rely on the clutch of slides. I must apologize for this. But I did not think that I would be giving a lecture in such surroundings. In fact, this is the first time that I am giving a lecture in such surroundings. If this was not a formal occasion, I would have asked all of you who are sitting there to come and sit down here in front, because then you might be able to see what it is I have on the screen. I also look at the list of speakers who have given this lecture before and found that most of them were people who quoted in fact speak and speak without visual aids unlike a scientist like me but you must bear with me as I go along....

I am going to talk on **Research and Higher Education**: I am going to address the issue of what are the challenges which are faced by India today. I am going to talk a little bit about Scientific Research and about Science because that is the subject that I know something about. But when I say Scientific Research or Science, what is it that I mean? I mean Science, Engineering and Medicine. Now, it turns out in the sphere of Higher Education, Science, Engineering and Medicine have really been separated in India. But when I talk about the he lever research and at the level of higher education, I will really talk about all of them together, they are all Science. I would in fact like to include the Humanities, Social Sciences, Economics and Management also as a part of the Science as a whole. The question that we are going to address in higher education is question of fragmentation Vs Integration? We have made Institutions and Universities more and more specialized. We have fragmented them to a point where we need to ask the question should we continue doing this or is there a case for integration?. Now before I talk about the problem of Higher Education, I want to ask a question: how does one measure scientific activity, how does one measure and essence science?. In the brief meeting that I had with the faculty of the Management School just before I came to this lecture they did ask me this question. They asked me how does one incentivize research. How does one measure research?. Now what kinds of research are we talking about? We can talk about two kinds of sciences.

1. The Academic Science and
2. Applied Science.

The Academic Science by definition is of uncertain utility and it may not be useful to anybody. Presumably if it is good science it will be of use to someone at sometime or the other of we know that very well.

Applied Science, of course is something that has clear goals and clear targets. It has the kind of timelines that people who are Managers can see, they can enforce them, they can worry about project costs, they can worry about time taken to accomplishing project. One of the most recent projects which has gone on so successfully in India is the CHANDRAYANA MOON Mission, for example, which is a mission with clear goal, with clear target and with a very clear budget.

How does one assess Scientific Activity? In fact, One might ask how does one assess scholarly activity. The first, of course is you can use personal judgments and it can be informed judgment or they can be prejudiced judgments. It does not matter. The second of course is impersonal quantification and there is a science which has grown up around impersonal quantification which is called Scientometrics and this is really the Science of measuring and what one does in this case is to really look at the published literature and to look at the way the published literature has evolved by one author of a scientific paper citing his spheres in the field and this is done using what is today called the Science Citation Index. Now, Eugene Garfield, many years ago in the 1950s wrote a paper which was called Citation Indexes for Science - A New Dimension in Documentation through Association of Ideas. The title of the paper

is very interesting. Where did he get this idea from? He actually got this idea from Law. There is what is called the Shepherds Index and it is this which lawyers used to consult to find precedents because Lawyers always work by precedents. But it turns out social Scientist. Scientist also works by precedents. In a field if they study something, they are studying something which somebody else studied before and therefore has written something about it and therefore one must cite it. So one can then develop a methodology which allows you to collect ideas. But when Garfield wrote this paper in 1955, more than half a century ago, he did not imagine that one day this would become possible because of the Electronic and Computer revolution. Because, at the time that Garfield did this, you have to document everything by writing it down. So if you made a Citation Index, it would be like a Dictionary - a big book in which you would list Authors by name in alphabetical order or you could search this very easily. But Visionaries like Garfield know that Technology will come to your assistance at sometime or the other in the future and Information Technology has actually solved this problem altogether. So today you have what is called the Web of Science available on the Internet through which you can search the millions and millions of articles which have been written by Scientist in all fields. But those of you who are students, will of course realize that Google has completely transformed the way we search for informations. Today's search engines are so powerful that there is no excuse for anybody to say that they can't find a piece of information. Unfortunately, it turn out that even today students and Professors still have difficulty finding information. I would urge you every time you look and use the Internet to ask the

question, how one search for information does, and how does one relate one piece of information to another piece of information and it will turn out that this is Research. This may not be laboratory research but this is research nevertheless. Garfield has made this possible to track science and to track the work of Scientist and to look at interconnections and association between ITS. I was once asked to give a talk to a group of Scientists, interested in this area and the title I gave to my talk is **Science, Scientists and Scientometrics**. Now many years ago, Lewis Carroll then writing under his real name – Lewis Carroll of course under his real name, he was a mathematician Charles Dodgson. He said that **“Man is an Animal that Writes Letters”** Today of course one might say Man is animal that writes emails. But in the old days, they wrote letters and those of you who have for example looked at the collected work of Mahatma Gandhi or of Jawaharlal Nehru will be surprised at the volume of correspondences that they did. They wrote and they wrote and wrote to many people and they received letters from many people. I would like to paraphrase if I say that Scientists are animals who like to publish papers and therefore they do a piece of work they write it when it gets published in the journals.

Now today, I went around your campus, I was shown two Libraries. The Libraries of the Health Sciences and Library of the Management Schools and in turn that both are wonderful Libraries. They are treasure house of information. Of course, you might wonder why we need Library. We need Library only because people who are writing. If you stop writing there would be then no need to having Libraries. When I say Scientists are animals who like to

publish papers, I would hope that show our people who do research in management, show our historian should also write and everybody should write? Now we have this problem in Science, of course, Science publishing journal which I will not to worry much today. But if these journals which carry much work of Science, they allow us to assess science, they allow us to assess Institution and they allow us to assess scientist. The history of this kind of assessment can really be traced back to the work of Garfield whose picture I showed you there. But this kind of bibliographic tool is only one of many which is available today and this bibliographic tool has been given new teeth. It's been given new teeth by the search engines which have appeared there are such powerful search algorithms which are now available that we can now do word searchers, authors searchers, title searchers journal searchers, in a fraction of second today and get a large amount of information. Of course, Garfield did a very interesting study, many years ago. He looked at all the papers that Scientist had written between 1945-1988 in a set of journals which he analyzed. He found 175 million individual items and he asked this question how many of them at least are cited by someone else in the literature which would mean that at least one other person had read that particular paper. What happened was that he found that out of 175 million only 33 million have never been referred to literature which means even the author who wrote the paper had not referred to his own paper again in the literature, this means that he did not find it very useful. He then came to the conclusion that only 18% of all published material is cited at least once. One can then say that if the papers cited very highly then they must have a great impact and therefore they

must be influential and they must be influential in determining the course of field and therefore today we do have these kinds of quantitative tools with which one can assess how important a piece of scientific research really is? But in producing knowledge and this is true for Sciences, it is true for Engineering, Social sciences, Art, Humanities and even patents and this is a paper which just appeared in the year 2007 there are typically more people, more authors involved in producing a piece of scholarly work. So, there is an increasing dominance of aims in production of knowledge and what it tells us of course is that it is important for people to work together when producing knowledge and therefore research requires collaboration, research requires teamwork. Now using these kinds of parameters, one might now rank Institutions in the world and now I am sure that your institute would of course like to see where it appears in India Today's ranking of management institutions or in any other magazine which appears do the same thing here and you will ask this question did we move up, did we move down, did one of our competitors move up this lists. Of course, there are academic rankings of World Universities. This one came out in 2003 from Shanghai and it is called Shanghai Rankings. It uses interesting parameters for ranking institutions. They used only five parameters here, they use 21 subject categories including the social sciences. They asked how many Nobel Laureates an institution has and gave a different weight for award dates. For example: If an institution like Indian Association for Cultivation of Science take credit for C V Raman's Nobel Prize, they will say well that was obtained in 1930, so many years have passed, so the weight has gone down. So

there is a differential weight. They gave weight for papers in highly cited journals, in articles in Garfield Science index the number of papers published by faculty what is called academic performance of faculty and then produce the rankings. Now are these parameters the right parameters to use. They are very tough parameters. But it turns out that if you did ranking by prejudice and were asked to rank the top Ten Universities in the world, you would probably come out of the following:

The List (Top 500)

- | | |
|--------------------|--------------------|
| 1. Harvard | 16... |
| 2. Stanford | .. |
| 3. Caltech | ... |
| 4. Berkeley | ... |
| 5. Cambridge | 19. Univ. of Tokyo |
| 6. MIT | ... |
| 7. Princeton | ... |
| 8. Yale | 25. ETH, Zurich |
| 9. Oxford | ... |
| 10. Columbia | ... |
| 11. | 251-300, IISc |
| 12. | ... |
| 13. | ... |
| 14. Univ. of Tokyo | 451-500, IIT Delhi |
| 15. IIT Kharagapur | |

You may not get the right order but your will get the top ten more or less as obtained in this. Now of course, you might ask where do Indian Institutions appear. In this ranking which is basically a research ranking, the Indian Institute of Science was

the top Indian Institutions and it appeared between 251---300 in the world with these parameters. There are other parameters which one might use, the number of students graduated, the amount of money that is spent so on. But this is not a particularly encouraging ranking. You can also rank countries by using these criteria and if you look at below list, India comes out 22 on the below list.

The Scientific Impact of Nations

D A King Nature 2004 430 : 311 (July 15 issue)

Rank order	Nations	1997-2001	Share of Top 1% cited publications
1	USA	23723	62.76
2	UK	4831	12.78
3	GERMANY	3932	10.4
4	JAPAN	2609	6.9
5	FRANCE	2591	6.85
6	CANADA	2195	5.81
7	ITALY	1630	4.31
.			
19	CHINA	375	0.99
20	S. KOREA	294	0.78
21	POLAND	231	0.61
22	INDIA	205	0.54
	Total	38,263	136.5 Collaboration

This was done in 2004 by David King, the then Scientific Advisor to the British Government. The USA of course is on top, UK is there, Germany, Japan is there, France, Canada and Italy are there and so on. China comes in at 19th. Things might have changed little bit now but not very much. Now the question of course is how does one go up and how does one improve.

In research, one of the things that I might mention is that there is somewhat unrealistic sequence which everybody draws between pure science and technology. That it goes in the lineal sequence to applied science to engineering and eventually to useful technology. It does not always happen. But science has to be practiced today, was defined at the end of the Second World War in a famous report written for the American Government by Vannevar Bush in which he says that ***“Science by itself provides no panacea for individual, social and economic ills. It can be effective in national welfare only as a member of a team. But without scientific progress, no amount of achievement in other directions can insure our health, prosperity and security”*** He said this in 1946. More than 60 years later, the same philosophy which is applied for justifying the public funding of science in every country and you must remember that by and large scientific activity and technological activities is publicly funded until it appears to show commercial prospectus. Is there a difference between Science and Engineering? I found this article by Henry Petroski, American Scientist, 2008 Vol.96, 368 entitled ***“Scientists as Investors”*** and what he said was ***“often considered distinct, engineering and science are frequently difficult to distinguish”*** but the famous aerospace

Scientist, Theodore Von Karman said many years ago that ***The scientist seeks to understand what is that the engineer seeks to create what never was***"; but this is no longer true.

For Ex: Chemist and Biologist really seek now to create materials and organism which never work and therefore it turns out that engineering and science really are intimately mixed together and medicine really is a sub set of this. If you have three circles, Engineering, Science and Medicine they must have intersect at the very frontier of knowledge. There are some words which everybody uses: Discovery, Invention and Innovation. In management Schools, I am sure the word Innovation is one which is most popular. We would like everybody to be an Innovator.

I have given my own examples of what I consider our discovery? What is Invention and what is innovation? Penicillin of course was a true discovery. Fleming did not know what his discovery was, Edison invented the Light Bulb and you might also say Einstein invented Relativity. So Scientists can also be Inventors but innovation of course would be the retail store for instance where you have in fact innovated to some extent in your ability to take products to consumers. Now you can here clearly see the difference in scholarly activity between these three activities.

Now of course, one must have ideas for innovation, one must translate these ideas and one must develop them and eventually one must get a marketable product. But what happens in Scientific Research of course is that very often **"Success in laboratory does not always translate into success in the market place"** and I have taken this quote from an article

on the pharmaceutical industry which is the industry which spent the maximum amount of money on research and development. It is one of the most expensive areas of research and 100 million dollars have to be spent before a new drug really enters the market. Therefore, Pharmaceutical industries do not have the same kind of margins which other industries have unless they make their drug really unaffordable to most people. It is only then can they recover the cost. But in talking about Innovation, I thought I would draw your attention to a book which appeared in 1997 and if the students have not yet read this book, they must read it called ***Pasteur's Quadrant – Basic Science and Technological Innovation*** and it is written by a man called Donald E Stokes who died shortly after this.

Above is an illustration which I have prepared what is today called Pasteur's Quadrant. Along the X axis I have written use inspired research and along the Y axis I have drawn fundamental research. Now of course, I have divided this space which is what one might call, the space of academic

Research, the space of innovations and this into four quadrants and now we might ask what is Pasteur's Quadrant? The top left quadrant is what is called Bohr's Quadrant – means Bohr of course is the man who did the fundamental work on atomic structure. At the time he understood the structure of the atom, it was fundamental physics, it may not have had a major application. Then of course, the extreme bottom right quadrant is Thomas Edison. He invented the Light Bulb. Edison was the man who could in fact have discovered electron. But very quickly J J Thomas discovered Electron but Edison was more interested in quickly taking a discovery that he made in the laboratory to practice and he focused all the attention which he had and his collaborators in developing the Light Bulb. Edison was an inventor. But in the top right Quadrant is Pasteur. Pasteur of course is the famous French Scientist and you might ask what he did do. Everybody had heard of Pasture. Pasteur is the father of Microbiology and it is because of the fact that he is the father of bacteriology and Microbiology that we in fact have christened this procedure for sterilizing milk as pasteurization. So if you get good milk in those packets you can think kindly of Pasteur every morning. But at the same time Pasteur was the man who discovered the fundamental principles of organic stereochemistry. He discovered the fundamental principles of what today is called Chirality in molecular. He did this in 1850's. It is after that a century of research long. So Pasteur worked in many areas. Some of his works lead to vaccines, they lead to practical applications of Microbiology and the preservations of foods for instances but they also advance the science of stereo-chemistry and organic chemistry to points where was of great use

in today's pharmaceutical development. So Pasteur did the highest degree of fundamental research but at the same time his research had enormous applications and immediate applications even in his own time. You might ask where are we? We are in fact at the bottom left Quadrant - RK Lakshman's Common man and there we are and that is average academic and Industrial R&D and what it will seek to do now in this academic space, try to move upward in the vertical direction, try to move horizontally in the right direction or move diagonally towards Pasteur Quadrant in the highest level of academic innovations.

What do I have in the Bottom left quadrant the Iconic building which represent my own institutions, the main building of the Indian Institute of Science now constructed about 90 years ago. Its construction was begun more than a century ago and one might really ask this question can one take India's institution from this point in the bottom left quadrant and take them up in to any of other three quadrants of the Stokes Diagram. What do you mean? Now I have floated along the X axis I have floated administrative flexibility and along the Y axis, I have floated Financial Resources. But in addition to all of this, there must be a intellectual climate, there must be a quality of faculty and students which will in fact take our institutions forward and head towards what one could look at as an idea.

Sometime ago I was given the task of talking to a course participants which was conducted by National Institute of Advanced Studies in Bangalore and one interesting thing about this institution is that they will also give you a title on which you are supposed to speak. They will get

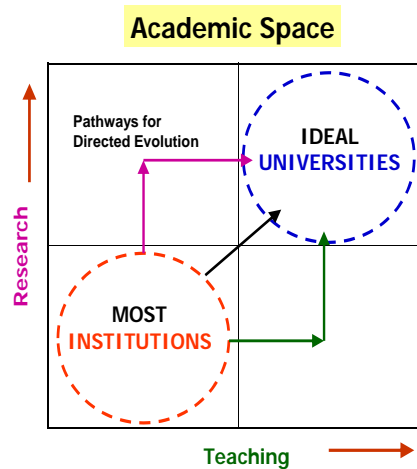
administrators and teach them. So they gave me this title which is rather complicated title but I thought that it was interesting. They said that Restructuring Indian Universities and they also said that "if you want you can choose another title" Reforming Indian Universities. I said it does not really matter and I taken two words Restructuring and Reforms. What does Restructuring remind you? It reminds you of a famous Russian word "**Perestroika**" and this word was introduced by Mikhail Gorbachev many years ago. He introduced another word also called "**Glasnost**" which was transparency. When he tried to restructure the Soviet Union in a transparent manner, of course the Soviet Union collapsed and fragmented into many other countries. The word "Reform" in science often also gives another title "Paradigm Shift". Although I don't like the word Paradigm very much many of you would have heard this so we are really looking at these two words in connection with education. I was asked a few minutes ago in my meeting about Teaching and Research. Now of course, teaching and research are two sides of the same coin. You can't do research if you do not teach and if you teach without doing research you can't teach much. Therefore, I think both Undergraduate and Post graduate education really need some kind of intimate linkage. This is what the great Universities of the West have always had and this is what systematically over the last half a century we have tried to do. What have we done? We have taken our Universities and we have separated Medicine and Engineering from our Universities. Karnataka has a Medical University, Karnataka has an Engineering University and there you might ask what is left in the real University? The real University of

course has little bit of Science, little bit of Humanities and Social Sciences. They have a separate Law University and we have a separate Agricultural University. Then of course, the only advantage that one can see in having so many Universities is we have more Vice Chancellors. One might ask this question do we need more Vice Chancellors and I think there might be a conflicting answer on this. We will have more administrators but really we will then separate the intellectual space and fragmented to a point where different disciplines are no longer in contact with one another. Today when we talk about intellectual property and patents, what we are talking about? We are talking about protecting scientific innovations, we are talking about protecting engineering innovations, but nobody in our institutions really has very much of an idea of Patent Law, they do not know what it is. We have large biology research institutions. They are completely separated from medicine and agriculture but at the same time Committee after Committee one will hear that the major applications of biotechnology are in the fields of medicine and agriculture. We have in fact reached a situation where students come out of our institutions without knowing the connection between various disciplines. They have no appreciation for the disciplines that they do not study. Some years ago probably more than a dozen years ago i.e. sometime in the 1990's the Indian National Science Academy had a discussion and at that time one of the educationalist in India, Prof. P N Shrivatsa who was the Vice Chancellor of one of the Universities had written something about the newspaper. The Newspaper and of course the only newspaper which would write editorial on such thing is Hindu. Hindu has interesting editorial and I have

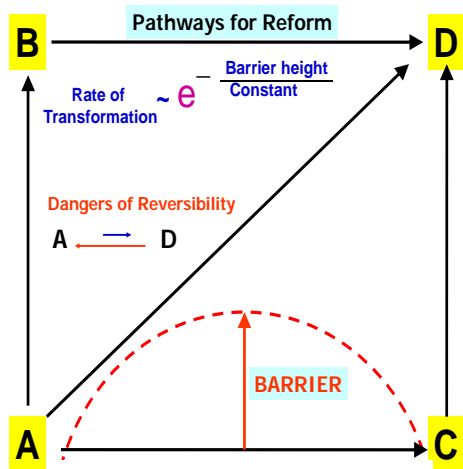
never forgotten this. The Hindu said that ***we now take students into our Universities and then transform them into intellectually macerated individuals.*** I could not quote of this phase I think we must really worry about this.

So when we look at the academic space of teaching and research, we are really looking at the problems of transforming most institutions into ideal Universities. What are the pathways by which we can go from one point of space to another? This is a subject. In a diagram like this it comes in my own field. I ask the questions For Example: putting two dimensional space where the axis are different how does molecule go from one region or space to another. I can ask the same question here.

I was asked another question in the meeting that I had with the faculty. They asked me ***“How are you the Director of an institution? You are a Scientist.”*** My only answer to this was that most institutions are managed by people who have not studied management and sometimes the departments which are most poorly managed by institutions are Departments of Management.



I would therefore think that you can in fact sometime managed by analogy and think about problems by analogy and here is two dimensions map which with I am very familiar. In fact two dimensions map in the subject and I do research is called Ramachandran map looks exactly like this except it has two different axis, taking about different subject. It was one of most the fundamental ideas to come out of India, came out of Madras University many years ago. I like thinking in what I called two dimensional spaces and this is two dimensional spaces of research and engineering.



We have to move along with direction, we have to go from point A to point B and we have to find a pathway. Now of course when we look at pathways for reform what do we confront when we go to A to B. There will be a rate of transformation and there will be a Barrier height which you have to cross. This is exactly what happens in Chemistry. If we have large barrier you have lot of energy in order to cross the barrier, the rate of chemical reactions will be very slow. We are actually now looking at the rate transformation of institutions from the left most quadrants (the bottom quadrant) of the Stokes Diagram up into top quadrant of stokes diagram or any one of the other quadrants. There is also the danger of reversibility which is there in chemical reactions. Point A can go to Point D but it can go backwards from D to A.

What our institutions had shown is that even if they improve up to a point, they can very quickly relax back when an administration changes. Therefore they must be built in safeguards which prevent a relaxation in the reverse direction of Indian institutions and this is something that must

be understood by everybody who thinks about reforms and restructuring. Now I ask the question that the Bearer to be transformed. You know there was a famous Scientist after whom Bearer Height is named. This is the Swedish Physical Chemist Arrhenius. This is called the Arrhenius Barrier in a chemical reaction. We have to climb it to transform. What are the factors which contribute the Barrier Heights in improving an Academic institution? Is the Academic faculty, the Administrative Structure and the public Will and Political Ambience? That is really what we worry about. **What are the issues?** Faculty and students recruitment - should it be regional or national?. Resources, should they be State or Central or should they be private?. Governance- should institutions have autonomy and what is academic responsibility? These are the issues that everybody should consider.

What about Teaching?. I found a very interesting editorial in a journal "**Those who can teach, should** (Editorial, nature Chemical Biology, Dec 2007,). It is only then they would teach the next generations. What do we have today? We have Universities in which they are teaching without Research. Then we have National laboratories in which there is Research without Teaching. We must worry about the Role of Research Projects in Undergraduate and Post Graduate Education. Today, when I went around the Department here in Biotechnology, I found it was remarkable that they are undergraduate students who are actually doing projects. I think this project work which is most important and then the teaching of Writing and Communications Skills. This is very important because it turns out that we are creating graduates

who cannot write and who cannot communicate. Of course there have been people who have said other things. George Bernard Shaw on creative work said **“He who can, does; and he who cannot, teaches”**. But this is not really true. Bernard Shaw is very cruel man when it came to his writing. But I found this in an Engineering Journal sent to me by my colleagues who is one of the founders of the Applied Mechanics and first Editor of the Journal of Fluid Mechanics, (George Batchelor, Research as lift Style, Applied Mechanics reviews, 50, R11, 1997) and he says **“Contrary to popular opinion, it is not usually the equations which need to be understood for the effective communication of science, it is the words. Literacy is important as well as being the door to the world of literature; why is it not taught to graduate students?”** So I think even if you are studying management, it is very important to be able to communicate and communicate effectively.

Now of course, I will come to India. The National Knowledge Commission, headed by Sam Pitroda and of which I happen to be a member for sometime had produced many recommendations for higher education, printed them and distributed them in 2007. There were these ideas for expansion. Of course I ask Mr Pitroda once, How can we create 1500 Universities? We are already struggling with one that we have. Pitroda had very interesting arguments. He said look , if we say publicly say 1500, 1500 may be.....

Because at some Politicians get the idea this man is crazy. He is talking about 1500 Universities. We can not afford that many. May we will satisfy him with 50. Then we will get money for 50 new

Universities. This was the philosophy with which he moved.

He also suggested that we should have a new regulatory body which will now integrate the disciplines and this of course is the recommendation which has met with greatest amount of resistance. It was met with so much resistance and the greater amount of resistance from Ministry of Human Resource Development that I suspect there must be something good in this recommendation. Then, there of course, if an idea meets with enormous amount of public sort of criticism, then you must think about that idea very seriously. If it passes without any criticism, it is probably some non descriptive idea which doesn't seem to bother anybody. This must bother large number of people. Then of course, Increase in Public Spending, then of course Excellence, you must reform and everybody knows all of these and last one the Salary Differentials. It is sort of interesting. This was anticipated. One of the faculty members here asked me how do you incentivize science? How do you make up for the poor salaries that the faculty of Indian Institute of Science gets compared to those working in Investment Banks. Why did your all Engineers not go away to investment banks? I suspect the economy goes even poorer and capitalism collapses may be the public institutions do better. Then of course, there is the issue on Inclusion. This is something public institutes reconcile with it to ensure access for all deserving students and those who have admission process which needs supply and introduced some kind of National Scholarship Scheme. Everybody should get education that they deserve and in merit. Then Affirmative Action – Reservation and use of Deprivation Indexes. These are

extremely controversial areas. These areas which cannot be avoided, the areas that and those areas here stay. Only thing we can worry about how to manage, how to in fact go forward in trying to do the best that we can with the limitations we have.

Then we have **Action** – there must be reforms within existing systems, there must be changes in policy and of course one can have new statutes or legislation which is of course most difficult to do. There are many challenges in creating world class institutions. Today, I was surprised three budgets after 100 crores grant for the Indian Institute of Science was announced. Everybody here is asking what happened to that Rs.100 crores grant? It has made deep and wider impact. Immediately Chidambaram announced four years ago in 2005, he immediately said this was the first step India was taking in creating a world class institution. Now world class institutions can hardly be created with an investment of 25 million dollars. Now one might then ask this question how does one create this. There are many many parameters which I have written. But the last one is what I want you to think about Higher Education is Public or Private? Should research always be done only through public funding?

Dr C V Raman once saw this building moved into it and did his remarkable research. Raman's story at Indian Association for the Cultivation of Science is historic, it is romantic and it will never be repeated again. We must look for our sustainable model. The first attempt was by J N Tata when he set up the Endowment for creating Indian Institute of Science in 1896. It took up to 1909 to set up the institution. In fact the very first response of

Lord Curzon in 1901 said that it appears to have no relation either to charity, or to suffering or to the queen or to 300 million of India. What was asked of Lord Curzon was £5000 per year which would be recovery grant given by Government of India for this new institution. Of course after 13 years, the Institution was fully set up. Today we have Indian Institutes of Management, Indian Institutes of Technology, we have the Indian Institute of Science one of its kind and then newly created Indian Institute of Science Education and Research (IISER) which was created by Government in an attempt to promote Science and Education. The Indian Institutes of Management largely judged by Placement performance and its Alumni. The Indian Institutes of Technology, their flagship is the joint entrance examinations, students' selection, graduate programmes and the performance of alumni what is called Brand Equity today. My own institute is Post Graduate teaching and research institution and it is judged really by the research done by the faculty and students. It is not judged by the salaries that taken after they graduate. Therefore, you will find there are different parameters by which these institutions are judged. Unfortunately, it turns out that in government and public perception, all these parameters mixed up together in judging institutions. Today, we have many kinds of institutions; we have Affiliated colleges, Autonomous colleges, Universities which are affiliation centres, research institutions, National Laboratories, Deemed Universities, Deemed and Customized Universities. They have been set up by Dept of Atomic Energy, Dept of Space, they have been set up by CSIR and in this process India is the only country in the world which has completely reinvented the definition of a University.

One has to ask the question have we done everything correctly or is there a problem with what we are doing. It is not popular to talk about this. What are our models? There are enough models to look at the famous Research University of West. Harvard and Stanford have been there for centuries now. There are Indian models before independence and immediately after independence at Kolkata, Madras, Delhi, Banaras and Allahabad which were all famous Universities which produce the highest quality of research which came out in India. Post independence – We have what have done in 1970s onwards and I have been a personal witness to this because I have began my career in 1970s. We have in fact accelerated decades. We talk about this but we have not been able to do anything. We have this question of specialist Institutions and Broad based institutions. Should our institutions be very small or should they be large. All the Universities in the west are large. We need to create an ambience. Governance, faculty and students performance, carrot and stick research facilities and some ability to promote scholarship by academic debate, participatory governance and interdisciplinary dialogue is what we need. There are parameters like institutional performances which we used, we know that they are but we don't use.

We must in fact give some credit for the resources generated by an institution. Today, if you are a public institute, if you generate a resource, the government actually holds it against us because they would say will deduct it from next years grant that there is too much of money in your corpus. There is no incentive for institutions to really raise funds. It is better to rely on tax payer. But since the tax

collection of the government appears to be going down with the decline of the economy one must worry about where our institutions are increasing number of institutes are going to get their resource. We must worry about the Role of Private Philanthropy and a Public Private Partnership. But it the role of Private Philanthropy which I would like to highlight in this surroundings. Because, there has been in act of Private Philanthropy in the area of research in higher education to match that of J N Tata in 1896 In the entire 20th Century that has followed there has not been a single example and as Indian Economy has boomed as the number of Millionaires and Billionaires in India are increased. They have not been philanthropy in India in the manner in which philanthropy has been practiced in the capitalist society of the West particularly in the USA. So, I thought I would conclude really where TATA's request of 1899 for asking £5000 per year and Lord Curzons response to offer £2000 and he said...**TATA entirely owes it to me that he gets anything; and if he is not wise enough to accept it, I am ready to drop the whole thing tomorrow** (Deepak Kumar, Ind. J. Hist. Sci., 19, 253-260 (1984). It was lucky that he did not drop the whole thing tomorrow and our institute did come up with the 100 years that has followed ; and that I am here really to be able to speak too. But I think in the years to come, we will have to worry about some of the problems I have raised. If research and higher education in India are really to go to the next level and if they are to be competitive in a completely globalised world. It is not enough really to argue the word that has globalised and globalization affects the industry. Globalization affects every walk of life and it will affect Higher

Education in a very drastic way in the years
to come. I hope that some of you will in

fact be able to do something about it if you
worry about it.

Thank you very much.

About the Speaker: DR. P. Balam



Dr. Balam received his Bachelors degree from Fergusson College, Pune followed by a Master's degree from the Indian Institute of Technology Kanpur and his PhD degree from Carnegie Mellon

University. After a postdoctoral stint at Harvard University with Nobel laureate Robert Burns Woodward, he returned to the Indian Institute of Science, where he has been ever since as a faculty member in the Molecular Biophysics Unit.

Dr. Balam's main area of research has been the investigation of the structure, conformation, and biological activity of designed and natural peptides. He has been a major contributor to the evaluation of

factors influencing the folding and conformations of designed peptides, and has investigated structural elements playing a key role in the formation of secondary structural motifs such as helices, beta turns, and sheets. Along with Isabella Karle, a frequent collaborator, he has also pioneered the use of alpha-amino isobutyric acid to induce and retain helicity and constrain peptide conformations. Balam has authored more than 400 research papers, and is a fellow of the Indian Academy of Sciences He was also a colleague of late Prof G.N Ramachandran at the Molecular Biophysics Unit of IISc. He presently is the director of the prestigious Indian Institute of Science. Prof Padmanabhan Balam is well known among his students for his oratory skills and his editorial in journal 'Current Science'. Dr. Balam received several National and International awards some of them are:

The Gujar Mal Modi Science Foundation's 2009 year's award 'Padam Shri' – an internationally renowned scientist for his outstanding contributions in the field of Molecular Biophysics.

Padma Shri by the president, Government of India (2002)

Shanti Swarup Bhatnagar Prize of CSIR (1986). The Shanti Swarup Bhatnagar (SSB) Prizes are awarded annually by the Council

of Scientific and Industrial Research (CSIR) for notable and outstanding research.

TWAS Award in Chemistry (1994)

G.D. Birla Award for Scientific research (1994),

Distinguished Alumnus Award of IIT Kanpur (2000)

Fellow of the Indian Academy of Sciences, Indian National Science Academy and the Third World Academy of Sciences, Trieste, Italy.