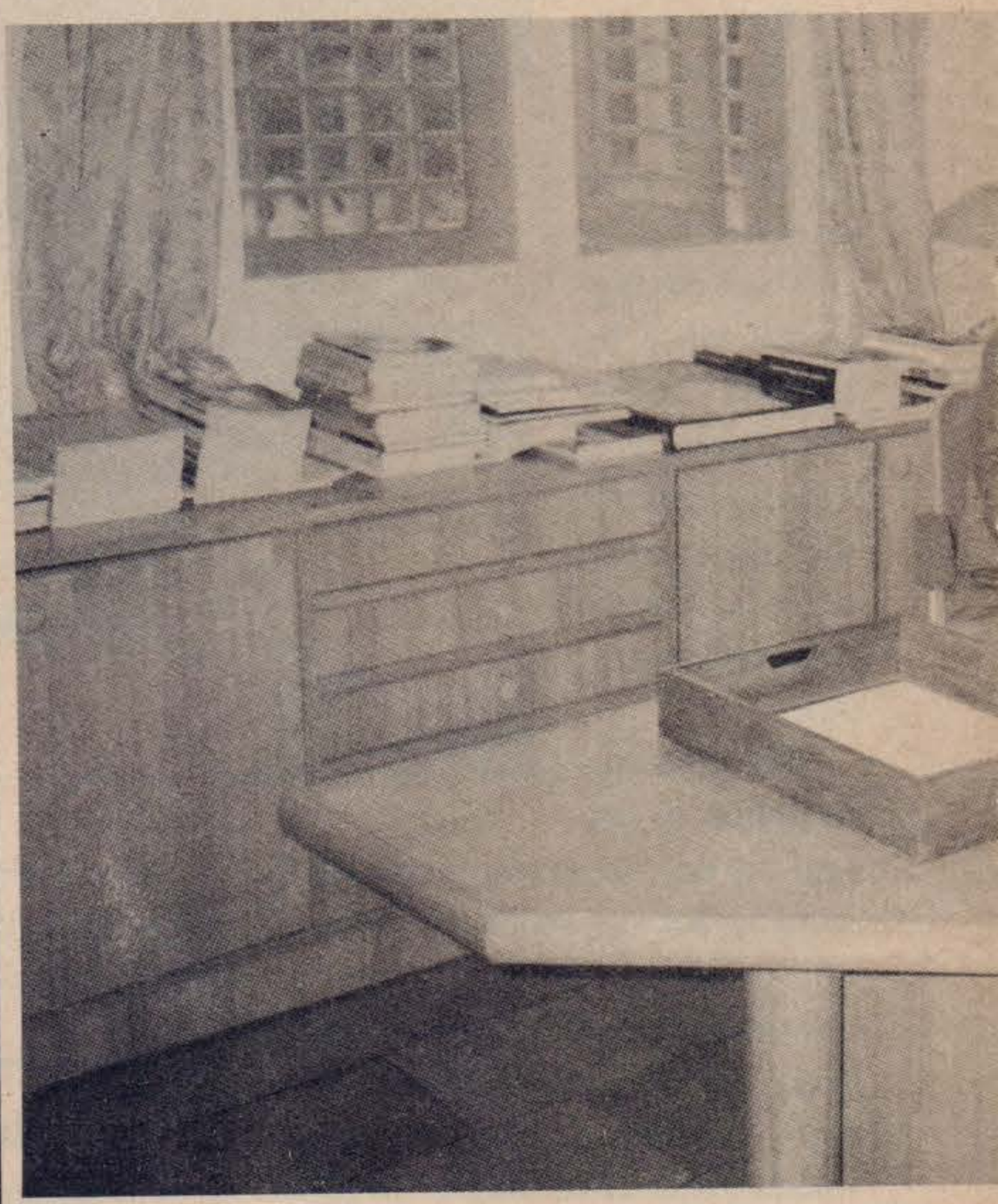
TECHNOTALK

800 Papers, 30 books

In an exclusive interview to ***Technoworld,*** *the plight of research activities in India and* ***Coneti GiriMohan*** *about his work in 'super -*



Foot Prints on the sands of Time

He has been listed on the 'Who's who Dictionary of International Biography' 'International Book of honour' 'International leaders in achievement', 'International who's who of intellectuals' and 'Men of achievements.' He has been included in the 'Directory of Distinguished leaderships.' He has held several key positions including the chairmanship of the Science Advisory council to the Prime Minister of India. His work during his tenure as the Director of Indian Institute of Science has been highly commended. He was a member of the University Grant Commission and the Planning Commission. His yeoman service in the field of Applied chemistry, superconductivity and 'Spectros copy and molecular structure' has been appreciated by scientists and science foundations all over the world. He is India's best bet for a Nobel Prize in Chemistry. He is Prof. C.N.R. Rao, a proud son of India and an asset to the science community at large.

Prof. C.N.R. Rao acquired his post graduation from Banaras University in 1953. In 1958 he obtained a doctorate from Purdue university USA. He published his first scintific paper at a tender age of 19. Since then he has published a little more than 800 papers and written 3o and odd books, This effort of his drew recognition in the form of medals, honours, citations and awards. He is presently working on the phenomenon of 'Giant magnet resistance'. He is being invited by universities around the world for 'guest lectures' and talks. In his capacity as the president of the Jawaharlal Nehru Center for Advanced Scientific Research he is involved with furthering the cause of scientific research in our country.

TW: Why and how did you go about pursuing science as your career?

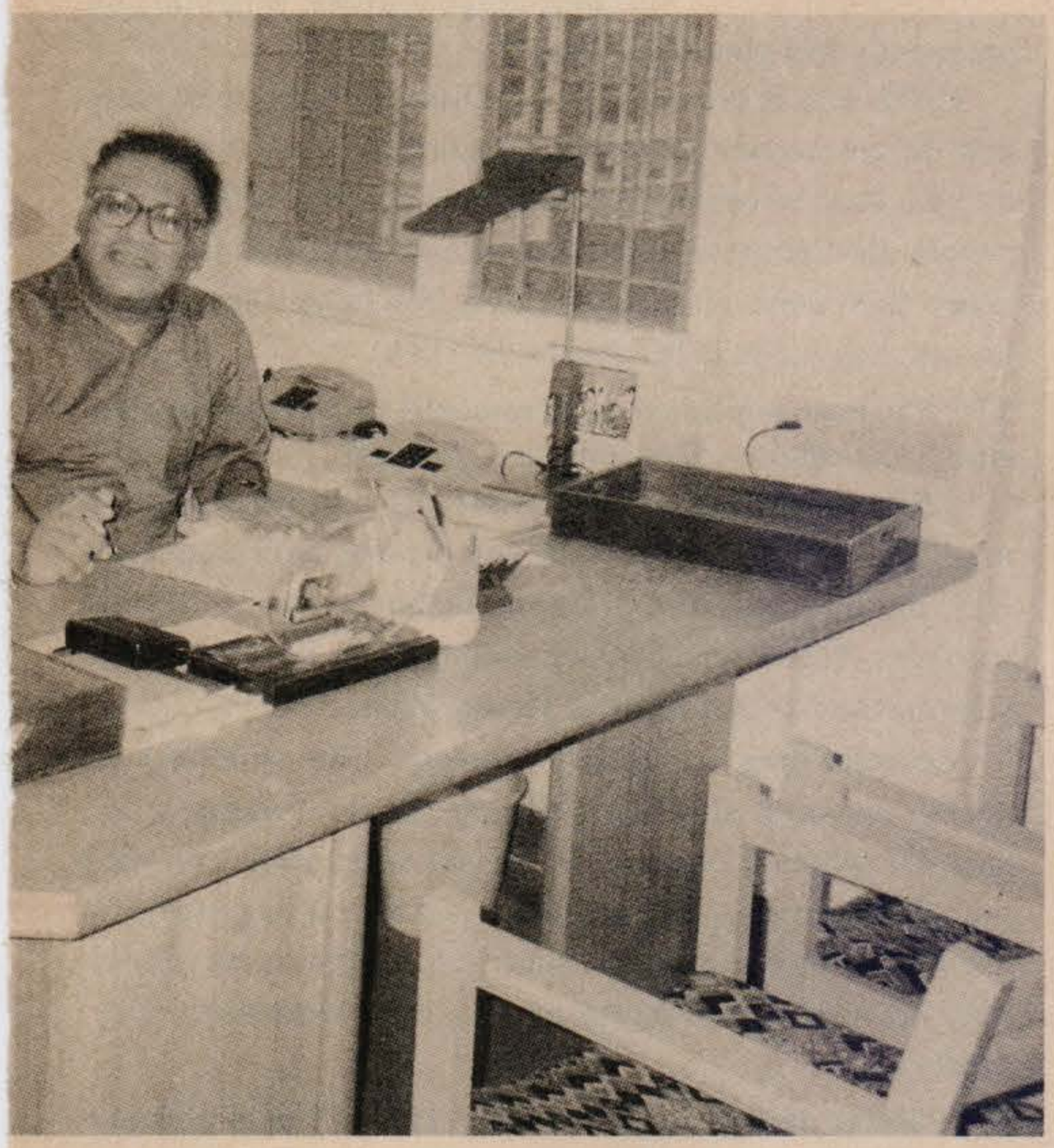
CNR: If one is seriously interested in science then he or she has to completely devote his life to science and research. An administrator, for example, cannot be a good scientist. I experienced this during my tenure as the Director of IISc. My research definitely suffered during this period. This was the reason for me to quit the post 2 years back though I was asked to continue for another 3 years.

Once you have decided to take up science and research as a career you have to work substantially hard.

TECHNOTALK

and still going strong

Prof. CNR. Rao disseminates his views about abroad. He talks to ***G.P.Vinayababu*** *and conductivity' and Metal oxides' .*



There is definitely no substitute for hard work and I work very hard. I took a fascination to creating new things, discovering new phenomenon, new processes, new relation between properties and structures of molecules. All these things really excited me, So I try to work very hard to contribute to my field viz 'Applied Chemistry'. I have been working on advanced material, materials which have unusual surface and magnetic properties, superconductors and materials which are of great importance to current and emerging technologies. Much of my work is utilised.

TW: Your views about Industry Institute Interaction. in India

CNR: In India industries have a major shortcoming. They are not able to realize a one to one relationship with the research establishments. If industries were really ahead in innovative technology there would have been an automatic place for engineering and scientific research. Then there would have been no need to ask the government for funds to carry out research. We are looking at a setup where industry will whole heartedly support research. Today only 5% of the money spent on research comes from the industries.

There should be a quantum leap in the quality of our industries. Then the demand for science and its application increases. One area where this demand is increasing is chemical research and the only successful sector as far as the Indian scenario is concerned is the chemical industry. About 10 years ago exports in this sector fetched only 5 crores. Today Indian exports in this sector is worth 2500 crores. Also, the petrochemical industry in India has grown in terms of developing 3 major cataysts. This change is because of the direct involvement of R & D in the drugs and the pharmaceutical sectors. So, given a target and demand in any sector there are people to meet them. According to me energy, transportation and communication are the most crucial factors in a society. These have to be drastically improved in India. The present government has rightly taken steps to invest in these sectors. The communication sector still isn't up to the mark. C-DOT for example though doing quite a good work, could not transfer technology to the common man.

There should also be a change in the science policy if we are to compete with countries like USA and Japan. The next five years would be a transition period for the Indian Industry by which time they should gear up. If it isn't going to happen in the next five years then it will never happen.

TW: About the Role of IISc?

CNR: IISc is one of the premier Institutes in the country. It is one of the most successful institutes as far as industrial consultancy is concerned. But I am still not satisfied about the extent to which support by the industry is extended to the professors. As a professor in one of the universities in UK I

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have got an industrial grant. I only spend 6 weeks a year in this university. It is unfortunate that not a single industry in India has come forward to give me one such grant to enable me to work on a project. We have to absorb technology like the way the Japanese do. For example when we borrow technology for a 200 MW turbine, the technology transfer should enable us to develop a 500 MW turbine. A marriage between the Industry and Institute would definitely help us. As the Director IISc I introduced the integrated Ph.D. program. In India people obtain a degree without actually getting anything out of it. For example if one's Bsc program was strong enough then there would be no need for one to pursue MSc. UK and USA doesn't have an MSc program as such.

TW: Do you think that in India, project conclusions are translated to effectivity?

CNR: In India this has not happened by and large, though it has been done in some sectors. Nobody out here identifies the product, the component, sponsors the work, get the work done and eventually develop into a prototype and make a technology out of it. This chain from lab to industry called the innovation chain is very weak in India.

TW: Could you enlighten us about the Industry-Institution relation in America?

CNR: In America, Industries support fundamental research. I had an industrial fellowship as soon as I went there 40 years ago. They also support sponsored research to address specific areas. The industries out there smartly pick your brains by paying your brain's worth. Sixty per cent of the research in America is industry sponsored, which has scope for development. Though so many software companies are cropping up in India, it is sad to know that Indian share in the world market as far as software development is concerned is a mere 0.1%. Here boys and girls entering the foreign software companies are elated with the kind of pay packets these companies offer. But little do these young people understand the kind of money the software companies are making out of them.

TW: Today students immediately after their graduation leave the shores for either higher studies or some other venture. What do you personally feel about this trend?

CNR: This is very true. To hold back such people requires that the government offer them challenges in our own country with good incentives. Another problem today is that young people are taking to management and administrative jobs which fetch them a fast buck. This is becoming a grave problem not only in India but also in the USA.

TW: You have published more research papers than anyone else in the country. How did you start off?

CNR: At the age of 19, I wrote my first paper. During my Ph.D. work I used to work with several professors apart from my own professor, trying to obtain results for several problems. This way I ended up writing 25 to 30 papers along with the thesis paper required for my Ph.D.

Understanding the ultimate structure of the molecules interested me a lot. Besides, there was no one working in this area. The distance between atoms and things alike fascinated me. (From there to my latest paper it's been a long way.) Of late I haven been working on metal oxides. The nature of work I am involved with is bound to change the technology of recording.

TW: Being the president of the Third World Science Academy, do you think due recognition has been given to

"There is an unwritten racism in science. Together there is some sort of condescending attitude and patronage attached to this...."

third world country scientists?

CNR: There are not many outstanding scientists from third world countries who can compete with the scientists from developed countries. You can't be excused just because you are coming from a poor country. Somewhere down the line this notion of a 'black man' came into picture.

Magneto Research

I am right now working on what is known as 'Giant Magneto resistance'. This is a phenomena wherein the resistance of a material disappears on application of a small magnetic field. This is an extraordinary phenomena which has tremendous applications because, this can be used in recording in a very big way. All over the world people are interested in this material. Two years ago most of the materials used were metallic bi-layers like chromium, copper, iron, cobalt. Now I have found that an oxide layer would be much better. This would revolutionize the $100 billion dollars recording industry. Actuators & sensors would no longer be the same. The other areas I am working on are carbon fulleries & carbon tubules et.al. Diamond and graphite are the known forms of carbon. Fulleries are a new form of carbon which was discovered in 1990. These find applications in electron emitter in flatbed tubes such as high definition T.V.s (HDTV).

TW: Are we talking of 'Racism in Science'?

CNR: Oh yeah! very much. There is an unwritten racism. I wouldn't exactly call it racism, for it sounds a bit crude. There is some condescending attitude or some patronage together with an unwritten, unsaid prejudice. For example if I were to send a paper to 'Nature' magazine from IISc it would be rejected but if I were to send the very same paper from my California address it would be readily accepted.

To be nominated for the Nobel prize itself is an achievement. Nobody in the recent past has been nominated for the Nobel prize in the science areas from the third world countries. Some of my foreign friends believe that I have to be nominated.

TW: Shall we say that Prof. CNR Rao would be the best bet from India?

CNR: I wouldn't say this. It is a sort of slip between the cup and the lip.

TECH: Are we talking of American Lobbyism ?

CNR: Americans put so much pressure to influence the decision of the nominations to the extent that even American ambassadors stay in Sweden only to get a Nobel prize for their country.

There is a lot of lobbyism. Even the American president goes to the extent of lobbying for his country men when it comes to Nobel awards. This is true with other developed countries too. The Britons are frustrated that they haven't got a Nobel award since 1982. But in India the Prime Minister is least bothered about Indians winning Nobel prizes. It's high time India gets a Nobel prize. Another problem is that the field you are working on should be recognized before you are recognized in that field. I predict that in the next 10 years more number of Nobel awards would go to Japan than any other country. This is because of the heavy investment they are making on R and D activities.

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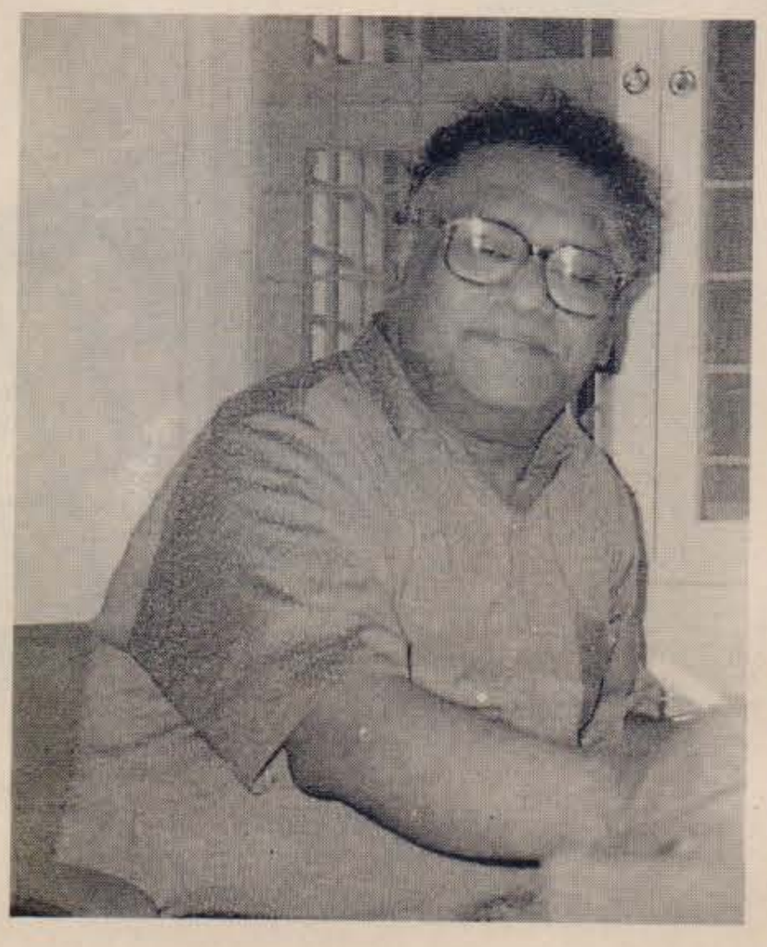

TW: Having worked on nearly 800 papers, how have papers helped the society in terms of application.

CNR: I don't know, I don't care and I am not going to worry about it. It's for the government to bother about it. As I mentioned earlier it is here the Industry has to play a big role.

TW: What do you see as the future for India?

CNR: The next 5 to 10 years is crucial for India's growth. With free market economy taking roots in the country, there is hope of tremendous Industrial growth in the next few years. India should make the best use of this situation to come out a winner.