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Dr Alla Venkata Rama Rao (Dr AV Rama Rao) need no introduction. Rama Rao is the only Fellow of the Indian National Science Academy (FNA) who has trained 112 Ph.D. students, published more than 250 papers in reputed international scientific journals, developed over 30 process technologies for making life saving drugs more affordable and finally after retiring as Director of Indian Institute of Chemical Technology, built a multi-million dollar pharmaceutical company (Avra Laboratories) that currently has over 550 employees.

First of all, Many Congratulations on winning the prestigious Padma Bhushan Award. Please describe your journey so far.
Dr AV Rama Rao: I was born and brought up in Guntur (A.P.) and did my graduation (Chemistry) in 1956 from A.C. College. After working for two years as demonstrator and technical assistant in A.C. College and Agricultural College, Bapatla, respectively, I joined Bombay University Department of Chemical Technology (BUDCT) in 1958 for my graduation in Chemical Technology with specialization in pharmaceuticals and fine chemicals. I continued my career as a Ph.D. student at National Chemical Laboratory (NCL) under the guidance of Prof. K. Venkataraman, the then Director of NCL and obtained my degree, Ph.D (Tech.) in 1964. Unlike many who go abroad to pursue their post-doctoral career, I followed Prof. Venkataraman's advice to stay at NCL and worked on the structure of lac dye, an age old problem unsolved for almost 100 years. I was offered Scientist B at NCL in 1965, without crossing the seas. For the next 7 years, I was totally committed to academic research and believed that industrial research means a mediocre work that was carried out by industrial laboratories. In 1973 based on CSIR directive I initiated, process chemistry and came out with a novel process for manufacturing Diazepam, an anti-anxiety agent and used widely world over. During that period I met Dr. Y.K. Hamied, the present Chairman of Cipla, who showed keen interest to commercialize my process without wasting much time. This was the first example of a CSIR Technology transfer to Industry and successfully commercialized in 1973. Since then I brought the culture of institutions and industry interaction and helped pharmaceutical industries in several ways.

In 1975, I felt the need to spend two years at Harvard University in Prof. E.J. Corey's group (Nobel Laureate in Chemistry in 1991) to enhance my skills in organic synthesis. This exposure brought a big change in my outlook on scientific and industrial research. I was selected as head of the organic chemistry division at NCL in 1980. I established in India for the first time a school of excellence for the synthesis of bio-functional molecules such as anti-tumor antibiotics, immunosuppressants, cyclic peptides including vancomycin etc. I moved to Hyderabad in 1985 as Director of RRL and transformed the Regional Research Laboratory (RRL) into more globally respected Indian Institute of Chemical Technology.

I was the first Indian Scientist to take the lead in nurturing and fostering integration in basic science, technology development and engineering design to provide complete package for commercial exploitation. I was also instrumental in pioneering the concept of institution and industrial interaction with several leading pharmaceutical industries such as Cipla, Lupin, Cadila, Dr. Reddy's, FDC etc. I was also responsible in developing alternative affordable technologies for several essential drugs including anti-HIV drugs which enabled the Indian pharmaceutical industry to introduce them in the market at a fraction of the prevailing international prices.

You are one of the few scientists entrepreneur who have successfully commercialized research. What is the secret recipe of your success? What advice would you give to the scientists who want to commercialize their research?
Dr AV Rama Rao: While working at NCL, I started working as a consultant to Indian pharmaceutical industries. I had long association with Cipla and interacted closely with Dr. Y.K. Hamied on various aspects on products from the concept of

identifying the compound, developing laboratory scale suitable process that can be adopted by the industry and finally marketing the same. This knowledge enabled me to attract funds from private industries. It is essential to have close links with the manufacturing chemists and engineers and incorporating various parameters that go into smooth commercialization. Before we undertake lab work, I also insist on my collegues to work out paper technology taking into account the cost of raw materials, alternative affordable technologies and finally transfer to industry. I always believe that the success of technology depends on many people who are working on the shop floor and if it fails, I use to take the entire blame but never happened.

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Most of our scientists have to learn several lessons concerning commercialization of a product such as sourcing raw materials, simple concepts of scaling up the process, hazards involved and safety aspects of it etc. This is mostly lacking among our scientists. Doing science is great but taking it to commercialization is not easy. I was the first academician to realize the potential and commercial opportunity in providing chemical research services (Now referred as CRAMS) to various International pharmaceutical companies by starting such programs after my retirement as Director IICT. Following my example, today there are more than 500 such companies operating in India. Avra Laboratories Pvt. Ltd., the company I founded in 1995 with no external investment has grown significantly and now has over 550 employees. Avra is the first chemical company to receive CSIR Diamond Jubilee Technology Award for 2014 (Rs.10 lakhs cash award to be given by the Prime Minister of India)

For a successful industrial research, choosing a good industrial project for commercial research is very important, secondly one should know the cost involved, third thing is to know how to scale it up in the industry and finally, one should also look at the market within India and outside. Some of these aspects, pure scientists have no idea, and that's why industrial projects generally are not successful.

Also it happened that, I came from chemical technology background I had a basic understanding of chemical engineering and also my personal interest I used to keep track of what drugs are coming in the market how important they are and how best we can manufacture them.

It was a purely personal interest which made me a successful industrialist.
My advice would be to interact with the industry as much as possible and try to understand the problems that the industry is facing and coming up with a solutions for them.

You have had a very envious and an illustrious career both in research and as an entrepreneur. Which is easy to break in -research or entrepreneurship?
Dr AV Rama Rao: These are two different things. Fundamentally, I am a researcher, I liked to do research. I received several offers from industry during my career. Although the offers were very attractive, but I refused, because when we do science we get satisfaction and we feel happy.

Research and entrepreneurship do not go hand in hand. It worked out in my case. 30 years of research exposure and also because I was a consultant to various pharma companies, I learnt the tools of the trade i.e. how to translate science to technology and transfer to industry, and how to commercialize research, how to market the product etc.

Could you please share a turning point or defining moment in your professional life?
Dr AV Rama Rao: My exposure to scientific research in Prof. E.J. Corey's group gave me the confidence in carrying out research in relevant areas to society. It was also my elevation from Scientist E to Head of the organic chemistry division by the then Director of NCL, Dr. L.K. Doraiswamy and the then DG, CSIR, Prof. M.G.K. Menon gave me the desired opportunity to do research in areas that are being carried out in various reputed universities world over.

The next major turning point in my career was moving from Pune to Hyderabad as Director of Regional Research Laboratory (RRL), Hyderabad at the instance of Prof. M.M. Sharma, the former Director of UDCT. As Director of IICT (1985 - 1995), I was involved in several major national projects. I also served several National and International policy making organizations such as World Health Organization and Ozone cell of United Nations Environments Protectives agency etc.

What you like to do when you aren't working? What are your hobbies?
Dr AV Rama Rao: I used to spend most of my time in the laboratory and do not have much free time. Only on Sundays, I used to go with family to city, eat out and see a movie etc. I also love spending time with my dog.
For me my research students are a big asset, we used to discuss not only work, but other general things as well. My students still remember me very fondly. We are like a family, but in the process my wife has to carry on all the responsibilities and take

care of our kids in a way single handedly. Both of my sons are Ph.D.'s in chemistry, one from JNTU and the other from Cambridge University. They both help me in day to day affairs of Avra laboratories. My daughter (M.D.) is married to a medical doctor.

What are your thoughts on the quality of research stemming from India? Are there enough opportunities for researchers?
Dr AV Rama Rao: When I was studying, the state universities, like Andhra, Osmania, Pune, Mumbai, Madras, etc were world-class and were involved in very good research. We used to read scientific journals to know what research was coming out of these universities. Today, unfortunately, research in state universities have totally vanished. They are focused now only on teaching. In all the state universities the quality of education and research has gone down mainly because of inbreeding. A person joined as a lecturer becomes a reader after 10 years, no posts get advertised. Earlier, most of the Universities used to attract the best available talent as professor. Today, most of the state universities, do not hire people from outside.

Number of research papers published are increasing but unfortunately quality of research is decreasing.

Today, the opportunities for researchers in any field are ample. In chemistry alone, we don't find many suitable candidates to take up teaching in universities or to work in pharma and fine chemical industries. Science is not any more an attractive subject.

In the recent times, Indian Pharma companies are in the news for wrong reasons, getting slashed by FDA. What are your comments on that?
Dr AV Rama Rao: In India, we have more than 100 USFDA approved sites to manufacture API's / Formulations. We are the largest supplier of generic API's and Formulations world over. Most of them follow rigorously all regulation requirements as per USFDA or European and other countries regulations. Inspite of it, some lapses on the part of Quality Control (Q.C.) or Quality Assurance (Q.A.) departments resulting in suspension of production or issuing 483 notices. I trust that Indian companies have realized their lapses and taking stringent measures not to happen such issues in the future.

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