Indian Institute of Management, Bangalore

26th Foundation Day Lecture

Science, Sensibility and Business of Science

Dr. K. Anji Reddy, Chairman, Dr.Reddy's Group

October 28, 1999

Ladies and Gentlemen:

I deem it as a great honour and privilege to be invited to deliver the foundation day lecture of one of the country's premier business management institutions, the Indian Institute of Management, Bangalore. The city of Bangalore is famous for its academic institutions. Apart from IIM, the other institution in this City we all admire is the Indian Institute of Science.

On the face of it, the mission statements of these two institutes may seem very different. While one educates our youngsters in the world of business, the other educates our youngsters in the method of science. And yet, in the coming century, there is more binding their destinies together than keeping them apart.

This leads me to the theme for my talk today – Science, Sensibility and the Business of Science. While the "science of business" is something which you all understand, and which the excellent faculty of this institution strives to propagate, the subject of the "business of science" has been less well explored and even less exposed to the glare of academic scrutiny.

Science was never as inextricably intertwined with business as it has been towards the end of the 20th century. We have come a long way since the beginning of this century when the gentleman scientist toiled alone in his laboratory, pursuing the mysteries of science with single-minded devotion, without regard to the possible benefits or dangers of the technology to society. Since most of them were independently wealthy, profits were never under consideration. Indeed, it may have been considered vulgar, if someone suggested to a scientist that he should patent his invention and then sell it to the highest bidder. This attitude was even more prevalent in the medical sciences, which still somewhat naively, took the altruistic position that all health giving inventions must be publicized to benefit the many rather than exploited to enrich the few.

In the early 1920s, Frederick Banting with the help of a medical student Charles Best and the permission of the departmental head Prof. John Macleod of Univeristy of Toronto discovered that a pancreatic extract could keep a diabetic dog alive -- this marked the discovery of Insulin. The pharmaceutical company Eli Lilly wrested the rights to insulin manufacture and use and then applied all the resources at its command to put a usable product on the marketplace. Frederick Banting won the Nobel Prize for his discovery and Eli Lilly had become a leader in Insulin. However, the product was never patented and Frederick Banting remained a scientist.

Compare this with what happened 50 years later. Herbert Boyer and Stanley Cohen discovered "scientific cloning" and reported their historic experiment in November 1973 in the proceedings of the National academy of sciences. Soon after this was published Herbert Boyer was approached by a venture capitalist called Robert Swamson. Was it possible, Swanson asked, not just to use cloning technology to create countless identical strips of an entire gene, but to exploit the technique to make the gene's product? Boyer's answer to Swansons's question about the possible manufacture of human proteins using genetically altered micro-organisms was a "yes" because a plasmid could code for a protein and use the bacterium's internal protein-making machinery to produce it. And in giving this answer, Boyer set in motion forces that were to establish an entire new industry; Biotechnology. Boyer borrowed $500 and joined Swanson in forming a company which would exploit this new science. They called it Genentech, for genetic engineering technology.

Genentech wanted to make a protein with a recognizable name. From the very start, it sought credibility – and so they decided that insulin should provide that.

Once again the product is the same. In 20s, it was made from pancreatic extract. In 70s it is the first product to come from an entirely new industry – the biotechnology industry. In 20s the product was never patented. The Noble prize winning scientist did not exploit this invention to become wealthy. In the 1970s Herbert Boyer did not win the Nobel Prize for his invention – but his association with venture capitalist made him worth a cool $80 million in 1980.

The partnership between Scientist (Herbert Boyer) and Venture Capitalist (Robert Swamson) has resulted not only in the creation of Genentech – a $20 billion market cap-company today - but an entirely new class of Industry was born which now popularly called the Biotechnology industry. This industry is now on the verge of unveiling a cluster of new products; US authorities approved approximately 20 biotechnology products in 1997 and another 220 product were in pivotal (Phase III) trials at the end of 1998, representing a three-fold increase in just two years. The total revenues grew from a mere $124 millions in 1984 to $15 billion in 1997 a compounded annual growth rate of over 42%. The total market capitalization of this industry in 1997 is over $80 billion, which does not include 1000 or so private biotechnology companies. This dramatic evolution is a fine example of how the 'business of science' when properly harnessed can create enormous wealth.

Coming back home, I have tried to find a suitable example. Unfortunately, all the science in India is carried on in Government and Academic Institutions particularly the Defence and CSIR Laboratories, IITs etc. ISRO for example leased its INSAT 2 series transponders to Intelsat. In fact ISRO has received its first commercial payment from Intelsat in May 1999.

A typical and convincing example would be from our own laboratories. I would like to narrate how science was harnessed as a business in our own laboratories.

As you are aware, the Indian Patent Act 1970 has enabled pharmaceutical companies to recreate the drugs that were discovered by international pharmaceutical companies all over the world. The industry has developed innovative processes for many internationally developed drugs and made them available to Indian people at affordable prices. *However, the industry has not harnessed science to discover new molecules till 1993.*

Actually the process for drug discovery in India has begun with me and in this very city, when I was elected as President of Indian Pharmaceutical Congress Association (IPCA) in 1993. As president-elect from the industry I had to make a policy statement in the speech. The topic of the times was the Patent Act. Words like GATT, TRIPS were on everybody's lips. The Government was contemplating to join the GATT and endorse the TRIPS in order to be part of the WTO. You cannot be a member if you do not fulfill these obligations. There was vociferous opposition to this Government move both from the public as well as from the pharmaceutical industry.

Giving a call for its acceptance and painting a picture for the future I said, "Intellectual Property Rights (IPR) has been a subject of national debate in recent times. Looking at the acceptance of the patent regime by 90% of the nations and the rapidly changing scenario, the issue before us is not "*whether to accept the patent regime or not" but a question of when it will be accepted.* If this has to be accepted in 10 years**, one needs to adopt a Japanese model of advancement into basic research and upgrading industry into invent new molecules for development. The Japanese industry first excelled in process R&D, then upgraded itself to invent new molecules and finally shaped alliances with MNCs in USA and Europe for co developing and co-marketing new molecular entities (NMEs) The Indian industry may emulate this model and make a beginning at new molecular invention. Basic research in this direction is an arduous task and is said to be expensive. Drug discovery and development in these countries is estimated to cost between $100-200 million. It is my considered opinion that in the Indian context, such an endeavor may be accomplished within a cost of Rs.100 million (expenditure per annum). An expenditure of this magnitude is within the reach of some Indian companies.

**(The patent regime is actually going to come by 2005)

So I put my neck out. Not only did I say that we can do it, but I mentioned a figure of Rs. 10 crores per annum. But I must tell you that behind this logic there was a lot of groundwork that has gone into it. When I decided to go for basic research I made an in-depth study of how drugs are discovered. Once in a while there are path-breaking discoveries, like the discovery of beta-blockers and H2 antagonists by Sir James Black, who won the Nobel Prize for it. But, bulk of the 35 or so drugs discovered every year is the result of analoguing.

And what is analoguing? I was amused to find that Hoffman la Roche removes a phenyl from Piroxicam and substitutes it with Thenyl and you discover a new drug. I became more confident after coming across such instances of simple jugglery with the known molecules.

While I was making a policy statement at the IPCA, the construction of my Rs.20-crore Research Foundation was already in progress. In October 1993, we started functioning at these new premises. While I gave complete freedom to the President and the scientists to go ahead with the anticancer research; I personally identified a promising area in diabetes research and led the team of researchers. In 1994 when we identified this new area of "Insulin Sensitisers" there was no compound of this class in the market. Sankyo's Troglitazone was in Phase-III. There were already 135 patents. My scientists came around these patents, discovered and synthesized hundreds of compounds. Finally in March 1997 we created history by becoming the first ever-Indian company to license a compound to a multinational company in return for upfront, milestone and royalty payments. As I predicted the four years of research effort cost me Rs.40 crores and we have already earned US$ 6.25 million (Rs.27 crores).

The current position is that we have licensed two compounds to Novo Nordisk, which are in clinical development. In addition, two compounds in anticancer area are entering clinical development shortly – one in India and one in Netherlands. We are expecting a Cox-2 to enter clinical development next year. In the anti-infective area we are expecting a compound shortly.

Mine is an example of Scientist-businessman rolled into one –quite different from the partnership between the Scientist & the venture capitalist. Even in USA, the kinds of partnerships between scientists and businessmen are no longer the stuff that make the news. Indeed, the star of today's biotech enterprise is the scientist-businessman, rolled into one, and among nations the United States is preeminent as a country that nurtures this tribe of "businessmen-scientists". This partly explains the fact that with over 500 biotech companies in the US, it dwarfs all other countries and even the entire European Union, in terms of the breadth and depth of its biotech sector. If we must emulate something about the way the Americans run their country, this may be one such thing.

One might come away from hearing all this that the subject of the "business of science" is a subject of interest to academics who study the "science of business". And to some extent the scholarship of premier institutions such as the Harvard Business School has focused on this subject to generate ideas, hypothesis and cutting edge comment. But the credit for popularizing the "business of science" and indeed powering it towards expansion must belong to the tribe of venture capitalists who populate Palo Alto. They have been responsible, first for the emergence of the US biotech industry, and now for the meteoric phenomenon of the so-called "dot coms" or "Internet companies". Venture capital investment, is not only important for the capital requirements of the start-up, but also contributes for the generation of intellectual wealth. A recent study reported in Business Week has found that venture capital funding produces six times as many patents as corporate R & D spending and may account for 15% of US industrial innovations.

Creating the environment for business and science to mix is an agenda for all governments in the future. The danger is, overenthusiasm in managing what is inherently an unmanageable process. Indeed the US government's role in enabling the felicitous mixture of business and science has been through enablement, rather than initiative. Government initiatives, in this regard, are like pulling a plant out of a seed, when efforts might be best expended towards creating the right environment for the seed to germinate. This is precisely what the US government has accomplished. Managing what is essentially a complex process, however well intentioned, is doomed to failure. Ultimately, the best incubator for innovation is the free-market and governments should best focus their agenda for creating the environment for the free-market to develop.

I would now like to shift attention to some of the business-related issues that impinge on the innovation process in companies. Industrial R & D utilizes the services of scientists who have been trained in the academic setting of a university. Anyone looking at these two institutions cannot escape noticing the fact that, in some senses, they are polar opposites.

Let us look at the way we train our PhD's in science. A smart youngster spends years working for a mentor with whom he develops a close relationship, a relationship that is mutually beneficial, and yet full of tension due to the inevitable conflicts of interest between mentee and mentor. The penury of the mentee, and sometimes even the mentor, is seen as a badge of honor. Any short-cuts are frowned upon. After much dalliance a problem is chosen for detailed study. It is then atomized into excruciatingly small and manageable fragments, a point at which it starts bearing little relationship to the problems of society at large. Experiments are carried out under carefully controlled and monitored conditions that are as far removed from the complex realities of life in the real world as possible. When the middle aged man or woman emerges after years of monk like isolation and single-minded devotion to a problem that society may care little about, a personality change has taken place that makes this freshly minted PhD exquisitely unsuited to the life of an entrepreneur managing people and capital for profits. A life of contemplation in the still groves of academe seems more appropriate at this point.

The reductionist methods of science are entirely appropriate to a career in the so-called pure-sciences. Academic scientists are not obliged to make products for the marketplace out of their inventions. They do not have the need to take the systems view that the market demands. But innovation of new products is the very reason for the existence of the industrial R & D scientist. At a time when industry is facing a scarcity of good people for its laboratories why is it that government's continue to invest in a system of training that is oriented to the needs of the minority who go into the academia rather than the majority who are desperately needed by corporate R & D labs. How can we justify the flight of talent away from creative scientific work towards mundane Y2K solutions when our industrial R & D establishments are finding it difficult to find the bright people who can solve tomorrow's problems?

Before calling for a wholesale rearrangement of the way science training is organized, it would be helpful to look at the traits and qualifications that distinguish a good R & D scientist in an industrial setting.

Good industrial science is done in a project environment, where groups of scientists representing various disciplines come together to work as teams. This is the antithesis of the lone superstar academic researcher. Working with other people, collaborating, networking and communicating are key skills that the industrial scientist must be endowed with in order to succeed in the workplace. How often do we teach these skills in university classrooms?

Another key area is that of portfolio management. In the industrial environment of today, scientists are often called upon to make choices. They are also compelled to juggle a collection of research projects and reevaluate them periodically to ensure relevance and commercial viability. Objective financial evaluations of project viability may override the bias of the scientist in favor of his pet project. Such external considerations affecting the way a scientist conducts his science would be very unusual in the academic environment, in which scientists work in the same area for an entire lifetime. Thus the industrial scientist must not only be dispassionate about his work, but he must also be multiskilled and flexible in moving from one area of research to another.

Just as there will be a need for a reorientation for the scientist who wishes to crossover into the world of business, we also have to consider the need to broaden the perspectives of our managers to encompass technology related issues. In the future most of the good jobs, even in management, will be in companies with a technology focus. Guess who will lead these companies – leaders who have an intuitive understanding of scientific and technology issues, either through formal training or work experience. Fortunately, the current MBA education is flexible and broad enough to leave the fresh MBA graduate unjaded and receptive to cross-disciplinary learning. We must not only integrate technology issues into the mainstream MBA curriculum, but there is also room for post-qualification exposure to technology issues through the workplace or through more structured classroom training.

While corporate innovation will still be largely driven by PhD's, it is essential to have business leaders who can truly understand science leading these organizations. It is good to remember that high-tech start ups are not successful just because they are nimble; but also because their founder-CEO's have the kind of intuitive understanding of technology that comes only when you are soaked in it.

The theme I have tried to get across in this presentation is the need for our scientists and businessmen to develop shared perspectives. We need them to be able to think outside their respective professions. In other words, we need PhD's who think like MBA's and vice versa. The knowledge era enables this by permitting the easy deconstruction of knowledge followed by reconstruction into domains customized to the needs of the user, something we are already seeing in the form of Internet user groups and specialized websites. Thus access to the relevant cross-functional expertise will no longer be the issue. The issue will be how we as individuals make use of the tools that enable us to assemble our own customized knowledge domains that help us remain competitive in the workplace. This is a critical issue particularly for the knowledge intensive industries such as pharmaceuticals and information technology.

The traditional portals for knowledge delivery will, if they can reinvent themselves, continue to have an important role in this process. The teaching of business science must remain a marketplace oriented commonsense discipline instead of becoming a dry and academic pursuit. Supply Chain Management theorists should keep their minds open to studying the dubbawalla's of Mumbai for inspiration. Perhaps, through more consulting activities, academics could play a more central role in business, more like the jockeys in a horse-race rather than punters watching powerlessly from the stands.

Just to emphasize the convergence of technologies and disciplines, it is of interest that Georgetown Univ., Washington has a program titled the Communication, Culture and Technology Program and the Internet "incubator and entrepreneurship" program. Obviously, the Georgetown University academics are looking outwards at what is happening in the real world when they design their programs.

The business media in the US shares the same enthusiasm for technology issues. Issues of the Wall Street Journal and Business Week have comprehensive and insightful coverage of technology and science issues that we do not see here yet. Science is not just left to the boffins. It is dissected threadbare by people who hope to profit by it. We need the same level of public discourse on science for people to recognize technology issues as a part of mainstream national consciousness.

The IIM's of India and the IISc Bangalore have earned an international reputation for the excellence of their education. As we draw to the end of the century, these institutions will have the major responsibility for the trained people we will need in the next century. The question we should ask ourselves is –"What kind of training will best equip young Indians to productively participate in the global economy?" Our experience tells us that people with cross-functional skills will be in great demand in the future. In anticipation of this we must urgently take the steps needed to break the functional silos that isolate individuals in their islands of specialization. The leaders of our academic institutions have to rise to this responsibility for innovation in the educational process. If we can do this we will be well on the way to a resurgent and prosperous India. Let us make it happen.

Thank you for your attention!