

Yash Dal

Eighty Years Young

Yash Pal

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NCSC

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PREFACE

My memories go back to the times when at the first International Conference for Science Communicators, Prof. Yash Pal in his inaugural address mentioned that "one of the joys of growing old is that, everybody you meet is a friend and you see your friends on many occasions. This hall (Chandrasekar auditorium of IUCAA) is filled with so many wonderful friends without whom I could not have imagined my life.

The organisers, in spite of having financial problems and lack of resources have managed to make this event a success. The remarkable efforts have paid off. With the presence of so many luminaries and noted science communicators, this unique event will be remembered for many years to come."

Incidentally, Professor Yash Pal was our keynote speaker at the second International Conference of Science Communicators, which was organised at the BARC, Mumbai to felicitate and honor renowned Astrophysicist and Science Communicator Prof Jayant Narlikar.

Professor Yash Pal most heartily accepted our invitation to be with us at third International Conference of Science Communicators, held in Rio de Janeiro, Brazil. However, he had to opt out because of ill health.

Now, is the time when a person who has become so dear to us for the past so many years is completing 80 years of his most fruitful life. And to commemorate this event, the National Centre for Science Communicators (NCSC) has decided to felicitate Professor Yash Pal, a renowned scientist and science communicator, by organising a National Conference on 'Challenges and Vision 2026 in Science Communication'.

It was a great moment for us when Professor Yash Pal gave us his consent but the credit of this would certainly go to Professor Jayant Narlikar, who was very much instrumental in getting Prof. Yash's approval.

When we thought of bringing out a publication; compilation of reminiscences of Prof. Yash Pal's close association with his colleagues and associates, we were emotionally touched by the response we received. Every single person has taken us down that unforgettable memory lane and here is the outcome of it, which is here with us, forever to stay. I am truly indebted to all of them.

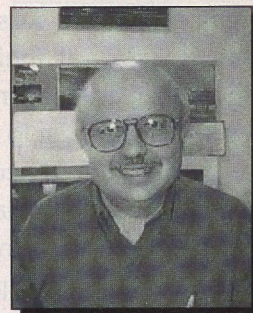
*A P Deshpande
Chairman,
National Centre for Science Communicators, Mumbai*

Cosmic Rays and Particle Physics with Yash Pal

Reminiscences

Cosmic Rays and Particle Physics with Yash Pal

Gaurang B. Yodh



It was some 48 years ago that I first met Yash Pal, when he returned from America to the Tata Institute of Fundamental Research. In USA, he had worked with Professor Bruno Rossi in high energy cosmic rays and astrophysics. My wife, Kanwal, and I were getting ready to go back to USA to continue work on particle physics at the Carnegie Institute of Technology in Pittsburgh. Yash Pal and Nirmal moved into our two room flat on Jenkins road in Mumbai, when we departed for USA.

In the next decade, Yash made important contributions to physics of cosmic rays, studying the propagation of cosmic rays in the atmosphere. The work was the first calculation of atmospheric neutrino fluxes using the best current models of particle physics with Professor Bernard Peters. It was in 1971 that I came to know him personally and professionally when I invited him to come to work with me at the University of Maryland and when he spent several months in College Park. I had been analyzing cosmic ray data to determine what was energy dependence of the probability of proton-proton interactions (cross section). I wanted to explore whether the cross section increased with energy, at energies above those available at particle accelerators at that time. Yash Pal's extensive knowledge of the primary cosmic rays and their propagation in the atmosphere was very



From left to right : Yash Pal, Kanwal Yodh, Nirmal Pal and Gaurang Yodh , 1971. Accompanying photo was taken in Maryland at that time in our garden.

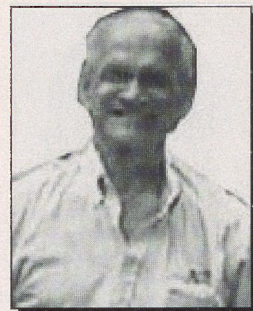
helpful in establishing the result I had found, which was that proton air cross section is increasing with energy quite rapidly. We wrote a seminal paper which provided evidence for this increase and which was published in Physical Review Letters. A year later, this prediction was confirmed at the CERN ISR proton-proton collider.

It was a real pleasure to discuss not only physics but also future of science and of overall development in India with Yash Pal. Interacting with Nirmal and Yash Pal, we became good friends and were convinced that Yash Pal would play a pivotal role in science and education in India.

Over the years, we have kept in touch, usually at Cosmic Ray Conferences and other meetings. A

“Yash” - The “Pal” We Know

P. J. Lavakare



I heard of Yash Pal way back in 1955 when I joined the Tata Institute of Fundamental Research in Mumbai as a research student. It is not the Yash I know now, but his name was entwined in the scientific publications in a ‘triad’ combination - “Lal-Pal-Peters” involving two other luminaries of space science. Yash was away in the US at MIT for his PhD, but his publications under this triad, which had appeared even before he left for the US, had all young students like me, rather impressed. I often saw Lal and Peters at TIFR, but had to wait for a few years, before Yash Pal returned to TIFR with his MIT degree. His presence, in fact, inspired me to do my PhD in the US and follow in his footsteps to do postdoctoral research at TIFR. Our institute had a unique policy of encouraging young students to go to the US for higher degree and even gave us paid leave for part of the period. Perhaps Yash had set a good example for this policy.

As a senior colleague, Yash was always fun to be with; always with new ideas, new approaches and almost shunning the traditional thought process. I still remember we were on a panel discussion at one of the international conferences on Astronomy in Europe. Yash encouraged a young colleague like me to be a panel member with him. It is this openness of Yash that has made me to be forever in touch with him. Our paths crossed again and again after TIFR.

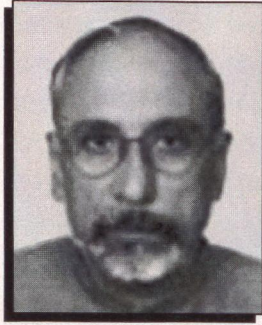
At ISRO, while I was working on the Aryabhata Satellite, Yash had ventured into Science Communication and the memories of SITE always reminds me of the “soft skilled” Yash. We had an American Satellite but what do we broadcast and

how will it reach our villages was his concern. It is here that his Science Communication skills came to the forefront and he deservedly won several international accolades. In UGC as the Chairman, he triggered the idea of Interuniversity Centres to bring in universities into the Science stream. IUCAA in Pune was truly his initiative. At DST, he came as our Secretary and put forward several of his innovative ideas. He had great faith in his officers. Once I confronted him with a question “Yash, you are throwing up so many ideas, but who will implement them?” Prompt came the humble reply “Prabhakar that is your job”. His challenges were always refreshing.

Finally the other part of Yash is his tremendous popularity with women. He was a great charmer and his wife Nirmal loved him for that. This part of input is from my wife Sheela, who is a great admirer of him. When we met last month at IUCAA, I got another side of Yash handling domestic issues. I was having an argument with my wife as to which is the right road to take. For once, I happened to be right. and I started emphasizing how right I was. Yash was in the back of the car. He gently tapped me on my shoulder and said “Yaar, in such situations, even if you are right, don’t rub it in”.

This is the ‘pal’ Yash that I know. Let me wish him and Nirmal a long happy life on this occasion.

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The 'True' Educator

Ashoke Chatterjee

I came to know Prof Yash Pal soon after my arrival in Ahmedabad in 1975, when I joined as head of the National Institute of Design (NID). Prof Yash Pal and his colleagues at ISRO were then immersed in the SITE experiment. He immediately offered enormously important opportunities for NID students and faculty to engage themselves with this path-breaking experiment in designing and implementing educational technologies that could reach remote villages and the least served of our citizens.

His concern as a scientist with those at the margins of society and 'progress' left a deep impression. It was to influence the way I and NID of those days looked at opportunities to test contemporary design within an Indian reality. What struck me in those early interactions was Yash's ability to de-mystify the complexities of space science and interpret its intricacies in terms that made practical, grass root common sense. This ability became an example to all of us, influencing our own ability to interpret design as an instrument that could help resolve the everyday problems of ordinary people.

Yash was a frequent visitor at our campus, sharing experiences and his learning as well as his range of contacts in the world of international science. His enthusiastic response to any search for quality encouraged and inspired us, and the humility that accompanies his great learning made him very quickly a close friend and guide. Yash has an amazing ability to achieve rapport with youth, without ever talking down to them. It is the quality that later enriched his career as a TV host, taking

science to millions! Nothing is outside his 'scientific interest'.

One of the projects that caught his attention and won his respect was the extraordinary "Rural University" experiment in which NID collaborated with the late Prof Ravi Matthai of IIMA and the weavers and leather artisans in Jawaja block of Rajasthan, yielding lessons relevant even today. Their interaction with Yash, when he visited their villages was unforgettable.

When Prof Yash Pal accepted our invitation to head NID as its Chairman, he brought a fresh, interdisciplinary outlook to the Institute that was further enriched by the important alliances. When Yash moved on to head the University Grants Commission, he helped us to forge with Indian science at a national level, and then with Indian higher education. His encouragement towards NID to protect its innovative system of education, away from the rigidities of conventional university systems, provided stamina and reinforcement during a prolonged and difficult struggle.

Through all these years he and his inspiring partner Nirmal have been those people whom I consider touchstones in my life and career - individuals who represent not just great learning, but even quality of humanity and caring that is unique and rare. May his inspirations inspire us for many more years to come, for Yash is a class all by himself.

Dr. Ashoke Chatterjee

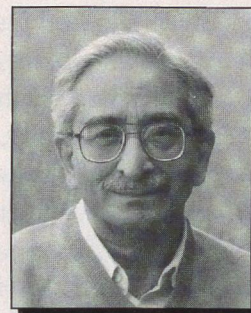
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Down The Memory Lane – Professor Yash Pal

Narender K. Sehgal



My first acquaintance with Professor Yash Pal (PYP) goes back to some lectures he gave during 1960-61 to the physics trainees (fourth batch) of the AEET [Atomic Energy Establishment, Trombay (now known as BARC, the Bhabha Atomic Research Centre)] Training School, in Bombay (now Mumbai), at the Express Building just outside Churchgate Station. He was not even 35 then. But we never really had any out-of-class contact or conversation then. That opportunity came much later, in 1972, via the *Scientific Opinion*, a quarterly journal, I had brought out from my home town, Jalandhar, soon after quitting Matscience, the Institute of Mathematical Sciences, in Madras (now Chennai), in 1971, simultaneously and together with three others. He responded enthusiastically to the inaugural (August 1972) issue of the journal and contributed a letter-to-the-editor. He was among the earliest individual paid subscribers of the journal at TIFR, the Tata Institute of Fundamental Research, Bombay (now Mumbai).

We had some correspondence while I was in Somalia (E. Africa), teaching physics at the Somali National University's College of Education, in Mogadiscio. It was in September 1978, when my close association with PYP began in right earnest in Ahmedabad. I had joined SAC, the Space Applications Centre of ISRO, as Visiting Scientist, after my return from Somalia, on an invitation from PYP who was the Director of SAC, at the time. My very first engagement at SAC involved organisation of a national seminar, intriguingly titled

"Technological Vectors and Cultural Dynamics". We had some fascinating discussions while preparing for and during the seminar. Unfortunately, a final report on the seminar never came out after a draft left with Shri Kartikeya Sarabhai (for a look through) never came back.

I was at SAC for more than three years during which we got to know each other well. Once, at SAC, sitting in his office, when I told him that my ground floor office room was right underneath his office, he looked at me and asked with a smile: "Do I make too much noise?"

Before 1981 ended, PYP left SAC to become the Secretary General of UNISPACE-2, the Second UN Conference on Outer Space – and I joined DST, the Department of Science and Technology, where I soon assumed charge of NCSTC, the National Council for Science and Technology Communication, which was in the process of being set up. We came in close touch again when, after returning from the UNISPACE-2, PYP joined as Chief Consultant, Planning Commission, and thereafter first as Secretary, DST, and later as Chairman, UGC, the University Grants Commission. It was a week or ten days before he joined as Secretary DST, when he walked into my office and sat in front of me. I got up and greeted him. After a pleasant chat, he asked: "Naren, am I doing the right thing?" Meaning, by joining as Secretary DST!

Once I went to discuss something with him in

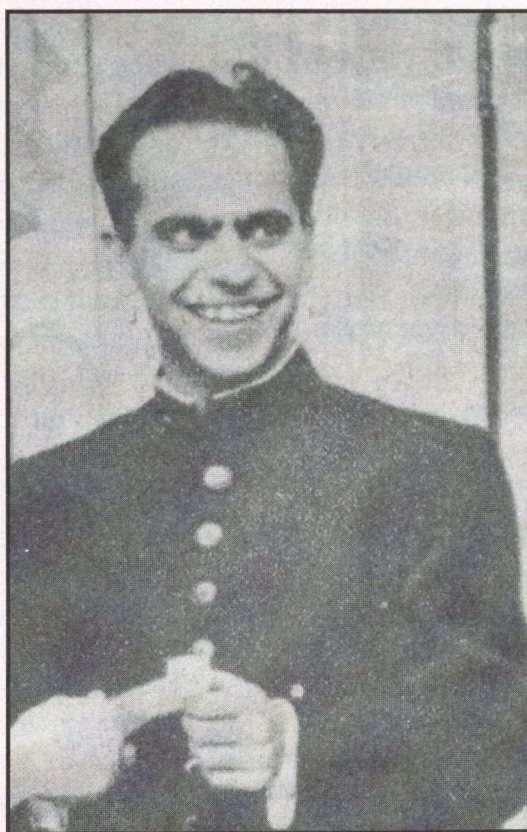
his office and had just taken a seat in front of him. "I will be with you in a minute". He had just picked a letter drafted for him by an Adviser, who later became Secretary, DBT, the Department of Biotechnology. As he read the very first sentence, he appeared very annoyed. He took out his ball pen, gave it a half-twist in the middle and started to correct the draft. He soon got so angry and used his pen so hard in crossing out what had been typed, that his pen tore through the paper. "Gawd", I heard. He then threw that paper on one side of his desk and turned to me: "How can anyone write like that?"

After he received a copy of the proposal (for organisation of the 1987 BJVJ, the Bharat Jan Vigyan Jatha), which I had forwarded to him before convening a meeting of the high-level committee headed by him to consider the proposal), PYP got so excited that he called me on the phone and we spoke for half an hour discussing different aspects of the project. He was Chairman of UGC at the time.

Of the many things about PYP that endear us, the following fascinate me most - his ability to easily and effortlessly become part of any group of people, discussing any subject, at any level - physicists discussing string theory; group of villagers discussing drought, flood, a failed crop, child marriages or sati; a group of folk performers acting, rehearsing and working on the script of a play; a group of children discussing their school project; a group of social scientists/researchers discussing a survey questionnaire... you name it! In his writings, he comes up with fascinating constructs, plays on words, and refreshingly new expressions for looking at the same old, familiar and boring things. One could go on and on...!

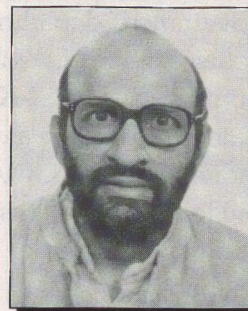
Above everything else, PYP is a warm and decent human being.

Dr. Narender K. Sehgal
Former Director (NCSTC),
Department of Science & Technology, New Delhi
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Prof. Yash Pal – A Renaissance Scientist

Arvind Gupta



I first heard about Prof. Yash Pal in Kishore Bharati – an NGO that initiated the famous Hoshangabad Science Teaching Programme (HSTP). That was way back in 1978. At that time I was working with Telco / Pune as a Graduate Engineer Trainee and had got tired of a mass-production factory job. In 1972, I had heard a lecture by Dr. Anil Sadgopal in IIT/ Kanpur. He was a molecular biologist from Caltech. In 1970 this idealist left his job at the TIFR to start a 'spartan' voluntary organisation named Kishore Bharati (KB). He was aghast to see the horrendous way science was taught in schools – by rote without any hands-on experiments. Kishore Bharati gave a proposal to work in 16 government schools for 5 years – and look at the possibilities of doing activity based science using low-cost local materials. In 1972, Prof Yash Pal (a Ph.D. from the prestigious MIT) came as the first teacher trainer and spent a fortnight with 40 village teachers devising simple science experiments.

The 1970's were politically volatile. The Vietnam War had ended. Scientists and intellectuals all over the world were seeking a meaningful role for themselves. A role, in which they were not designers and perpetrators of human destruction, but were helping provide for real human needs.

Few scientists in India have had the vision and the humility of Prof. Yash Pal. Sitting under a tree he would discuss science for hours with village school-teachers. All the while the teachers would be puffing away at their *bidis*. Often he would be

bombarded with questions. The teachers were aghast when he honestly admitted that he did not have answers to their questions. "But you are a Ph.D. and you must know the answers!" the teachers would howl back.

In 1978, I spent six months in Kishore Bharati designing low-cost science experiments. It was then that I made the Matchstick-Cycle Valve tube Mecanno. Prof. Yash Pal was then in-charge of the SITE programme – which aimed at beaming educational programmes to remote villages via satellites. In 1978 the HSTP expanded from 16 rural schools to 250 middle schools covering the whole district of Hoshangabad. Prof. Yash Pal sent a SITE team to film the HSTP teacher training programme. When the film team saw the low-cost Matchstick Mecanno they made a separate film on it. I was later told that Prof. Yash Pal liked the low-cost Mecanno very much.

After working for a couple of years with a trade union I returned to Pune in 1984. My Telco experience would have easily got me another factory job. But that did not excite me one bit. By then Prof. Yash Pal had become the Secretary of the DST. He had just set up the NCSTC – the popular science wing of the DST. I wrote to him, a postcard seeking a fellowship to collate a book on the science experiments that I had designed for the HSTP. I sent him a proposal entailing the printing of 2,000 copies for trial. Prof. Yash Pal insisted that the work I had done was great and the first print order should be 25,000 copies! Such clear thinking in a

government department is rare. The visionary of course was Prof. Yash Pal. Thus in 1985, the first print order of ***Khel-Khel Mein*** was 25,000 copies. Later, this book was translated and printed in 12 Indian languages. Over the years it has sold over a million copies. This is rare for a science book (unless it happens to be an NCERT kind of textbook).

I had still not met Prof. Yash Pal. In 1988, I read in a Poona newspaper that Prof. Yash Pal was coming to lay the foundation stone of IUCAA, as a UGC Chairperson. By then I had written my second book ***Kabad se Jugad (Little Science)***. I saw this as a great opportunity to meet my mentor. So I drove on my Luna to present Prof. Yash Pal my second book. He hugged me and patted me on the back and that meant to me much more than words.

The scientific community has quite a few liberals but relatively few progressives. There are few scientists of the calibre of Prof. Yash Pal who have deeply involved themselves with grassroots educational programmes. He seems to have grasped the liberating, renaissance nature of modern S&T and used it consistently for human goodness. Rather than make missiles he used the mass media for educational purposes. He conceived some of the best best-researched

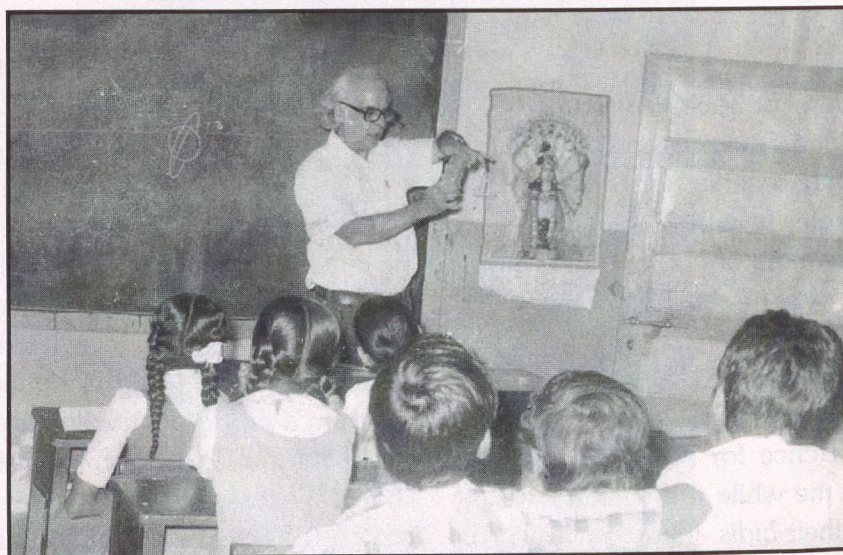
programme on Indian S&T like ***-Bharat Ki Chaap*** and ***Turning Point***.

In 2000, I sent him a copy of my new book ***Ten Little Fingers***. He promptly wrote back that it was high time he bought a packet of cycle-valve tube for his grandchildren!

I now work in IUCAA's Children's Science Centre. Prof. Yashpal inaugurated this Centre in June 2004. On a later visit to IUCAA he spent a whole day in our Science Centre. He just came in and joined a workshop we were having with teachers. The teachers were animatedly discussing blissfully unaware of his presence. Later he delighted the teachers with some simple but innovative experiments.

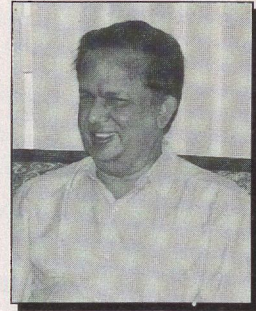
His simplicity, non-authoritarian style, his discourses which are usually a fusion of Hindi and English have endeared him to ordinary people. If I was asked a simple question – Which living Indian scientist has contributed the most to human goodness? Without a second thought I would name Prof. Yash Pal.

Dr. Arvind Gupta
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Prof. Yash Pal - As I know

G. Madhavan Nair



Prof. Yash Pal is a pioneer in the application of technology for socio-economic benefits of mankind. He laid the foundation to implement the vision of Dr. Vikram Sarabhai, the father of Indian space programme in making India, second to none in the application of advanced technology in order to solve the problems of mankind and society.

It was Prof. Yash Pal who led the Satellite Instructional Television Experiment (SITE) project. Application Technology Satellite, ATS-6 of United States was positioned over the Indian Ocean to enable to conduct SITE. It involved telecasting a series of educational programmes on health, family planning, agriculture and the like to over 2,500 Indian villages in India during 1975-76, a period when even major cities did not have televisions. SITE was hailed as the largest sociological experiment ever conducted in the world. It was also under Prof. Yash Pal's leadership that the Satellite Telecommunication Experimental Project (STEP) was undertaken using Franco-German Symphonie satellite during 1977-79.

SITE and STEP paved the way for implementing the operational Indian National Satellite System (INSAT) in the early 80s which has now become the largest domestic communication satellite system in Asia-Pacific region with indigenously built satellites. INSAT is providing a variety of services in telecommunication, television,

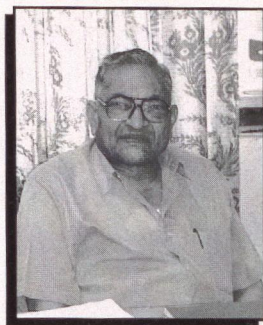
meteorology and disaster warning. The INSAT application has a large component of social application like Training and Development Communication, Jhabua Developmental Communication Project and the EDUSAT that are derived from projects undertaken by Prof. Yash Pal.

Space Application Centre (SAC) of Ahmedabad was created by ISRO in the 70s to carry out cutting edge of technology space application under the leadership of Prof. Yash Pal. Today, SAC has become a major centre of ISRO and along with the co-located Development and Educational Communication Unit, it conducts research and evaluation of space application in several fields like telecommunication, television broadcasting, tele-education, tele-medicine, meteorology, disaster management and remote sensing. The team's infrastructure and the technology created in this vital area owes quite a lot to Prof. Yash Pal.

Prof. Yash Pal is a practical scientist with great vision and leadership qualities. Above all, he is an excellent communicator with people whether young or old. Thus, Prof. Yash Pal is synonymous with space application in the country.

Dr. G. Madhavan Nair

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A Few Words On The Occasion of 80th Birthday of Prof. Yash Pal

Devendra Lal

I would like to begin by offering my heartiest felicitations to Prof. Yash Pal at the occasion for completing 80 years of extraordinary career as a brilliant scientist, educationist, organiser of academic activities, and as an unselfish human being who made important contributions to the academic ambience of India.

I have known Yash for more than 55 years. In our early days at the Tata Institute of Fundamental Research (TIFR), Bombay, as colleagues, we wrote several research papers together under the tutelage of Prof. Bernard Peters. But soon, Yash went to USA to pursue higher studies at the Massachusetts Institute of Technology (MIT), whilst I continued at the TIFR. Yash returned to the TIFR in 1958 after his Ph.D. at MIT. We continued to be close friends, working at the TIFR until in 1972, Yash and I both moved to Ahmedabad in 1972 after the sad passing way of Dr. Vikram Sarabhai. A large number of persons were elected to replace him. Yash took on the directorship of ISRO's Space Application Center, and I took over as a director of the Physical Research Laboratory. Yash continued at SAC, Ahmedabad until 1981, which marked for the second time around, a decade of our close interaction.

Now, if you ask me: Do I know Yash? Can I describe him? What are his special attributes? The answer is "no" to the first two, but I think I know a little about the third question.

Yash is the man who demonstrated extra-

ordinary accomplishments in the fields he delved: science, science education; organisation/planning. After high level research in high energy physics/astrophysics, Yash's memorable accomplishment was the successful implementation of the Satellite Instructional Television Experiment (SITE), initially planned by Dr. Sarabhai. This was an extraordinary feat. "One had to learn to develop and build two major Earth stations, to design, develop and fabricate thousands of direct reception sets along with their low noise amplifiers and antennas, and to deploy them in distant clusters across a distance of a few thousand kilometers. One could not buy most of these systems anywhere in the country, or abroad." *The net result of the efforts of Yash was that a satellite-based direct television broadcast became operational for education and development in rural villages of India.*

After Yash left Ahmedabad I kept in touch with him only through distant interactions. Yash played very important roles, all very successfully; Chief Consultant, Planning Commission (1983-1984), Secretary, Department of Science and Technology (1984-1986), and Chairman, University Grants Commission (1986-1991); so forth and so on.

I do not wish to go on describing his multiple adventures, all related to science, education, communication, but instead would like to now tell you as a matter of fact that I never understood the working of Yash's mind; how he thought even when he worked. In all appearances, he was an easy going person. I rarely saw him working. When the

weather was fine, he would take a day or two off and go for a long drive. He was not great at writing long texts; on the contrary, he wrote small texts and enjoyed doing so since in those few lines he had packed all that was to him, interesting, worth saying and recording. When did Yash work, how did he think, and how he always had the right solutions for all problems?

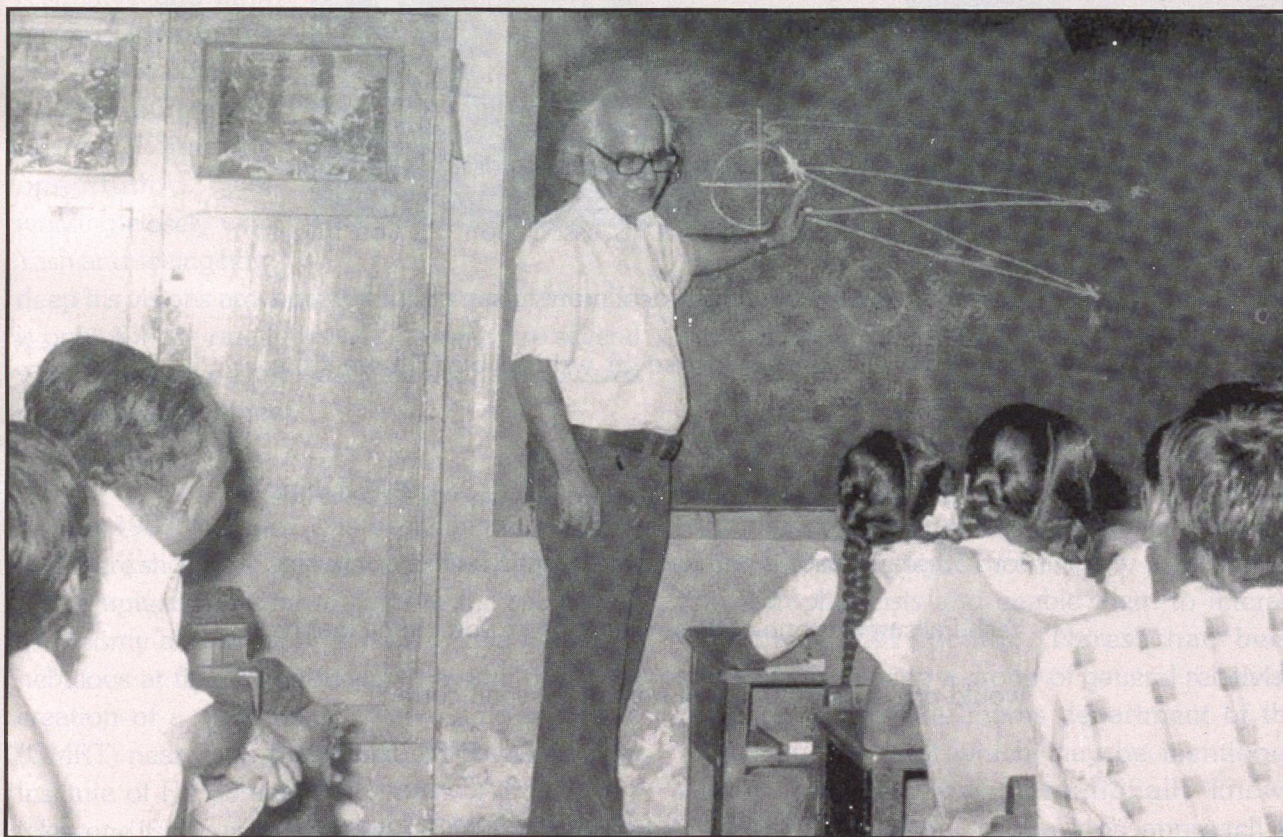
Considering the accomplishments of Yash, and his capacity to perform at super-levels, I can best describe him as a super-human being. The world's most recognised superheroes and pop-culture icons, "Superman" would be a good analogue for Yash, since no one knows how superman takes off from the ground, flies, or lifts huge masses, or have X-Ray vision? All these violate many laws of physics: conservation of energy, momentum, etc. Consider even for example how one can get an X-ray image

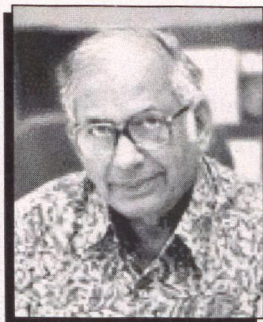
if the X-rays are being projected from the Superman's eyes through the body that is being X-rayed. Where is the image formed? Nevertheless, the analogue fits well although Yash does not break laws of physics. This is not difficult to envision since Superman is a fictional character, but Yash is real!

In conclusion, Yash is a naturally born ingenious, powerful thinker/ philosopher who selflessly goes around working for the intellectual betterment of society. I wish him more challenging opportunities in the future.

Dr. Devendra Lal

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Yash Pal as I Remember

P. M. Bhargava

Yash Pal has surely been one of our finest intellectuals and human beings that the country produced in the last century. His clarity of thought, his vision and his commitment, combined with professional excellence and creativity of a rare order, have inspired several generations. He has been without question one of the most effective popularisers of science in the country.

My family and I have been privileged to know him and his wife, Nirmala, as one of our closest friends. We have benefited tremendously from his association. As you might expect, I would have a great deal more to say about him and would have loved to do so in writing but I have time constraints.

There are only few-selected very few-who deserve to live for 150 years which is perhaps, the life span built in our genes. Yash Pal surely is one of these selected few and I hope that he would prove my estimate of human life span correct!

Dr. P. M. Bhargava

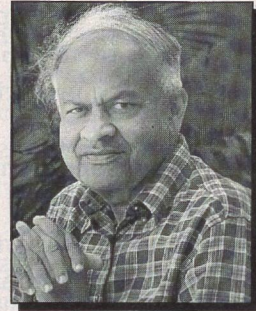
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Yash : A Man with Multiple-Vision

Jayant V. Narlikar



I have great pleasure in recalling my many pleasant encounters with Yash Pal, over the last four decades. As several incidents crowd my mind at the same time, causing a traffic jam, I will be restrictive and limit my narrative to the last fifteen years or so. For during this period, I had the opportunity of working closely with Yash and seeing how deep his visions are. I use the word in plural, for he is one of those rare types who can nurture several visions and yet devote adequate attention towards realizing each of them.

The IUCAA

In 1987, the idea was beginning to nucleate that there should be a resource centre of excellence in the university-sector to cater to the subjects of astronomy and astrophysics. The idea had been nebulous at first, being triggered by the proposed creation of a giant metre- wave radio telescope (GMRT) near Pune under the auspices of the Tata Institute of Fundamental Research. Although the telescope itself was to come up about 90 kilometres from Pune near Narayangaon on the Pune-Nasik



Road, its academic headquarters were to be in the campus of the University of Pune.

Taking advantage of this development, Naresh Dadhich at Pune University pushed forward a proposal to have a centre for astrophysics in the university of Pune, which will act as a local nucleus for university astronomers and astrophysicists and enable them to interact with the GMRT facility. Naresh had been successful in having a group of general relativists regularly visiting the maths department of the university, amongst which may be mentioned Abhay Ashtekar, the internationally known relativist and initiator of the loop approach to quantization of gravity. The university took up this

idea and got the support of Govind Swarup, the originator of the GMRT proposal and then in charge of the project.

To get support from the UGC to this proposal, Naresh approached Yash Pal who was then the Chairman of the University Grants Commission. When Yash looked at the overall picture, he came out with a more ambitious idea. Instead of a local Pune University Centre, why not have a national centre with several built-in facilities for faculty and students from various universities? He had in mind what today is well recognised as an *Inter-University Centre*.

I think it was in September of 1987, that Yash called Naresh and me to discuss the concept further and the modality of how to go about it. *See Big...Think Big...Act Big*, that was his message. He felt that the universities had missed out in the development of overall research programmes in the country which were largely confined to the autonomous research institutions of the various departments of the Government of India. There was need to redress the balance by creating resource centres of excellence in the university sector. One such centre was already coming up, the Nuclear Science Centre in the campus of the Jawaharlal Nehru University in New Delhi. It would have a national facility in the form of a pelletron for nuclear studies to be used by faculty and students from universities.

Why not create another centre for astronomy and astrophysics, that could have guaranteed access to the GMRT?

This was the beginning. And from the beginning Yash gave an enthusiastic backing to the project. It went through several brainstorming discussions, leading ultimately to a project report on what the centre should be like. Naresh and I sent it to the UGC for approval.

That was when Yash made that all-important

phone call. I was at home around lunchtime when he came on the phone. He came straight to the point. "Will you take on the directorship of the new centre and the responsibility of setting it up?" I had of course been enthusiastic about planning such a centre, but in an abstract way, without thinking of who actually will translate vision to reality. My role I had envisioned more as a distant advisor from TIFR, than as the person in the driver's seat. Sensing my hesitation, Yash used his trump card: "I will approve the setting of this centre only if you will take on this job and that too by cutting your links with TIFR." Having been several years at TIFR, he was only too familiar with the reluctance of its academics to leave the place for good and take up some responsibility elsewhere in the country, especially in the university sector. Indeed during my tenure at TIFR I had seen many academics venturing out on lien, and returning after an year or two, finding the conditions in the real world too harsh. Yash did not want that to happen to me

After pondering over the question for no more than fifteen seconds, I replied "Yes, I will take on the responsibility". I did not consult, as I should have, my family. For it was a major transition to make. But Yash had posed a challenge and I had to respond to it. Moreover, I resolved to make the centre so attractive to work that others from TIFR would follow without thought of turning back.

Of course, when asking for total loyalty to the new centre, Yash had laid on his own assurance that he would back the project 100 percent. He did not say so in so many words, but all his actions spoke louder than any words. When I look back on those years of setting up IUCAA, I find so many right things happened at the right time...the first and foremost being the above fact

Man of Ideas

In the UGC one of the senior officials once confided in me: "Here our job is to implement

what we are given. When we have a man of ideas like the present Chairman, our job is that much more challenging." Shortage of ideas had never been one of Yash's weaknesses! After a fruitful research career as a cosmic ray physicist belonging to the first generation trained by Bhabha and Peters, Yash had moved on to other challenges. I recall his moving to Ahmadabad shortly after I had joined TIFR, to take up the implementation of the SITE programme...the so-called satellite instructional television experiment. How to use satellite TV to communicate educational and informative programmes to remote areas in India, areas which were not easily accessible to road transport or by rail? What kind of programmes would do justice to the target village audience? How can one receive and evaluate feedbacks? In the 1970s this was uncharted territory and Yash had to use his own imaginative mind to successfully meet these challenges.

Even after finishing this experiment, the Indian Space Programme did not want to let go of this imaginative mind and so Yash continued in Ahmedabad with new projects, to do with remote sensing. Once I met him during one of his brief passages through TIFR and he expressed his yearning to get back to the academia, to resume research. But that was not to be. His managerial skills and imaginative mind would not be let go by the Government of India so easily. And so I saw him 'trapped' into one administrative job after another. In each position he has left his own stamp...his starting the National Council for Science and Technology Communication at the DST, and then the various inter-university centres at the UGC.

The NCSTC has been playing seminal role for science popularisation in the country. Yash encouraged such efforts not simply as office-based programmes but ones like the Jnan-Vijnan Jathas that went right amongst the masses.

I recall, during one of his early visits to IUCAA, his mentioning the need for harnessing information technology towards facilitating access of universities to libraries. From that early vision sprouted what we today know as the INFLIBNET. Likewise his desire to get universities closer to the research facilities of the Atomic Energy Department initiated the IUCDAEF at Indore. Perhaps an offshoot of his Ahmadabad days of distant education was the CEC, with its programmes in audio-visual modes of presenting different topics in the university curriculum.

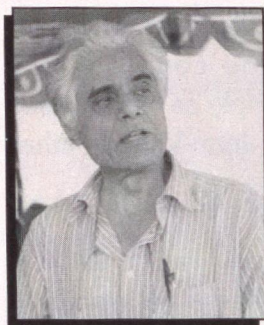
Man of Culture

But the same information technology, I know, makes him worried about the future. Will the rapid spread of knowledge lead to a thermalisation of ideas and a world which is very homogeneous? Such a world, devoid of its present cultural variety, would be a very boring place to live in. How to preserve ethnic individuality, the regional specialities, the neighbourly differences, that are now fast disappearing? A man who appreciates and values the differences of culture will have cause to worry. But while he worries about this problem, I am sure Yash's fertile brain will come out with some idea to counter the trend. Let me wish this man for all seasons a very happy and productive life ahead.

Dr. Jayant V. Narlikar

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Knowing Yash Pal

S. N. Tandon



It is more than four decades since I met Yash Pal for the first time; he says that I was a young boy then. Before personally meeting him I was a bit awed by his person, but within minutes of talking to him I was put at ease. Soon after this, I joined the small group of students working with him in an atmosphere of excitement, fun, and total informality; this was in the year 1963 at the Tata Institute of Fundamental Research, Mumbai.

The main interest of the group led by Yash Pal was to understand properties of cosmic rays at

sources, and the changes occurring in these during their propagation in outer space, and in the atmosphere of Earth. An important part of this study was to understand the interactions of elementary particles at high energies, which were not accessible to man-made accelerators on Earth, but were obtainable in the cosmic rays on Earth.

Let me give some examples. In nineteen sixties, a hypothesis was developed that elementary particles with fractional electrical charge and masses much larger than proton-mass existed. If

such particles did exist, they would be created during interactions of cosmic rays of the highest energies, and would show up as late arrivals, delayed by a few nanoseconds due to their large mass, among the flood of particles in air-showers. Our group was one of the first to make the relevant calculations to check this; though no air-shower experiment found such particles.

Another interesting example concerns interactions of neutrinos. In those years, large underground experiments were the only means to observe interactions of giga electron volts neutrinos, which were produced in interactions of cosmic rays in the atmosphere. In order to make sense of the observations in these very important underground experiments, it was required to estimate flux of the neutrinos and anti-neutrinos. The group with Yash Pal was the first to calculate these fluxes.

Are antiparticles accelerated in the sources of cosmic rays? This question could be answered by looking for (negatively charged) anti-nuclei in cosmic rays. To find if a cosmic-ray particle has a positive charge or a negative charge, one looks for its bending in a magnetic field. Yash Pal figured out that a relatively small magnet can be used to measure this bending in a balloon-borne experiment from Hyderabad, provided the potential of nuclear emulsions is exploited to measure positions of the particles to a few microns. This experiment required manufacture of very flat but thin glass plates for depositing the nuclear emulsion, and these plates were made by the Applied Optics group at IIT, Delhi. On one occasion, a serious accident occurred and the glass plates broke during their transport from Mumbai to Delhi. After seeing this, Yash calmly pointed out deficiencies in packing, and encouraged us to go on with the job.

In the year 1975 Yash moved from the Tata Institute to take over as Director of the Space

Applications Centre. After this I had less direct contact with him till a few years back, and the contact was revived when I joined Ultra Violet Imaging Telescope (UVIT) project few years back on behalf of IUCAA.

Over the decades, I have had many occasions to discuss with him - issues relating to school education and communication about science. We have often discussed questions on phenomena we see daily in our lives, but fail to observe and be curious about, till some child raises a question. On one occasion we were discussing what all is seen if you put a pot with water on mild/strong flame of a LPG stove. After a careful discussion on this matter, Yash insisted that we check what we had discussed with an experiment in the kitchen, which happened to be free for our indulgence: There is no substitute for a real experiment.

He is always keen to find ways of exciting and satisfying curiosity of the young minds, without being constrained by the accepted wisdom. In his view, teaching good science in schools is as valuable as doing good research, and he has taken a very deep and lasting interest in science education.

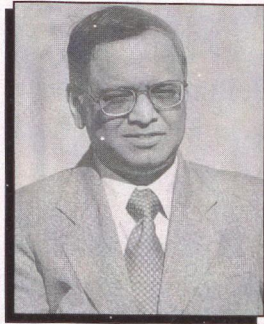
I have seen many dimensions of his personality, have learnt a lot from him about science as well as life in general, and have benefited from his generosity, to which was added kindness and love of his wife Nirmal. Learning from him has been a process of slow diffusion, the effects of which become apparent after a long delay and last long. A lot of what one sees of Yash Pal probably arises from his deep commitment to democratic values, and his optimism. I conclude with wishing Yash and Nirmal many more years of happy and exciting life.

Dr. S N Tandon

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SITE and CDOT Have Transformed Communication and Brought The Entire Nation closer

N. R. Narayana Murthy

Science is about unraveling nature. Technology is about making people's lives better. Invention is about new ideas, concepts and gadgets that did not exist before. Innovation is all about using and adapting known ideas, concepts and gadgets in a new context. The value of any technology is determined by the impact it has on its users. Using that criterion, there are two extremely important technological innovations that have transformed the lives of Indians like never before. They are SITE (Satellite Instructional Television Experiment) led by Professor Yash Pal and Sam Pitroda's CDOT (Centre for Development of Telematics) experiment of bringing the power of telephony to rural India through inexpensive and rugged 128-line telecom switches.

Why did I select these two technologies as the most influential innovations? Because I believe they have brought a very important instrument to strengthen our democracy- communication. Democracy works best in an environment of transparency and accountability. Prof. Yash Pal's SITE experiment blossomed into a full scale television facility connecting millions of villages of India, thus bringing the entire nation closer than ever before. This technology has made our political masters realise that their actions and inactions will be seen and judged by all people - from the forgotten villages of Assam to the activist villages of Kerala.

Thanks to this technology, the opinions of the rich and the poor, the educated and the uneducated, the powerful and the disenfranchised can be heard by a billion people. If we have today a vibrant, effective TV media by any global standard, it is because of SITE. Sam Pitroda's CDOT experiment has been equally successful in connecting the far corners of India with each other and in bringing a sense of new confidence to the people that they can reach out in a jiffy to their loved ones, officials and doctors to name just a few. The power of CDOT was demonstrated most vividly in what I experienced in 1990.

My memory goes back to a wintry morning when I was driving with a friend of mine from France to Nagarahole forest near Mysore city. Throughout the journey, I was waxing eloquent about Sam and his work. My friend, a perfect gentleman, after listening to this monologue for a long time, probably got tired. He gently said that he would believe all I said if he could call his wife in Paris from Nagarahole and the communication was clear. We stopped at the first ISD booth at Nagarahole and my friend dialed Paris. His wife's voice came through loud and clear. He smiled, extended his hand and congratulated me as if I had wrought this revolution. I was proud of Sam, CDOT and India.

Mr. N. R. Narayana Murthy
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Prof. Yash Pal - Our First Director

George Joseph



I first met Prof. Yash Pal at the Tata Institute of Fundamental Research (TIFR), Bombay West Canteen, with his constant companion – pipe – doing some ‘back of the envelope’ calculation, to drive his point on some scientific problem being discussed with others. It is characteristic of Prof. Yash Pal to start from the basic fundamentals to approach any problem. I had more intimate interactions with him at Space Applications Centre (SAC), Ahmedabad.

When Indian Space Research Organisation (ISRO) was reorganised into various centers in 1973, Prof. Yash Pal was invited to head the Space Applications Centre in Ahmedabad. While other ISRO centers were technology oriented, SAC has the responsibility to take the benefits of space technology to the common man, which was also close to his heart. The first task at hand was to realise the concept of Satellite Instructional Television Experiment (SITE) – the largest social experiment ever conducted - using NASA’s ATS-6 satellite positioned over India. Though the responsibility of SAC was primarily hardware



development and establishing direct reception systems in 2400 villages nationwide, Prof. Yash Pal realised that the experiment would not be complete unless the end objective of empowering the masses through television programmes is not achieved. As a result, he introduced the concept of ‘end-to-end’ experiment. Keeping this in mind SAC not only produced the hardware, but even 25 per cent of the software required for transmission. He did not stop there. He further ensured that there is a social evaluation team who will find out the impact of this unique experiment for the social transformation. The ‘end to end’ concept was followed in all future application programmes.

Extensive application of satellite remote sensing started with the launch of LANDSAT-1 by USA in 1972. Modern multi-spectral remote sensing in India was initiated by Prof. PR Pisharoty in Physical Research Laboratory in 1970, an activity which later formed part of SAC. Thus we were at par with other countries in initiating remote sensing activities. There are no well-tested paths as to how to organise a remote sensing programme with sound foundation, which can cater to the national need and we have to find it out in our own way. How Prof. Yash Pal structured remote sensing activity at SAC is only one of the examples of his visionary approaches in organising activities at SAC.

Prof. Yash Pal soon realised that all the basic elements of Remote Sensing Programme should be developed concurrently. He felt the necessity of developing sensors (cameras) to generate images of earth from aircraft/spacecraft and the need of a sensor development group to concentrate on this aspect (I had the privilege to lead this group). A data products team was formed for converting the data acquired from such cameras into a form which can be used by application scientists and formed a data products group. Ultimately, one has to demonstrate how the data can be used for practical applications and therefore an applications group was formed.

He formed a unique group which was called 'Utilisation Cell'. This cell was supposed to bring the remote sensing application methodology developed to the end users in various Government agencies. That is, all activities to make a successful operational remote sensing programme he conceived when the remote sensing technology itself was in its infant stage the world over. All these activities under one roof could not be seen anywhere else in the world at that time – a unique vision of Prof. Yash Pal. The concept developed and nurtured has given high dividends, which can be judged by the penetration of remote sensing technology for the benefits of mankind in various areas.

Management of time bound high technology programme, with a large number of linkages with various private and government agencies, faces with many technical and managerial crisis. 'Crisis Management' is thus part of the game. Many such situations had no precedence and one has to find solution oneself. Prof. Yash Pal had a remarkable management skill which probably is not taught in IIMs or at Harvard.

An interesting anecdote, which comes to my mind is about his handling of a situation involving SAC and local villagers. During those days, the approach road to SAC was not well developed. There used to be complaints from nearby village people that the SAC bus was moving at very high speed and they wanted to block the buses. This was conveyed to Prof. Yash Pal and he asked the Administration to invite the leaders of the village for a meeting with him to sort out the issue. When they came to meet Prof. Yash Pal, I was in his room, discussing some programme aspects and he told me: "George, we can talk about this later, but I have to talk to these people first, we have some crisis". When they came, he greeted them with a hug and asked them to sit down. They were taken aback by this gesture. Then he started explaining them about the importance of SAC activities for the national development and as neighbours, they were part of the SAC family and all problems can be sorted out together than taking the issue to streets. The village leaders who were so furious when they came, on listening Prof. Yash Pal's words, they said without making any complaint that it was their duty to protect SAC property and he may be rest assured that the whole village will stand behind the organization. Of course he also instructed the drivers to be careful in driving.

He had the conviction that our scientists and engineers have high level of competence to carry out any task given to them. Once he has identified the right people for a job, he gives them enough freedom to meet the overall goal of the organization thereby not only got the work done but also produced leaders with self confidence.

He was approachable, irrespective of the level one held in the organisation. If anyone comes to him even with a personal problem, he would listen to him very patiently and will get completely immersed in their problem as if it is his – a unique leadership style. Though it was not possible for him to satisfy everyone because of administrative constraints, people were happy that the head of the organisation was willing to listen to their problems and gave suggestions to sort it out.

His interests were much broader than the positions he held. He had the passion to spread the scientific temper across the country. He could convey the scientific principles to the children in a manner they understand and appreciate. His usual comment to them is 'science is fun!'.

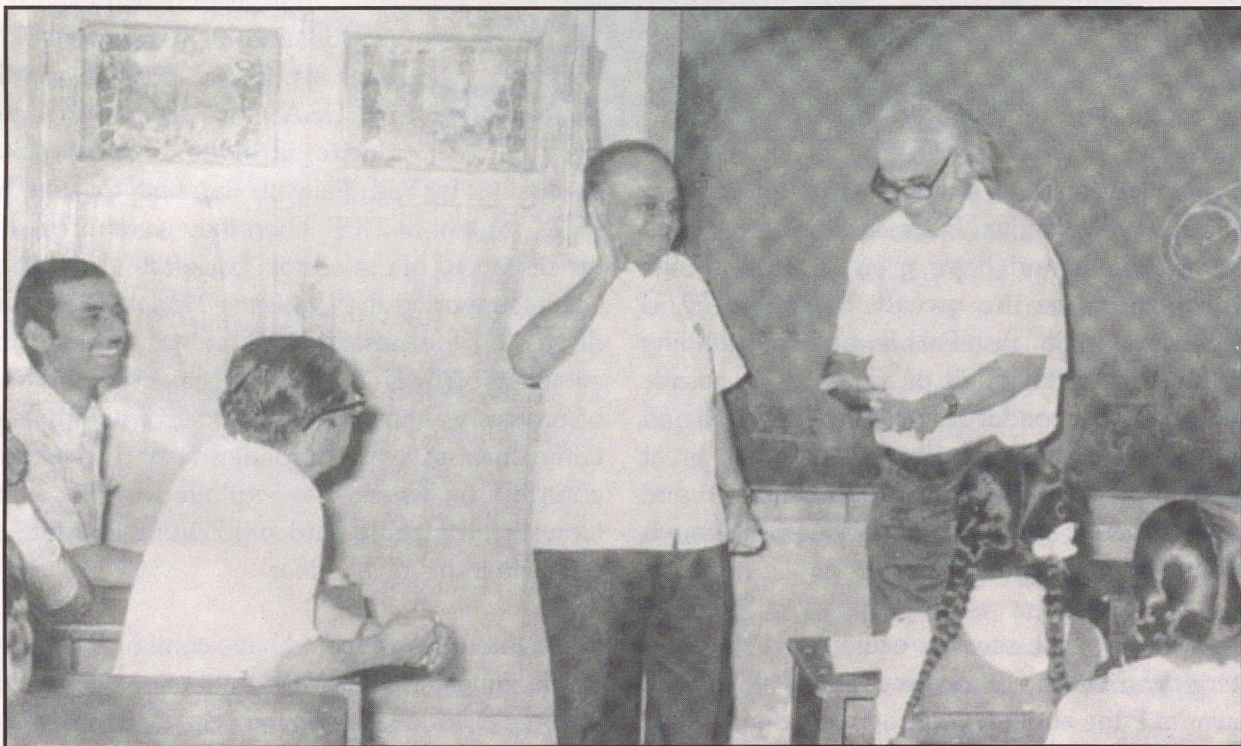
He guided and nurtured SAC for 8 years and left behind a rich legacy and unique work culture on which his successors build to make SAC a great organisation. He is a visionary, an excellent manager, motivating leader and above all a fine human being. No wonder, even after many years of his retirement, people in ISRO and SAC in particular love to see him and interact with him and many of us have pleasant memories of our association with him.

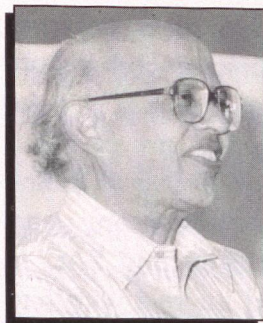
Dr. George Joseph

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My Musings On The Happy Occasion of 80th Birthday of Professor Yash Pal

Govind Swarup



Nations are built by those who nurture them selflessly. I have known Professor Yash Pal for the past 40 years and have greatly admired his contributions to the growth of science and education in India. Yash Pal has made outstanding contributions in the fields of astrophysics, cosmic rays, primary, secondary and higher education and also science popularisation. He has made great impact in each of these fields. His simplicity and yet great depth in looking at various problems is unique and highly admirable.

As one of the several examples, I recall his interjection when I was discussing with Sharad Pawar at Pune about 6 years ago to get integrated science and engineering education in a few of the colleges in Pune, Yash interjected to say that "But in India, we specialise in putting science in one box and engineering in another!" Another example,

out of many, is his lucid explanations during the Turning Point programmes of the Door Darshan about 15 years ago. For science popularisation, I call Prof. Yash Pal the Carl Sagan of India. But Yash has made a much wider impact on our nation.

I first met Yash Pal about one year after I joined TIFR in 1963, and on his return to TIFR after a post-doc position at MIT in USA. In 1965, I recall participating in intensive

discussions by Yash Pal with Ramnath Cowsik, his Ph.D. student at TIFR when they were discussing the discovery of the cosmic background radiation which supported the Big Bang Model. They were discussing the possible role of neutrinos in the evolution of the Universe. Yash's insight in the field of physics was inspiring. The role of neutrinos in early universe was a pioneering and ingenious contribution which was exploited by Ramnath Cowsik admirably and who went to reach a pinnacle in his own career.

Although Yash could have continued to make outstanding astrophysical contributions at TIFR to become a world leader in the field, he accepted the position of the Director of the Space Application Centre at Ahmedabad, realising the importance of satellite communication for educating young and old in India, particularly in our rural population. I

remember his taking me around SAC during one of my visits there and discussing the present and future activities of SAC. In mid 1970s he conceived and made pioneering contributions to the experimental SITE project for broadcasting educational programmes beamed to the eastern rural India. This programme is still quoted by many for its impact.

Later, I had an interaction with Yash at the United Nations where he was the Secretary General for an international programme for the Peaceful Uses of Outer Space. I wanted a general support of the UNDP for the following project. In 1979, me, Okoye (Nigeria), Odhiambo (Kenya) had proposed setting up a 2km long and 30m wide Giant Equatorial Radio Telescope (GERT) at a site close to the earth's equator in Kenya, for which India was likely to support half its cost. It was part of a proposed International Institute of Space Sciences and Electronics Education (INISSE).

During my visit to USA Yash asked me to visit UN at New York to discuss the proposal with UNDP. In spite of Yash's negotiation skills it became clear that UNDP was hesitant for India to play a significant role in the growth of above areas in Africa. The view of the then Director of UNDP was that it would be more fruitful to support interaction between institutions in Africa with industries in other countries rather than establish advanced basic science institutes. Later Yash wrote to me from Columbia which has equatorial location that they would be very interested in supporting GERT. I did not pursue that possibility as Columbia was far away from India for us to be able to build the ambitious GERT project. Ultimately, GERT became the Giant Metrewave Radio Telescope (GMRT) in India.

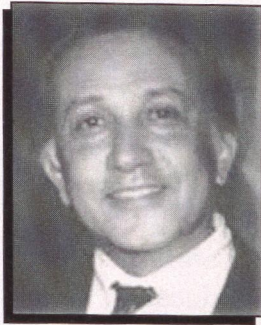
I also had several interactions with Yash when he was at the Planning Commission and later after he became the Chairman of the UGC. In 1987, TIFR decided to build the Giant Metrewave Radio Telescope (GMRT) about 70 km away from Pune with an academic centre at the University of Pune. Soon after, as Chairman of UGC, Prof. Yash Pal discussed with

Prof. Jayant Narlikar and approved the establishment of the Inter University Centre for Astronomy and Astrophysics (IUCAA) at Pune in a location next to the academic centre of the GMRT at the University.

In October 2004, soon after Shri Arjun Singh became the Minister for Higher Education, on my request, Prof. Yash Pal approached the Minister and arranged a meeting with the Minister at his residence with Yash, me and Prof. Bhide, seeking his support for a 5 year educational programme at Pune after 10+2 schooling of selected students, similar to IITs but in the field of basic sciences and related disciplines by integrating teaching and research. Yash enunciated our dreams adding his own vision to the Minister Shri Arjun Singh appreciated the proposal and later it was taken up by Prof. C.N. R. Rao the Science Advisory Committee to the Cabinet and has now resulted in the establishment of the Indian Institute of Science Education and Research (IISER) at Pune and Kolkata, a truly ambitious initiative for science education in India.

Finally, I recall a question-answer interaction of Yash with over 500 school children in the auditorium of the Garware college in Pune. A mother of a 6 year old child got up and said that her son was curious as to why does the moon travel with them as they drive in a car, while the trees and buildings are left behind! Yash got thrilled by the observation and question of the young student and asked him to come to the dais and ask the question. Yash gave an answer to the satisfaction of the young student! He hoped that the kid would become a great scientist of India someday, if our education system does not kill his creativity! It is well known that Yash has been very active to get NCERT's books at the primary and secondary levels modified so that the school education becomes exciting and does not remain as rote learning.

Dr. Govind Swarup
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Professor Yash Pal- My Guru, Guide and Philosopher

Ramanath Cowsik



Professor Claude R. Canizares Director, MIT Center for Space Research has rightfully called Bruno Rossi as the grandfather of High Energy of Astrophysics. With this in mind I can certainly call Professor Yash Pal as the father of High Energy Physics and Astrophysics in India. He was a student of Rossi at MIT and worked on Cosmic Rays and Particle Physics in those pioneering days called the "age of innocence".

The world had emerged out of the Second World War, and India had emerged independent with great spiritual leaders and statesmen like Gandhi and Nehru filling every heart with hope and

higher values. And Yash Pal was in the thick of it, imbibing the spirit, and the science. Thus, we see in Yash Pal not only the pioneering and adventurous spirit of science but also the deeply introspective and egalitarian spirit of a social thinker and a reformer. The fertile seeds planted in his psyche by Gandhi, Nehru, Philip Morrison, Bruno Rossi and Bernard Peters grew within him, and thereafter, his toils and introspective meditations progressively transformed him into a man of wisdom, well versed in the sciences and with a deep knowledge and concern about societal dynamics.

Limited as I am by my own knowledge and growth, it is impossible for me to give you the measure of such a man. Accordingly, I will limit myself to recalling the singular role he played in my life. I should confess that I myself grew up in the "age of innocence"; where as Professor Yash Pal participated in the Indian independence movement and the resurgence of scientific enterprise as a youthful spirit, I was but a little boy walking bare-foot with a tiny satchel on my back to the elementary schools in various small towns to which my family moved every couple of years. All the same, having been brought up in the atmosphere that prevailed over those times, I am able to appreciate and admire the alchemy that Science and Social Consciousness have wrought in Professor Yash Pal. The two years at the Karnatak University, located in the backwoods outside Dharwad, hardly gave me any polish or sophistication to face Bombay, which to me looked like a foreign city, full of hidden secrets and adventure.

After one year in the Atomic Energy Training School, with my nose buried in books, I dreamed of doing research in Physics. My more knowledgeable friends had told me, that TIFR (Tata Institute of Fundamental Research) was the place for it. From my hostel in Bandra, a cluster of Nissen huts, which had survived World War II, I reached the Church Gate Station and trudged about three miles to TIFR. Again many of my friends were there, and they had extracted all the needed information: "Professor A wants to take 3 students, Professor B is doing some new kind of high energy nuclear physics" and so on. I walked up to the second floor up to the room where they had told me that I would find the Professor.

The door was open and billowing smoke was emanating from it and behind the table, deep in thought sat the source of it all - Professor Yash Pal with his famous Trichinapoli Cheroots. He was very friendly and asked me some questions about the statistical mechanics of the production of particles in high-energy collisions. Many of the questions were far beyond my knowledge and ability to answer at that time. Only much later, after a year or so, I came to know that these ideas were contained in the Statistical theory of multiparticle production, proposed by Heisenberg. In any case Prof. Yash Pal asked me to go into the laboratories where I would be working, that is, if he chose to take me on as his student. After my visit to the labs he asked me to come back the next day and said he will communicate his decision at that time. I did go back the next day, and he did decide to take me on, and thus began the most momentous turning point in my life.

Until that time, the first 20 years of my life, I was just like a sponge soaking up knowledge on physics, chemistry, mathematics, poetry, philosophy, business, psychology, botany, and the fine arts, all from the environment where I was drifting along. His accepting me changed all that - my life became more focused. I started learning physics in a very directed way, trying to understand high-energy interactions and the highest energy

particles in space - the Cosmic Rays. At that time Professor Yash Pal was also deeply interested in these topics, and within a few months of my joining him, he left for Copenhagen for a two-year collaborative work with Bernard Peters on these very topics. Before he left he told me that I should think about calculating the flux of neutrinos generated by Cosmic Rays in the Earth's atmosphere.

In about two years, Shyam Tandon joined the group as Professor Yash Pal's student and we worked away literally day and night calculating neutrino fluxes and devising means for detecting them. The results were presented by Yash Pal at the International Cosmic Ray Conference and this paper was a big hit. Professor Masatoshi Koshihara was in the audience and his excitement about our results equaled our own. Yash Pal and I discussed with great enthusiasm regarding the huge Cherenkov detectors made of millions of gallons of pure water contained in a big plastic balloon submerged in a deep lake or the ocean, an idea that could not be pursued in India due to lack of support. Thus, Professor Yash Pal and his group were the first to conceive the idea, which was later developed with extraordinary energy and finesse by the Japanese Scientists over the following decades, culminating in the award of the Nobel Prize to Professor Koshihara.

This is but one scientific idea that emerged from the fertile mind of Professor Yash Pal and I am greatly indebted to him for having accepted me as a student and thus giving me entry into the garden of knowledge, where many a flower blooms enriching our lives with color and fragrance. In closing, if I were to single out one quality which has been developed to an extraordinary degree in Yash Pal, it is "aesthetics". 'Pranams' to him on his 80th birthday- may he guide us for decades to come as he did through decades in the past.

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Fond Associations with Yash Pal

P. K. Iyenger

I first met the young Yash Pal at TIFR in 1952, when I joined the Institute, and he was working with Prof. Bernard Peters, a famous cosmic-ray physicist at that time. Our friendship has continued since then, for over fifty years. Even at the first meeting I was impressed by his nationalist dress - kurta-pyjama - in the laboratory, and his devotion to understanding Nature's laws, and for working at the frontiers of science. At TIFR he conducted basic research using the nuclear emulsion technique, exposed to cosmic rays, for studying interactions of the fundamental particles, leading to new particles using a technique that was adapted to Indian conditions. Not expensive, but innovative. Later, he went to MIT to continue his studies, leading to a Ph.D, and returned to TIFR.

At TIFR his bubbling enthusiasm for basic research, exposing young minds to new problems and articulation of one's thoughts in the form of lectures, all impressed on me his multi-faceted abilities: Though a practical experimenter, his ability to acquire knowledge in a wide variety of sciences and technologies, led him to be a leader and even take up the Directorship of the Space Application Centre in Ahmedabad, at a formative time in its history. He played a very important part in the evolution of the ISRO programme, recruiting appropriate technologists to design and construct many instruments for applications in space science. This gave him a broad understanding of the particular needs of a developing country like India, which fortunately

had young minds which could be shaped to build indigenous technology.

His interest in education and the need for propagating a scientific temper in the population, brought him in contact with the media, where he very innovatively explained the basic wonders of science, in simple language, to influence young minds. He is well known for his abilities as a spokesman for science to the general public.

Later he was given the responsibility of managing universities, as the Chairman of the UGC, and evolving technology, as the Secretary, DST. His keen desire to bring together scientific establishments to cooperate, resulted in a number of new initiatives like the Institute for Plasma Research, and the joint DAE-UGC Consortium for Scientific Research.

I have always looked to him for advice, co-sponsoring new initiatives in scientific research, and we have always agreed on the principles of scientific research initiated in the early days by Homi Bhabha and Vikram Sarabhai.

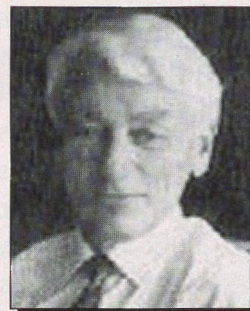
I am very happy that he is completing 80 years, and still active, with a sharp and sensitive intellect, and when I see him on TV I recall very fondly, our association over the decades.

Prof. P. K. Iyenger

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Professor Yash Pal

Eric Ash



I first encountered professor Yash Pal in the mid-eighties. We have seen each other fairly regularly ever since, our one point of connection being that we are both Fellows of the Marconi International Fellowship (Now the Marconi Foundation). This organisation was started by the late Gioia Marconi one of Guglielmo Marconi's daughters. Its aim was and remains to celebrate the epoch making achievements of Marconi - his contribution to the invention of wireless, and his amazing engineering intuition which led to the first transmission of signals from Europe to North America. But in addition to that she was concerned to commemorate the contribution, which Marconi's invention made to the betterment of human society. It was particularly this thrust in the early years of the Marconi International Fellowship which led to Professor Yash Pal's election to the Fellowship - the immense contribution he made to Indian society by the application of satellite technology to foster universal education.

The Marconi Fellowship meets once in a year on the occasion of the award to a new Fellow and it is on these occasions that I had the pleasure of exploring Professor Yash Pal's view of the world and the role of technology in our times. I never failed to gain enlightenment from our conversations, and often new inspirational thoughts. It is on these

occasions that it struck me forcibly that the world would be a better place if only Yash were entrusted to run it!

One of the problems of the Marconi Foundation is the choice of a new Fellow - one every year. For this purpose there is a selection committee who have the fiendishly difficult task of selection from a long list of proposed new Fellows - each one of them without any doubt excelling in their field. For some years I was on this committee and then became its chair. My first action then was to recruit Professor Yash Pal to this committee, where his insight and humanity were much needed. The task we had before us was arduous, but I do believe that in the end we arrived at as fair a result as humans can hope to achieve.

About four years ago Professor Yash Pal was invited to give a formal speech at the annual ceremony. He was asked to speak for ten minutes but actually spoke for about 40 - *and no one minded!* The breadth and depth of his discourse was such that we were all entranced. I am sure that becoming an octogenarian will not blunt his ability to inform and inspire.

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Yash Pal – A Phenomenon

D. P. Chattopadhyaya



To speak of Dr. Yash Pal as a scientist is beyond my competence. To his friends he is simply Yash, which both in Sanskrit and English means fame. Once in a public meeting he was telling us in his inimitable humours vein how “Pal” has been added to his original name. That he is a very gifted scientist is amply evident from his life-story, both academic and official. The academic achievements in the field of space research are for specialists in the field to tell us. But as an informed layman I have been hearing of his gifts and talents for a long time. His contributions as a very senior official entrusted with the responsibility of formulating and implementing science and space technological policies of the Government of India are also known to me from my friends and colleagues, both in Government and academia.

The circumstances leading to his Chairmanship of the University Grants

Commission are also in my memory. Still very active and creative in his scientific profession, when he was requested by the then Government to accept the Chairmanship of that prestigious institution called UGC, if my memory has not failed me, Yash was not initially very enthusiastic about it. At that time he was on a foreign tour and when this important Office was formally offered to him, perhaps he was initially hesitant to accept it.

But once he actually agreed to take this post, he took it in right earnest. Whatever Yash does he does it very earnestly and seriously.

When Yash was the Chairman of the UGC, another philosopher-friend of mine was its Vice-Chairman. The ways these two exceptionally gifted scholars; one scientist and another philosopher, worked together and set a shining example to be emulated by others for the overall functioning of one unified academic body is worth accolades. Yash as the Chairman used to keep with himself the decisions pertaining to the areas of science and technology in the University system. He left the areas of humanities and social sciences to his colleague, the philosopher. I had the privilege to know how smoothly and harmoniously these two distinguished academicians had been shaping the policy-making process of the UGC. This impression of mine has been well attested by several other members of the Commission at that time and with whom I had the good fortune to be associated with.

When I was living at 14, Mathura Road, opposite to Pragati Maidan, New Delhi, this distinguished scientist was my neighbour. In connection with academic activities and also for purely personal joy of conversation I used to encroach upon his valuable time from time to time. As a person he is, as ever he was, extremely charming. As a 'conversationist' his gifts are simply brilliant. In the public life he could be an orator extraordinaire, but his native humility enables him to contain himself within the confines of cheering conversation and exceptional communication.

He rightly received many honours and recognitions because of his scholarship and scientific contribution. When he was appointed as a National Professor by the Government of India, I, like many others, felt extremely happy. For him it was overdue I recall that the late Professor Ramalingaswamy, the former Director of All India Institute of Medical Sciences and of the Indian Council of Medical Research was also appointed as National Professor at the same time. Fortunately for me, both Ram and Yash, as exceptional scientists-cum-administrators in their respective areas, graciously helped me and my other colleagues as the Members of the Governing Board of the Project of History of Indian Science, Philosophy and Culture. Their academic inputs and administrative advice deeply benefited the policy-making process of the Project. Still Yash is a colleague of mine in the activities of this Project.

I and my other colleagues in this multi-disciplinary Project, running into 96- Volumes, have been immensely benefited by Yash's erudition imagination and contribution to different Volumes. His multi-disciplinary orientation of scientific mind invited numerous demands on his valuable time - Yash as a communicator, his programmes for the students on TV, 'Gandhian' views on *vicâr*, *acâr*, *sañcâr*, and *pracâr*, in meetings and at lunch tables, his availability to be with us at dinner table after he moved to Noida, his sparkling presence and presentations in seminars and symposia, his command of several languages and elegant switch over from one to another, the Sartorial charm of Yash, the ever young personality in him - I, together with all others, wish him a long and long

life. Brief reference to Mrs. Yash Pal, the charming lady and life companion of Yash.

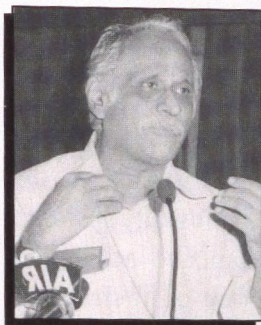
One of the right demands made in his time by a TV channel, at the instance of the UGC, was for propagating interesting scientific issues for the relatively young students of the University systems. I am sure, some scientifically disposed adults like me used to enjoy that programme of Yash. For it showed how the best minds, highly qualified scientists can very successfully communicate science to younger generations. This reminds me of the famous Gandhian views regarding the relation between *vicâr*, *acâr*, *sañcâr* and *pracâr*. Those who can think correctly can act accordingly but also in addition, communicate the same to the intended audience. What is more, is that such learned people are best qualified for propagating (*vicâr*) the right views to the public as a whole.

When I am called upon to speak on Professor Yash Pal, the scientist I cannot help remembering his sparkling presence and presentations at academic gatherings, he could speak for non-specialists and yet without extremely diluting the quality of the concerned themes. His presence forever used to be sparkling not only for his super style of articulation but also as we all know, for his sartorial elegance. His long and painted kurtas used to charm, I am sure, not only me but also many others. I wish many of us would have known the address of his designer of kurtas!

Many other things, academic and personal, come to my mind when I start speaking on Professor Yash Pal. We worked together in several Committees. We spent hours over lunch at the India International Centre (IIC) and other places. But after he moved to his Delux Flat at Noida the frequency of our meetings over the dinner table naturally went down lamentably.

On his 80th year of life I with many other friends and colleagues, wish him a long life continuing to help and educate us with his inimitable wisdom and personal charm.

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My Friend, Philosopher and Guide - The One and Only Professor Yash Pal

V. S. Venkatavaradan

It was more than forty years ago on a Tuesday evening, 4 p.m. to be precise, an ebullient gentleman came and occupied the seat in the front row when I was delivering a lecture on "Interplanetary Dust" in the Geophysics Seminar at the Tata Institute of Fundamental Research. He was so attentive to my talk and his personality so overwhelming that I was more or less addressing to that single person throughout my talk even though the Hall was nearly full.

"Strangers when we meet", as the saying goes, I did not know at that time who that astute gentleman was and I was wondering at the great interest he showed in my talk. After the lecture was over he came straight to me and shook hands appreciatively and immediately started commenting on the subject of my talk. It lasted nearly for an hour at the 'West canteen'. I was so much absorbed in the conversation, the coffee became cold and the snacks untouched. That was Professor Yash Pal who just returned from a stint at the MIT. There was a kind of resonance between us and we became friends instantly which has last to this day. Reminiscing about Professor Yash Pal and to recall the pleasant events for four decades and more will be a never-ending story.

Even before I met him I knew him through his work and more through his friend Professor Devendra Lal, my Professor and guide. Lal and Pal, great friends, both made it possible for me to

meet him and interact with him almost daily to have exciting discussions. Always smiling clear and succinct in his talks, it is a pleasure to listen to him on any subject under and above the Sun, including the Sun.

During the Satellite Instructional Television experiment (SITE) using ATS-6 satellite in which he played a key role brought me even closer to him. We were producing science programmes for broadcasting to clusters of villages and he was always around to inspire, advise and participate in the production of the programmes. Working with him on the SITE programme was an exhilarating experience to me as well as to others who made it a grand success.

Even when he moved to Ahmedabad as the Director of Space Application Centre my association with him continued, partly because he took my good friend George Joseph (who later became the Director of SAC) and partly because Professor Lal also moved to Physical research Laboratory.

He had handled all the assignments that came to him with ease, devotion and a lively manner typical of himself. When he became Advisor to the Planning Commission he asked, "Venkat, why don't you come to Delhi and be with me in the Planning Commission?" That was the first time I said, "No" to him, as I was sort of glued to Bombay. When my daughter joined the

National Institute of Design (NID) he was the Chairman of NID and my daughter used to say that all her friends were envious because she is the daughter of a friend of the Chairman.

When I joined the Nehru Planetarium his constant interaction, encouragement, praise and suggestions made it possible to produce some of the most beautiful and delightful Planetarium programmes.

Shankara has said, "Duhrlabham thriyamevedam deivanugraha hetukam

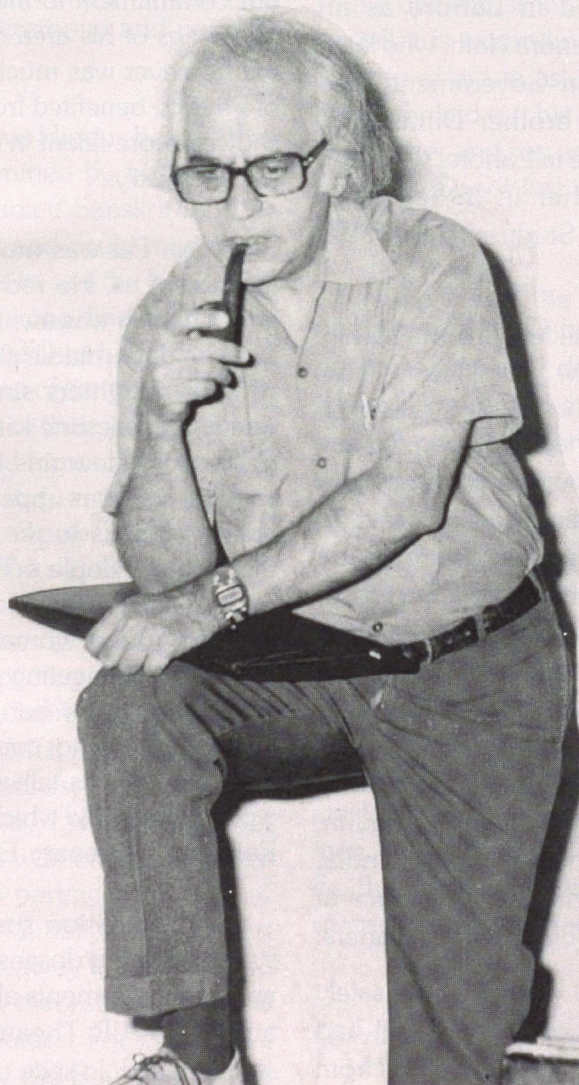
Manushyatvam mumukshatvam Mahapurusha samsrayam" "There are three things that are rarely obtained without God's grace—to be born as a human being, the desire to obtain superior knowledge and the association of great people". I am fortunate to be associated with this great person, Yash Pal, whose camaraderie made a great and enjoyable difference.

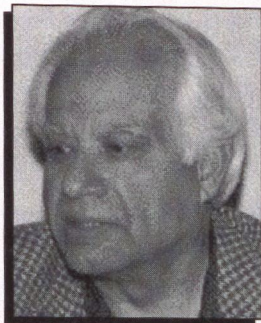
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Professor Yash Pal – 'Jeevate Sharada Shatam'

Shanti Tangri

Here are a few reminiscences about Professor Yash Pal's rich, colorful, creative and significant life that I had the privilege to be part of. After the Partition, I, a refugee located some friends and fellow students from Lahore, and resumed meetings of a study group I had founded in Lahore as an undergraduate. My friend Surendra Nath, who later, after a distinguished career in Government, died in a plane crash, his older brother Dina Nath, founder of Tagore Study Circle in Lahore, who later became a foremost publisher in India, and I reassembled the Rationalist Study circle in New Delhi.

I shifted from Physics and Chemistry to study Economics at the East Punjab University College where after a couple of years became a lecturer. Somewhere in that period I had the good fortune to meet an extraordinary group of young people through several activities we started in order to satisfy our own needs, and to help provide meaningful avenues for creative participation to about 3,000 college students mostly from Pakistan who were living under very stressful conditions. One such group was the Students Art Theatre, later named Nav Kala Pradeep. It was one of our common friends, perhaps Surendra Nath, who brought Yash Pal and Mohindra Singh Chhadha, who continues as a distinguished scientist in India, to one of the meetings which often took place at my family's modest flat in Tibbia College Quarters.

We were the lucky ones. We had come safely from horror, had roofs over our heads, and had enough to eat. We learned from each other and from

whoever was willing to help us free of charge to write plays, poetry, fiction, essays, dance, folk music, politics, world affairs and we all wanted to make a difference in the world. We were going to pursue different careers but always remembering our commitment to the society. Yash pal taught us folk songs of his area of origin in the Punjab. Like me he never was much of a dancer and the world of Physics benefited from that though Dr. Chhadha showed more talent in the area in addition to doing his chemistry.

Yash Pal was much more emancipated than the rest of us. He recruited his future wife to our group, which was awfully short of women. After all in those days middle class families did not approve of their daughters singing and dancing or even discussing Palestine with boys. Also, none of us had girl friends; a few girls, women, in today's language came to us from upper class and usually left wing politics, thanks to the cooperation for a while of the Indian People's Theater Association.. It was such a delight then to see a simply and smartly dressed young woman wearing sunshades walk into a group meeting at our place and sit down. None of us knew her till we discovered that Yash Pal, who could not come, had asked her to join us. Poor Nirmal was talked into playing a lead role in a play I wrote and which was produced in the Indian Railways Centenary Exhibition in New Delhi.

An exhibition surrounded by dozens of P.A. systems blaring dozens of different movie melodies and announcements about the fair, we struggled in an OPEN AIR Theatre to be heard. Our sound system failed. In spite of the valiant acting of Nirmal

and two of my brothers and others, including Surendra Nath, the play proved to be the end of my career as a playwright. The audience wanted their money back. We made safely out of the stadium.

Soon after I left the country to try my luck in Economics. Is it strange that I cannot recall where Yash Pal was when we needed him? Yash and Nirmal had a problem. She was a Brahmin and he I suspect was a Kshatriya. He never revealed his last name so I figured he must be an Arya Samaji with no love for the caste system. Nirmal's family did not feel comfortable with her marrying 'down', even if the young man was illustrious. So I offered to arrange an Arya Samaji wedding with a proper priest from that organisation and if for some reason the Samaj were to raise objections, I volunteered to learn the rituals for the ceremony and perform the wedding.

After all many progressive Hindus believe that the caste is not to be determined by birth but by achievement. Well, I had studied Sanskrit for four years in Arya Samaj schools and could master the few shlokas that were needed to seal the bond. The conspiracy proceeded. Then one fine morning a cab pulled up in Tibbia College Quater and a good looking but agitated girl got out of the taxi cab. With my neighbours gawking out of their windows, she rushed one floor upstairs, and announced to me "I am sorry I can't go through it. Cancel the plans. I will just have to persuade my family". And she did. I gave up on learning marriage rituals.

My third recollection relates to Yash and seven-months pregnant Nirmal, expecting their first child, driving cross country from Cambridge, Mass to Berkeley, Calif. in the third old jalopie, a Studebaker, making it across deserts and mountains. There was no way I was going to let Yash drive his very pregnant wife back to the East coast. So I talked them into parting with that car for a song before they left. Naturally I had to start learning how to drive right away. That car also taught me about how much theoretical physicists understand about car mechanics! For example if the car dies in the middle of the Bay Bridge at 2

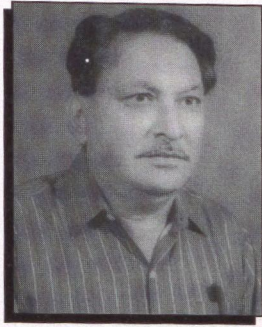
a.m. when you are returning from an evening in San Francisco and the nearest gas station is a few miles in either direction, and your date is becoming hysterical, the solution that works more often than any other, is to get out, open the hood, knock at a few components with anything you can find, spit at the alternator, and try a few curses in Punjabi that your date does not understand. Voila! Your date is safe in her home and you live to learn modern technology and string theory.

My two last reminiscences are from my back yard in Somerset, New Jersey. Sitting around my picnic table my son, then perhaps six or seven and I were trying to understand the Doppler Effect, and its use in astrophysics. Yash Pal was explaining the theory about the expanding universe. Neil asked, "If the universe is infinite, as you say it is, how can we tell it is expanding?" I had the same question but was afraid to ask. In the next few minutes the Professor laid out his answer, clearly and simply so both father and son could understand. I knew then, that he was not just a great physicist, but a great teacher.

I have had the privilege of knowing Abba Lerner, and the Nobel Laureate Robert Solow, two great economists who could explain complex matters in a clear and simple manner. In the same back yard he visited with his family one day. In between the chitchat and cooking I put him to work, helping me dig deep holes to put some new 2 by 4 wooden posts to restore my wooden fence that a storm had knocked down a little. I discovered that I did not need to outsource my repair work to India when distinguished Indians would come, pay their own fare, and put in hard manual labour to help me. That was not the most economical use of such high value labour. But it is memorable. Few people are lucky to have the privilege of knowing such men. Fewer have the luck to have them as friends. As the old saying in Sanskrit wishes, Jeevate sharada shatam - May you live a hundred years.

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Professor Yash Pal – Some Memories

Pramod Kale

It is indeed an honour to be able to share with others some of my memories about Professor Yash Pal on the occasion of his eightieth birthday. I will be able to share some memories about him but those cannot present a complete picture. He is a multifaceted person and I can only cite certain things about him which will throw light on only some aspects of his persona. He is a very warm, sincere and very interesting person. He is able to communicate not only at the scientific meetings but also with children and common people of any age. When he shows concern about some issues, every person feels and sees right away that he is genuinely concerned. He gets involved with issues and people.

In the first few months of 1972, after the untimely and sudden death of Dr. Vikram Sarabhai, a large number of people working in ISRO were wondering about the future leadership of the Indian Space Program. I was at the time posted at the Goddard Space Flight Center, NASA of USA as the Resident Representative of ISRO for the SITE-Satellite Instructional Television Experiment. Professor M. G. K. Menon was holding the temporary charge as Chairman. ISRO and I was fortunate to be able meet him on his visit to USA. He indicated that in August 1972 there was to be a major seminar in Ahmedabad on the ISRO program on Space Sciences and Space Applications. I was required to be there and was to present the INSAT studies that were going on for almost three years. He had outlined the new organisational structure for ISRO and had indicated that I would be meeting the First Director of the Space Applications Center

there at that time. He did not disclose the name to me at that time.

At that seminar I met Professor Yash Pal for the first time. I requested him to be present specifically for my presentation and he had kindly consented to do so. I also met Professor Satish Dhawan, whom I had met earlier on many occasions and who had been appointed as the Chairman, Space Commission and Secretary to the Government of India, in charge of the newly formed Department of Space. He advised me to return as early as possible after winding up my work in USA. I returned from USA in early 1973 to attend the National Conference on Electronics, and in the first week of January 1973 Professor Yash Pal had taken over as Director, Space Applications Center. Both of us were staying at the Physical Research Laboratory guest house in Ahmedabad and we spent long hours discussing various Applications of the Space Technology and opportunities available for us. I had briefed him about all the experiments on the NASA Applications Technology Satellite ATS-F in which we could participate. We had less than two and half years to get ready for experiments.

This was the beginning of a very long and fruitful association. Soon in a meeting with Professor Dhawan, Dr. Brahma Prakash and Professor Yash Pal it was decided that I should stay in Ahmedabad at Space Applications Center and not return to the Vikram Sarabhai Space Center till the completion of the Satellite Instructional Television Experiment and beginning of the INSAT project.

Professor Yash Pal took effective charge of the Space Applications Program in India with his very good understanding of the social implications of applying the Space Technology in our day to day life. Looking back I feel that we were very fortunate in having Professor Yash Pal as the Director, SAC. Under his able and patient leadership the SITE Program took very good shape. Even though the SITE program was taking up most of our time, he was able to spend enough time on all the issues connected with the Remote Sensing, Meteorology, Geodesy applications. Apart from the technical aspects of the conduct of the SITE program, ISRO had the responsibility of organising the Social Research required for the evaluation of the results of the experiment.

During the period, almost the four years that I spent in SAC, Ahmedabad we learnt many aspects of the art of Management from him. His infectious and feverish enthusiasm was catching and he participated in almost all the activities at SAC. I would like to elaborate on some of the important management aspects as I understood from him. These are not the things that are taught in management schools or learnt from books on management. He encouraged his young colleagues around him and was always ready to give them the responsibility and commensurate authority necessary.

Making an Event

Professor Yash Pal was able to make an "Event" of any thing happening at SAC. He could get all the staff, at all the levels involved in any Divisional activity or an activity of a particular Area taking place at SAC. This got people involved and a culture of Participative Management at SAC developed. This technique got people from all the diverse disciplines working at SAC together. We had scientists, engineers, administrators, software people, social scientists, technicians, tradesmen, gardeners and others at SAC and he got everybody involved. Today we talk about hiring "Event Management" companies for organising company level or departmental level functions for encouraging involvement and participation of the people.

Village Selection and Operation Electricity

During SITE we were required to provide direct reception television sets to about 2,400 villages in the states selected by the Planning Commission. To avoid any undue pressure we had evolved certain criteria based on which a computer program was developed. The required number of villages was to be selected by the computer using the criteria evolved by us and two of the most important criteria were the availability of electricity and the road distance from our maintenance sub centre. There was a time when we could not select the villages. Electricity was there in the villages but not in the public place of the panchayat or the school.

We had to ensure the availability of electricity at those places and had to evolve newer, more relaxed village selection criteria. We did that and then ran into a classic problem. Providing electricity was the responsibility of the state government or the local electricity boards. It was not a question of finance or money. What was needed was sheer physical work of providing the connections and meters. Professor Yash Pal came up with the plan of "Operation Electricity". We posted seven engineers for the work at local state government headquarters. They carried out the work of ensuring the availability of electricity through persuasion of the local people. Professor Yash Pal helped the work start by physically visiting a large number of people and persuading them to provide the necessary resources. His visits certainly helped persuading the concerned people and SITE was conducted as per our time schedule.

Delhi Earth Station of ISRO

During his tenure as director SAC, we were able to establish the Delhi Earth Station of ISRO. We had to change the main antenna contractor midway through the project and he was able to get that through. First of all it was a difficult task to get a place in Delhi and secondly it was happening in the glare of the political atmosphere in Delhi.

Pij TV transmitter and Kheda Project -

As part of the SITE Program we had

established a TV transmitter in a village, Pij, near Nadiad and a full fledged TV studio at SAC. This was supposed to be a temporary arrangement as part of the experiment. This transmitter and the required program production continued for almost ten years. Prior to this ISRO had established the Experimental TV studio in Mumbai. Professor Yash Pal was responsible for the basic concept behind the Science Programs to be produced for SITE. He developed the document called the "Our Credo" for that purpose. The Kheda project that followed SITE brought the importance of local programming in the right perspective.

Chairman, INSAT Project Management Board

This was indeed a difficult task for him. The project was organised out of Bangalore. The Space Application Center had the responsibility of delivering the earth station equipment for the INSAT-1 Master Control Facility. With his management and organisational abilities this was possible for him to do. Under his leadership the necessary equipment was developed and delivered. Most of that equipment is still working.

Remote Sensing

Next to the Space Communications as the major application of Space Technology, the technology of Remote Sensing and Meteorological Earth Observations was being developed at the Space Application Center. Professor Yash Pal had totally grasped the importance of those applications for the development and management of our agriculture and natural resources. He had totally supported our efforts in not just only the application area but also in the development of the payloads required for our satellites.

Chairman, University Grants Commission

When Professor Yash Pal was the Chairman, University Grants Commission, I got a chance to work with him closely for the establishment of the INFLIBNET- Information and Library Network for our Universities. He had already set up the Interuniversity Centers. During this work we could

again see his far reaching vision and understanding the needs of the aspiring university students.

He was responsible for setting the ball rolling for the "Countrywide Classroom" project, under which the Educational Media Research Centers and Audio-Visual Research Centers were established in numerous campuses of our Universities. These centers have provided us with the necessary large educational material broadcast through out the country. These centers will now provide us the necessary e-Content for our EDUSAT based efforts.

Science Communicator

Professor Yash Pal is an excellent science communicator. There is an old saying that I had come across which describes him wonderfully. The saying is – "A good teacher demonstrates. A better teacher is he who explains but an excellent teacher is he who illuminates and inspires". Professor Yash Pal has all these three qualities rolled into him. He comes across as a genuine scientist in all his television programs about science. His commentary during the solar eclipse events in 1982 and 1995 was excellent and he brought his enthusiasm on the doorsteps of every child that watched his programs.

Personally I have known him now for over thirty three years and I keep on wondering about his enthusiasm, his zeal and genuine concern for the science learning by the young children in our country. We have had numerous conversations regarding this over the years. These conversations have taken place while flying kites in Ahmedabad, while visiting Kennedy Space Center, while on his visits in Ahmedabad, Bangalore, Delhi or Pune.

Recently Professor Yash Pal was in Pune for the inauguration of the Astronomical Telescope established by IUCAA at Geravali. Looking at his enthusiasm younger people could not have felt that he will be completing eighty years. As a scientist he has inspired innumerable students and I sincerely hope that he will continue to do so for many long years.

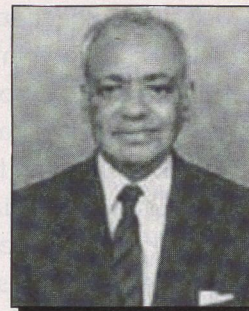
Dr. Pramod Kale

Former Director, Space Application Centre, Ahmedabad

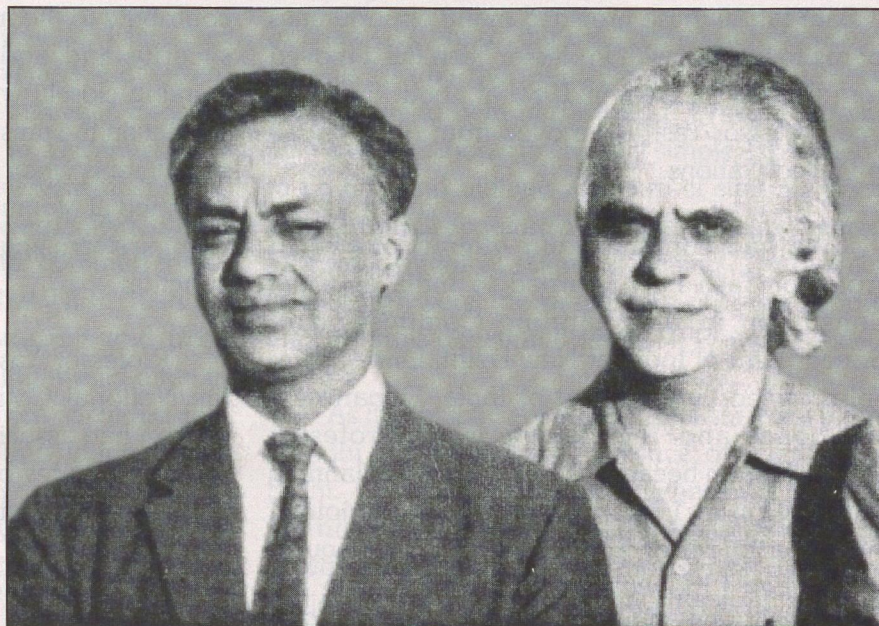
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Prof. Yash Pal and Myself

S. Varadarajan



It has been a privilege to have worked with Prof. Yash Pal in many organisations. We were together in the Council of the Indian Academy of Sciences during the years 1974-76 when Professor M.G.K. Menon was the President. I recall in one particular Annual Meeting in November 1975 at Nagpur when Shri Salim Ali, a Fellow, gave a memorable lecture. I have located a group photograph of Fellows in which Professor Yash Pal and I are standing next to each other. A copy of this wonderful photograph is attached.



Professor Yash Pal moved from the Tata Institute of Fundamental Research, Mumbai, to initiate the Space Application Centre of the Government of India, Department of Space at Ahmedabad in 1975. Many original innovations were made from here, which demonstrated numerous indigenous technologies to receive communications in all locations in India, especially rural areas, from Space Satellites. He continued to provide inspiration and guidance to many young scientists for such imaginative and original scientific and technological advances. These have grown in the last thirty years to bring information on agriculture, animal productivity, human health and

nutrition as well as education to all parts of this vast country.

Prof Yash Pal was also associated with the Physical Research Laboratory at Ahmedabad and other institutions in Gujarat. He was persuasive in obtaining enthusiasm for risk-taking in all programmes of the Space Application Centre. The results are visible today. Microelectronics, computer networks have produced globalisation and India is well prepared as a contributor and a participant. Not surprisingly, Professor Yash Pal was invited to be the Secretary General of the United Nations Space Co-operation in 1980 culminating in an international conference UNI Space in 1982.

It was a sheer coincidence that I moved from Mumbai to Baroda in Gujarat in 1974 to the Indian Petrochemical Corporation Limited (IPCL). I had to travel from Baroda to Ahmedabad several times a month to connect to a morning aircraft to Delhi with Engineers India Limited (EIL). I was also associated with other institutions at Ahmedabad such as the Indian Institute of Management (IIMA), the Ahmedabad Textile Research Association (ATIRA), the Physical Research Laboratory (PRL). Professor Yash Pal attended the Annual Meeting of the Indian Academy of Sciences in November 1976 at Baroda. All these provided many opportunities for me to interact with Professor Yash Pal. I moved from Baroda to Delhi in 1980 at about the same time Professor Yash Pal moved from Ahmedabad to United Nations.

We had continued our interactions when Professor Yash Pal returned to India as Chief Consultant in the Planning Commission of Government of India at New Delhi. Once again, I also joined Government of India, Department of Science and Technology, when Professor M.G.K. Menon became a member of the Planning Commission in 1982. Professor Yash Pal joined the Department of Science and Technology in 1984 when I moved to CSIR. To complete the circle, I joined the Planning Commission in 1986 as Chief Consultant, a position held by Professor Yash Pal during 1983-84. Professor Yash Pal again moved in 1986 as the Chairman of the University Grants Commission, a position he held with distinction till 1991.

I recall again a major meeting on monsoons called by the then Minister of Agriculture, Rao Birendra Singh in 1983 in which Professor Yash Pal and I were present together with the then Head of Indian Meteorological Department (IMD). Professor Yash Pal took keen interest in Meteorology and brought the IMD to the Department of Science and Technology in 1986. It has received very large support during the last twenty years to be in a position to take note of advances in electronic computations, communications, international co-ordination to contribute to the major requirements in air traffic, security and agriculture. I had the benefit of working closely with IMD, during 1975-78 on a project on the preservation of Taj Mahal and other monuments when a major petroleum refinery was designed at Mathura and huge rail traffic with coal burning steam engine was commonly seen at Agra Junction.

Professor Yash Pal was also a Chairman of the National Council of Science Museum with which I had associated and with Festival of India in United States of America. He continues to be actively interested in Science Education, Astrophysics and international communication. These are reflected in Television programmes related to spread of knowledge to distant rural areas.

Dr. S.Varadarajan,

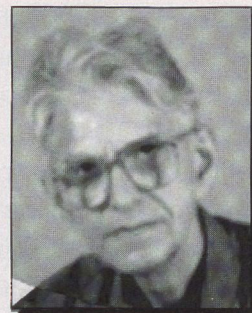
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Yash Pal – As I Know Him

Obaid Siddiqi



I do not recollect precisely when I first met Prof. Yash Pal; it must have been late 1962 or early in 1963 when I joined TIFR. In that year, Bernard Peters who had then moved to Denmark was spending the summer in Bombay. I remember going to a party at Yash's house on Warden Road with Peters and Bruce Dayton, another common friend who was spending a sabbatical at TIFR. Yash Pal and Devendra Lal had been students and close collaborators of Peters, and I found myself often in the company of this group which included late Prince Malhotra, Rama, Kausik and Tandon. Yash and Nirmal were hospitable hosts and their circle of acquaintances included many outside the TIFR Scientific community. The Institute, was not very large and those of us who gathered several times in a day around the tea table in the West Canteen, got to know each other well.

Yash was a few years older and therefore he bridged the gap between the newcomers and the not many, more senior people. He was an easy going person whose dress and demeanor was informal, hence it was not difficult to befriend him. I found that we shared the same beliefs. Yash had been a student activist and had worked after partition among the refugees in Delhi. He was an admirer of Jawaharlal Nehru and so was I. We believed that one of the purposes of developing science in India was to combat superstition and bigotry, and to inculcate what Nehru called scientific temper.

Madhuri Shah who was then a science officer

in charge of improving the teaching of science in schools run by the Municipal Corporation, drew some of us to help in this effort. I recollect going with Yash to schools to conduct simple experiments in physics and biology. A group of staff members at the Institute acquired a strong and lasting interest in improvement of science teaching. These small beginnings were the precursors of more serious efforts in this direction both at TIFR and outside.

As the initiative of Mr. P.N. Haksar, Mrs. Indira Gandhi convened a conference of scientists in Delhi. The purpose of the meeting was to draw scientists into national activities outside their professional sphere. The conference discussed subjects such as economic development, removal of poverty, improvement in science administration, reform of education, scientific temper and so forth, all the issues which, it seems to me, remain to be dealt with. I recall Yash working in a group which made recommendations on the importance of mathematical modeling and the use of computers in planning.

In the seventies when Vikram Sarabhai and Sateesh Dhawan set up the Department of Space Research, Yash led a major project on setting up a countrywide network of TV antennae and receivers to be used for educating the rural population. This was a feasibility study and, technologically speaking, a very successful experiment. Yash foresaw that, in order to be worthwhile, any truly educational TV programme has to have in hand imaginative material to be telecast. He mobilised a

group of young creative writers, movie makers and social activists for this task. I came to know some of them because they were, with Yash, frequent visitors to TIFR and were clearly infected with his enthusiasm. Using space technology for education and social transformation was close to Vikram Sarabhai's heart. Watching TV nowadays I have the inescapable feeling that this objective too remains to be accomplished.

From the Space Application Centre, Yash moved to Delhi as Chairman of the Universities Grants Commission, to deal with problems of higher education. At TIFR I saw Yash move often and we could exchange notes. Some ten years ago, I too shifted my sphere of operation from Bombay to

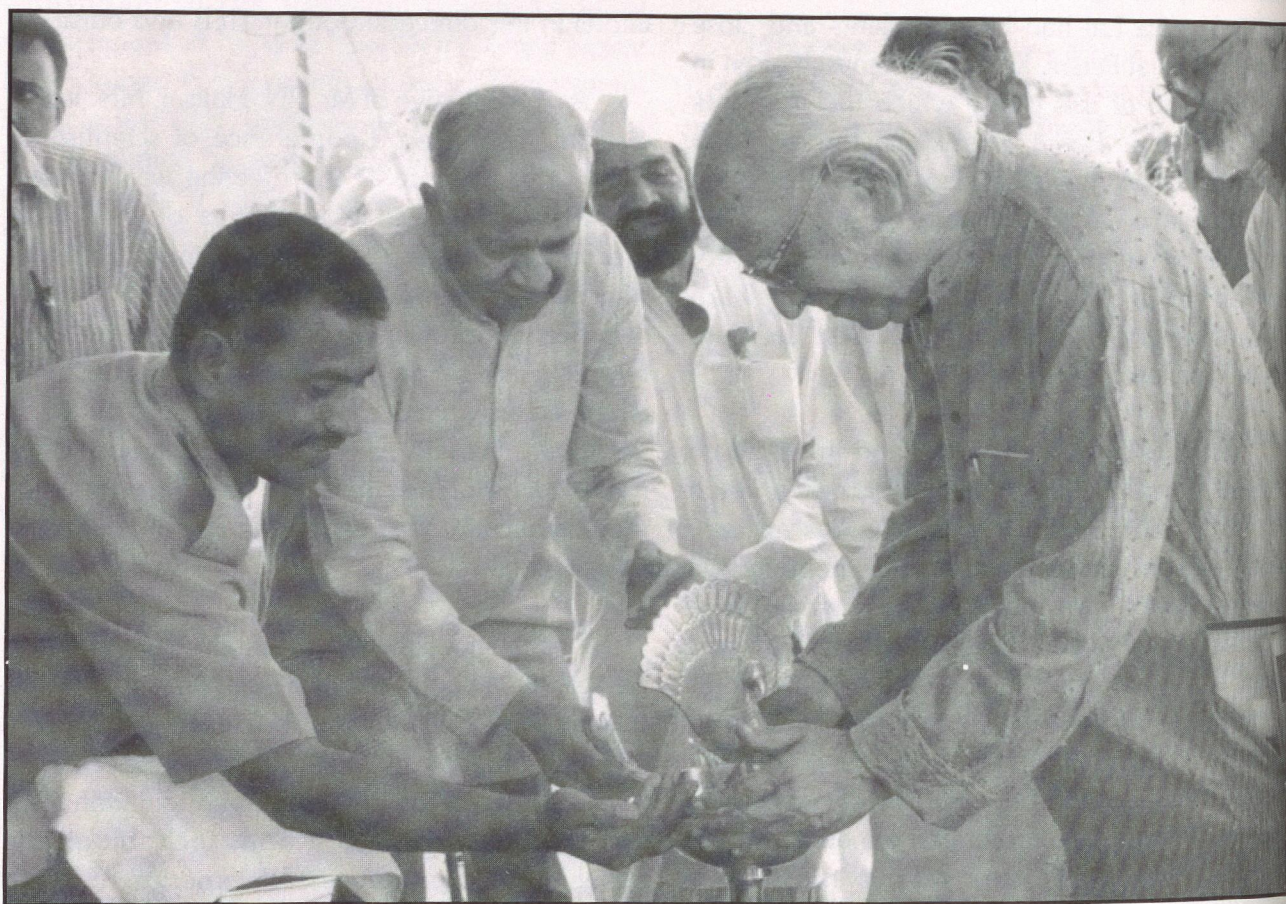
Bangalore, from one ivory tower to another. So I have not seen Yash much in recent years but I do see him occasionally on the television, discussing the ticklish problems of reservation, curricula and text books for schools or being interviewed on current scientific developments. He is now an elder statesman of science. It is a pleasure to watch him with the same questioning mind as always mildly iconoclastic but tempered with a sense of humor. I wish him a very long life in which he can continue to influence the minds of the young and the old.

Professor Obaid Siddiqi,

TIFR, National Centre for Biological Sciences,

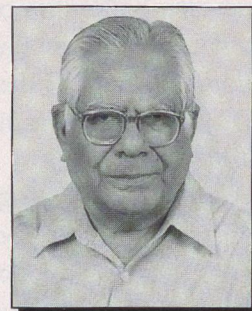
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Yash Pal - The Practical Idealist

Ram Prakash Bambah



I met Yash Pal for the first time in the summer of 1947, a few months before partition. Prof.D.S.Kothari had given me an appointment in Delhi University's Physics department. I came home to Lahore in the summer vacation and learnt that a family, which had moved into our neighbourhood, had a son who was not only brilliant in Physics, but was also devoted to the freedom movement. He was one of the very few students of Government College, Lahore, who wore only Khadi. Because of the prevalent violence at that time, we were apprehensive of more attacks in our locality. Our minds were totally preoccupied with the need to survive. Yash Pal and I found ourselves together during the night watch. We discussed and devised some measures to be taken in case of an attack on us. One of these was his version of Molotov Cocktail, fabricated from fused light.

I was happy to learn after a few years that Yash Pal had done very well in TIFR and MIT, and was now engaged in education through Satellite television. In due course, we started meeting at INSA and ISCA functions, and revived our acquaintanceship, which gradually developed into friendship. Our wives took to each other and the friendship became a 'familysome'. We had greater interaction when he became the UGC Chairman and I began to realise not only the power of his intellect, but also his commitment to true meaning of Science and Education. One of the proudest moments of my Punjab University



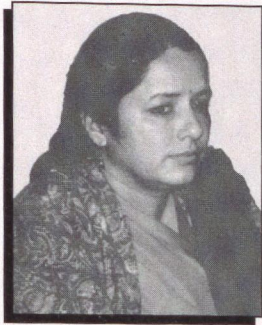
Vice-chancellorship was the convocation in which we gave Honorary Fellowship to three Punjabees: Yash Pal, Abdus Salam and Amrita Preetam.

In 1990-91, when my family became a target of terrorism, Yash Pal helped to relocate my daughter, son-in-law and grandson to Hyderabad, which eased my tension considerably. When I got associated with IUCAA, I learnt first hand what a vision of Yash Pal and dedication of Jayant Narlikar and his team can achieve.

At the age of 80 his enthusiasm and capacity to work are as great as ever. May he continue to contribute to our national development for many years to come.

Prof. Ram Prakash Bambah

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Professor Yash Pal : A Friend for Life

Chandita Mukherjee



The first time that I came across Professor Yash Pal I had no idea who he was, except that he was a member of the Governing Council (GC) of the Film and TV Institute of India in Pune, where I was pursuing my post-graduate studies. That was surely a disqualification as far as my friends and I were concerned, because we were having a wrangle with the authorities, threatening to go on strike and any member of the GC was surely not to be trusted.

For some reason the GC refused to meet us, possibly because we stood outside and made a lot of noise demanding an audience, threatening to gherao them. They sent out this jaunty pipe-smoking Professor to negotiate. He spoke mildly, trying to draw us into a conversation, but we acted

hostile, imagining that he had to be a slick hatchet man out to subvert our struggle.

We wanted to know who he was and from where. When it turned out that he used to be an astrophysicist and was now a manager in a government agency that made rockets, our mistrust was reinforced! The meeting was going nowhere and the man

courteously called it to a halt. He left, making us agree to meet him the next morning, after an overnight thought on his offer. We assured him that nothing would change from our side and in our vanity, we boasted that the poor GC emissary had been forced to exit in sheer frustration!

That night I went to talk to scientist N P Gupta, one of our seniors whom I trusted about the possible strategies for our struggle with the authorities. To my surprise, the same smooth-talking Professor was with him and I could barely hide my annoyance! Yash Pal took up the subject of the impending strike, asking me keenly about past events that had led to the current stalemate. He started turning the problem around, looking at it from various possible angles.

It was then that I realised that he was genuinely trying to help. He was not at all a villain and there was no reason to feel so hostile. We talked about all sorts of things—science, technology and society talk—like Rachel Carson's book *Silent Spring* and was it ethical for India to put resources into making an atom bomb—and had a most wonderful time.

The next morning, a typical victim of peer pressure, I kept up the hostile and sullen act when we met him. He was kind enough not to expose me and kept a diplomatic distance. Despite his sincere efforts, we went on strike and returned when we got what we wanted, after closing the place down for a couple of months.

A few months later, I applied for a TV producer's job with the SITE (Satellite Instructional Television Experiment) programme, a major experiment to see whether television broadcasting via a geosynchronous satellite could be used for wide-scale spread of education in rural India. When I went for the interview, there was the Professor again. It turned out that he conceived and built the Space Applications Centre (SAC), Ahmedabad, the organisation where SITE was based and he was its head.

Doing children's science programmes with SITE was a wonderful experience in every way. I grew out of a prolonged adolescence into adulthood during that time, learning to take responsibility and make impossible things happen. The manner in which Yash Pal ran SITE kept us all in a state of constant excitement, from the big boss himself to the middle bosses like E V Chitnis, Kiran Karnik, my studio head K Vishwanath, to the smallest bosses—producers like me who prowled around like tigers. Everyone was fully engrossed and everything worked, despite the huge pressures and desperate deadlines. Most importantly, we learned to work in teams—and not to compromise on quality.

There is plenty in development communication literature about SITE, so I will not tell the tale here

except to say that we were so enthralled with our work that it still matters thirty years later. Much of it was because of the way Yash Pal ran the show, triggering off the good qualities of everyone. Of course he had tremendous support from ISRO (Indian Space Research Organisation) Chairman Satish Dhawan and behind them was the vision of Vikram Sarabhai, the architect of India's space programme, who had died four years before SITE.

After SITE, I developed an independent practice as a development communication person, doing research, production and teaching. Apart from film and video, one worked in various media doing photo-documentations, slideshows, exhibitions and publications with a range of NGOs, UN agencies and government bodies. I ran into Professor Yash Pal at various re-unions of SITE people, seminars on education, communications and media during those years. He was always as curious and ebullient as ever.

"*Kya chal raha hai?*" is his favourite phrase and he has to hear everything you tell and then he relates that to other analogous things that he has heard of. This business of making frames and then juxtaposing them with other frames, making comparisons and transitions is typical of the way he works his way through unfamiliar terrains. "*Andaaz lagana*" he calls it.

Things race around in his mind and Yash Pal cannot help but pass on that excitement and curiosity. This one of the reasons why he has been such a success on TV with children and adults alike. He is thrilled if he understands a natural phenomenon and he will be dying to tell us about it and we viewers cannot help but be captivated and listen.

About a decade after SITE, in 1985, I thought of making an encyclopaedic set of films on the history of science in India. This was a massive project, involving many people all over the country and it would obviously be expensive to do. I was moving around, trying to build a consortium of

supporters. It was getting complicated—there were several funders, contributing differing amounts. The ones giving smaller funds wanted to have as much of a say in matters as the bigger donors. The latter wanted power to be shared on the basis of the financial contribution. This was outrageous according to the former, who viewed it as a committee of equals. Doordarshan refused to put any money in the pool but wanted their man on the committee anyway. Since it was the only broadcaster at the time, we had to agree.

I was wondering how this can be done, so went to Yash Pal for advice. He was the Secretary, Department of Science and Technology (DST) at the time and had promised me a little money for the research phase. He understood at once that the project was bound for disaster if the egos of so many different masters had to be accommodated and that the content would also get compromised like this. He said fine, bring the total package to DST, make me the chairman of a steering committee to run the project and say goodbye to the other funders.

It was bold and unbelievable, solving all the problems at once. That he could take a risk on me like this was something that gave me such tremendous strength and self-confidence at this crucial time that I thought I was levitating! A group of close colleagues and I made our reputations on this work, which was eventually called *Bharat ki Chhap*. The rest of this story too is known, or can be seen on google search engine.

By the time I came out of *Bharat ki Chhap*, Yash Pal was Chairman of the University Grants Commission. He did great things with the opportunities offered by the job. Always traveling, meeting all kinds of people, not getting stuck in the nasty stuff around him, pushing the good things through, he single-mindedly went on building departments of media and communications in universities all over India. He also helped to set up other centres, such as the Inter University Centre for Astronomy and

Astrophysics, (IUCAA, the Centre for Educational Communication (CEC), the Information and Library Network (INFLIBNET) and countless other institutions that brought all his favourite themes together. He chaired the committee that wrote the “Burden of learning” report, the classic critique of school education in India. I continued to meet him here and there and went for meetings related to these, since I too cared about the same things.

Of course he had his share of disappointments. The commitment with which the ISRO team had produced the satellite technology that gave India its satellite-linked national TV network, STD phones, ocean and meteorological data, remote sensing and so many other applications that we take for granted today, is something rarely seen in our society. They did it with no help from anyone, in the face of criticism in the country and external hostility, inventing and innovating, as they needed to. No doubt it pained Yash Pal deeply to see TV broadcasting, instituted primarily for education, get perverted into a means of entertainment of the already privileged.

Later, with satellite TV distributed by cable, the story changed far beyond recognition and TV became primarily a means of marketing, for ensnaring those outside the metropolitan world to buy into a lifestyle of colas and chips. That this industry was a magnet for the graduates of the media studies centres that he helped to set up, and that many of these centres themselves became sterile islands of mediocrity, did not escape his attention.

As an individual, Yash Pal is never down and out. Once he retired from his “official” life, not that it was much of an impediment in his case, Yash Pal now took to doing whatever he felt like, on the spur of the moment, no more a victim of his diary and its inescapable commitments. He speaks out against war, nuclearisation of South Asia and what the US is doing in Iraq. He goes around meeting all sorts of people, especially children.

He has a high-spirited partner in Nirmal, his wife of over fifty years who punctures his illusions. They have an adopted granddaughter Jyoti, and they delight in her questions and escapades and those of her younger brother. I think this has been the best phase of all in this rich and diversified life of 80 years, when Yash Pal just inspires others and sharpens their critical faculties, floating about, free of pedestals. He has had problems with his health, but on the whole, his zest for living shines luminously in his eyes. It has been my privilege to be able to talk to him throughout my adult life, to be inspired by him and to take pleasure in his company.

I have attended so many of his informal talks, his convocation addresses and read drafts of his articles that it all seems to collapse into one big theme: India. Education, information technology, networking the country to preserve diversity all come in this context. If he is talking about education, he'll celebrate the achievements of our crafts persons and farmers over the millennia, their capabilities to cope with adversity, to learn from experience and to innovate.

Relating that to education, he may say he wants children to be left alone to pull things apart and to learn how they work. He wonders about how children's questions can be made central to defining our educational system. With all the current talk of vocationalisation, he worries if we will have a nation of clones completely distanced from their own environment, its resources and needs, fit only to work in BPOs. Why not shift the emphasis to what people can begin to learn on their own, what they feel they want to learn? Learning is not delivered, it is created by the learner, he likes to say.

The developments in the past decade and half, particularly globalisation and rise of fundamentalism, have only sharpened his critical edge, giving him more to think and talk about in the science-education-society territory that is his home range. He loves to strip away the feel-good India-on-the-rise chatter of politicians, the people he meets at parties and seminars and TV commentators who claim that India is a world power in IT, biotech, agriculture and so on. While BPOs may get some of us a bit of employment, he always asks his audience to think about the value these workers generate for the overseas agency that employs them and how it ultimately it helps to increase the disparities between them and us.

Yash Pal is now keen on using information technology to network the whole of India, till the most remote regions, to enable information and experiences to be shared freely. "This might be a way of preserving our diversity and plurality. It might allow us to go our own way altogether. It might release tremendous energies. It might allow us the possibility that India will show the way to a new world. We must keep asking: *How to build an inclusive society? How to have an entirely new type of globalisation? How not to be dominated by centralising influences—international or national?* Networking might save us from social explosions, even from pathologies that breed terrorism."*

* Quote from article *India Can Follow A Different Path*, Yash Pal, *The Tribune*, 6 August, 2003

Dr. Chandita Mukherjee

Chairman, Comet Media Foundation

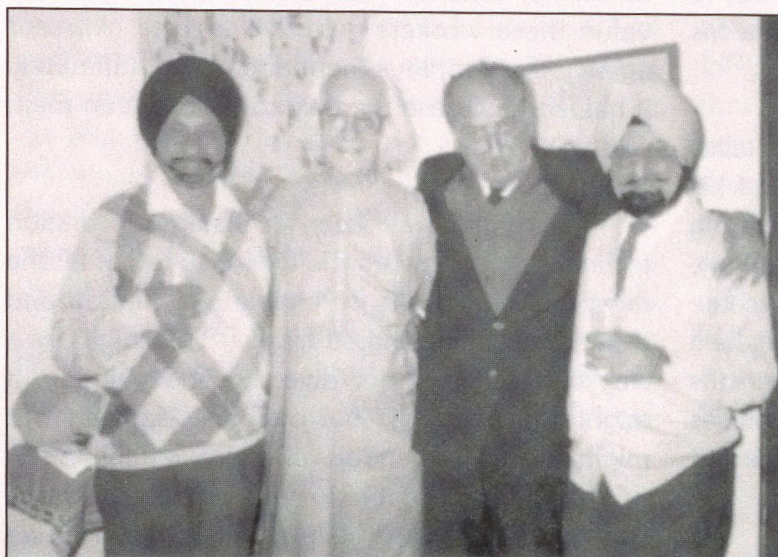
e-mail : cometindia@usnl.net





A Tribute to Yash Pal

Mohindra Chadha



I would try to recall some of the highlights of our friendship which is of long standing, dear to us and has enriched my personal life and that of others in the family greatly.

In the year 1943, we both landed in Lyallpur (now Faisalabad in Pakistan) to do our Intermediate in science (F.Sc.) at the well known Government College there. Yash Pal came from Jabalpur and I from Simla where our respective parents lived. We ended up living with our "Massi Jis" where we could get the comforts and the benefits of staying at homes under the patronage of close and loving relatives. Simla (as known in those days) had no college then, while Lyallpur had a degree college with science education till intermediate stage. Shimla has now a University and also the Govt. College at Lyalpur has become a full fledged University!

Lyallpur provided us with an opportunity to make many friends and to know Yash Pal and Nirmal who was a fellow student. He later married her in Pune in 1953. A decade's fondness for Nirmal ended in tying a knot and this wonderful relationship and companionship is ever so green after more than 5 decades!

Those were the years when the Freedom Movement was reaching a peak and Yash Pal was in the forefront of the student movement then and most of us had become great admirers of our leaders like Gandhiji, Pandit Nehru and others.

It was during this period that Quit India movement was gaining momentum. The atmosphere was charged with Patriotism and ferment of Nationalism took hold of our emotions and psyches.

This has survived in us over the years and gets greatly sensitized when any acts to disturb peace in the country, on the basis of any form of intolerance (caste, religion, region or language) are exhibited. We share a deep sense of admiration for our beloved country which is a unique bouquet of different faiths, religions, languages and cultures and which has been a cradle of a great civilization and is trying to re-build itself by taking economic strides and narrowing the gap between haves and have-nots and privileged and not so privileged. Yash Pal has made enduring contributions in the achievement of National Goals.

The friendship with Yash Pal and some others continued when several of us went to Lahore for our degree education, where we ended up in different institutions taking different courses. Yash Pal joined the Physics Honours School and me the Chemistry Honours School from Govt. College and Sikh National College respectively.

While we were receiving our education in Lahore, to our good fortune Yash Pal's parents moved there as his father Mr. Pyare Lal Bhutani was in a transferable job in Govt. of India. The move of the family from Jabalpur to Lahore was a wonderful thing to happen. It was the beginning of an era of friendship with the entire Bhutani family. I got to know a warm, highly cultured and hospitable family. The friendship, guidance and patronage of Yash Pal's parents (Bao Ji and Matta Ji) continued in Delhi where they migrated after partition and lived till the last days of their lives. They were true embodiment of a cultivated, hard working, noble, patriotic and benevolent Indian family. Their doors were always open for us!

While we were in Lahore, the virus of hatred amongst different communities and demand for a division of the country on religious lines had assumed a high pitch and when we were leaving Lahore for summer vacation for our respective homes in June 1947, we could never imagine that we would be meeting only as refugees in a fractured country due to partition in August 1947!! While it was the dawn of an Independent India, for many of us it was ending up with an un-predictable future, in terms of completing our education, finding our kith and kin, many of whom were lost and to find means to just survive. Those were difficult but challenging times!

Fortunately for Yash Pal, his father got a transfer to Delhi and I had an elder brother who was working in Delhi with whom I could live. Many others had to stay in make shift hostels in the old World War Two abandoned army barracks near Delhi University. Fortunately, Delhi University allowed the Honours School classes to be held on

its campus so that we could at least finish our undergraduate education. This we successfully managed and also we managed to complete our Masters' degrees in Delhi under the aegis of a make-shift Punjab University. Yash Pal finished University education with distinction.

In 1949, Yash Pal moved to Bombay to join the Tata Institute of Fundamental Research which was in its formative years and Dr. Homi Bhabha was the director of the Institute besides initiating the Dept. of Atomic Energy. Yash Pal worked closely with Prof. Bernard Peters and made several seminal contributions in the field of Cosmic Ray Physics.

After working in Delhi for 18 months, in 1952, I proceeded to Cornell University in USA for a doctorate in Chemistry and Yash Pal went to MIT, in Cambridge, Massachusetts in 1954 for his Ph.D. in Physics. He was accompanied by his bride Nirmal Pal whom he married to a few months earlier. Post partition, Nirmal's family had also migrated to Delhi and she worked there after doing her M.A.

In 1955, I moved to Berkeley California for a post-doctoral assignment while Yash Pal continued at MIT. We stayed in constant touch and even organised a concert at Berkeley and Cambridge respectively, by Pt. Ravi Shankar the sitar maestro. Later Pal and Nirmal, visited me in Berkeley and I visited them in Cambridge in June 1957, to spend a few days with them before returning to India. Nirmal was on family way then and a month or so later I got the welcome news that Anil Pal was the new member in the family!

Landing in Bombay and finding a job with the Dept. of Atomic Energy was a great event in my life as this is where Pals were to return and also it was here in 1958 that I met my future life partner and soul-mate Rajni Hora. After her return from U.K. with a Ph.D. degree in Psychology a few months earlier, she had taken a position with Hindustan Lever Ltd. in their MR Dept. In fact, when Pals came back from the States, we received

them and arranged for their stay in a hotel in Colaba in an adjoining room to where we were staying after our marriage in 1958. The four of us have been friends ever since and what a joy of life it has been!

It was during these years that Pals had their 2nd child Rahul who is now a scientist of considerable repute working at NII, New Delhi. Anil and Rahul and our 2 children Punam and Vikram have all integrated beautifully into our HAPPY FOURSOME relationship and has given an added dimension to our lives. This goes on as their spouses and next of the generation also talk of Pal uncle, Nirmal auntie, Mohindra uncle and Rajni auntie. Are we not FORTUNATE?! No visit of ours is complete without spending a few nights at PALS place in Noida and when they come to Mumbai we have the pleasure of having them stay with us and reminisce over the days gone by.

Yash Pal moved over from TIFR to the Space Application Centre, ISRO in Ahmedabad in 1973 and made some pioneering contributions in satellite communication and in later years he was the recipient of Marconi Award (1980). We visited the Pals in Ahmedabad and during a trip to Palitana, together discovered that his work at SAC had touched the lives of common people and young students. He was recipient of Padma Bhushan in 1976.

He served the United Nations as Secretary General of the UNISPACE programme in early 80's. On return to India he worked at the Planning Commission as Chief Consultant (1983-1984), Secretary DST (1984-1986) and finally Chairman of UGC (1986-1991). In each position he left an indelible imprint for his un-conventional and novel way of thinking.

His contributions which have touched the lives of all sections of the society besides the satellite television include production of highly popular TV serial "Bharat Ki Chhap" while he was at DST. His programmes on Door Darshan, like "Turning Point" have made him a darling of the people who respect

knowledge and in particular the school going children who want to learn more. In fact, whenever we have walked together, be it, the Bahai Temple, Qutab Minar or Suraj Kund areas near Delhi or Juhu Beach in Mumbai, within minutes a cluster of young student visitors from different parts of the country converge towards him and ask him for his autographs or a photograph with him. He is adored by student body in the country and his present involvement with Children's Science Congress is making a lasting impact.

He is well known for his constant fight against superstitions and his attempts to explain the so called miracles are praiseworthy. I am happy to learn from Rahul Pal that based on his contributions to the website egurucool.com, a book jointly compiled by him and his dad Yash Pal is under print! Hopefully it would be out before his forthcoming Birthday!

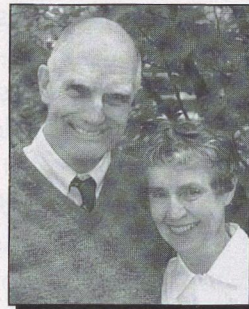
Whenever we get a chance, we talk about common friends, issues, policies and problems facing our own country and world at large. We have shared our grief over tragedies like the riots after the partition of India, intolerance of faiths leading to 1984 riots resulting in the loss of innocent lives, senseless demolition of Babri Masjid, Mumbai blasts (1993), 11/9 (NYC) and 11/7 (Mumbai), Godhra and Ahmedabad massacres and other sensitive issues. We have shared our concerns about attempts at 'Safronisation' of education and overall decay of human values. We have also often discussed exciting discoveries in Science, ideas related to Origin of Life, Space communication and overall questions related to educating and sharing of information with those who are curious to know. His own contributions in several of these areas are path-breaking and well known. I hail his overall optimism and enthusiasm for a Happy Tomorrow for the entire Humanity!

Prof. Mohindra Chadha

*Former Director, Bio-Medical Group, Bhabha Atomic Research Centre, Mumbai
e-mail : chadhams@mail.com*

Greetings to Yash Pal

Hale and Dottie Bradt



We remember very well your time here at MIT as a graduate student and as an officemate with me and Elihu Boldt. You had the same gentle warm personality and deep insight into problems that you have exhibited since. You and Elihu gave me an effective practice - PhD oral where Elihu was probing me about the physics of droplets in a cloud chamber. We also remember Nirmal from those days and how we entertained back and forth in our modest graduate student digs. For many years afterward we had a lamp in our home that we always called the "Yash Pal lamp", a gift from your home when you returned to India. Some years later, you came to the MIT sailing pavilion to wave me in, and we climbed to the top of the 30-story brand-new Earth Sciences building, before the access doors were secured. Our visits with you in the meantime have been few, but we have enjoyed every one of those. For example, we felt very privileged to be staying in the same residence as you in Bangalore in 1993. In all those years, we never left MIT!

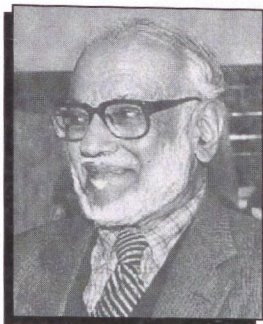
We wish you and Nirmal the best in the years to come.

The attached picture of Dottie and me was taken about 5 years ago.

Best wishes,

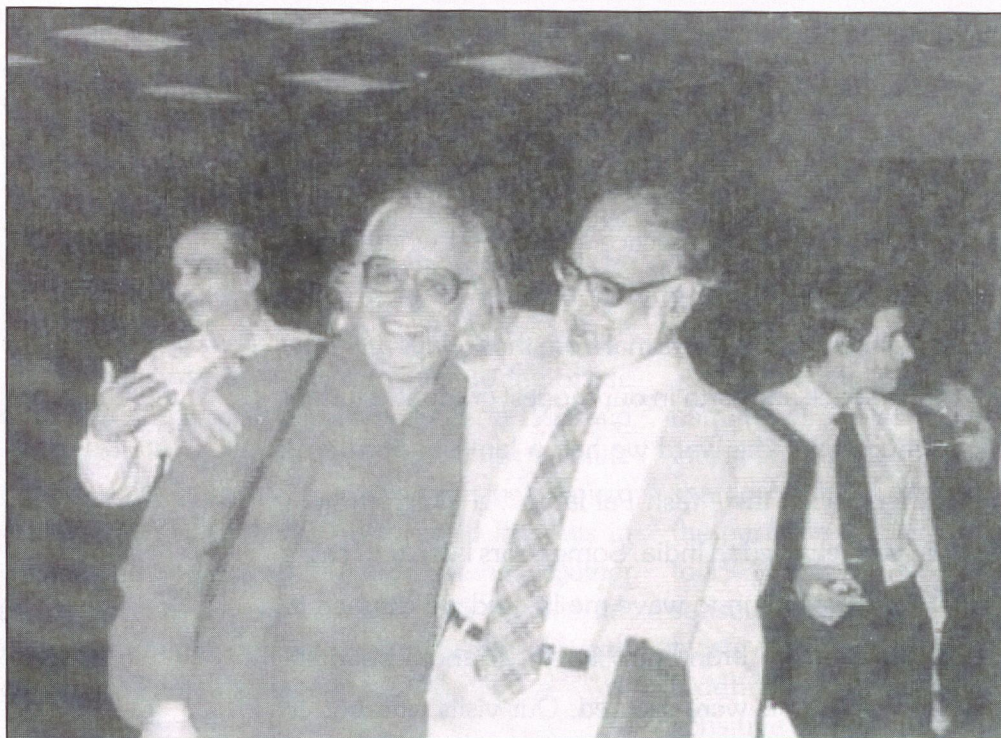
Dr. Hale and Dr. Dottie Bradt

Professor of Physics Emeritus, Massachusetts Institute of
Technology (MIT)
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Reminiscences of My Friend Yash

M. G. K. Menon



My first distinct memory of meeting Yash Pal was when he passed through Bristol in 1954, on his way to Cambridge, Massachusetts, where he was to start on a Ph D program under Prof. Bruno Rossi. It was in Bristol that I introduced him to Indu, who was studying at the University there, whom I married the next year.

I have a vague recollection of meeting Yash in Mumbai in the summer of 1953, at the Tata Institute of Fundamental Research, then located at the Old Yacht Club building near the Gateway of India. I was in India for a brief holiday, after spending, by then, 4 years at the University of

together! Those were truly friendly easy-going days. Fortunately, Yash has retained that spirit through more than five decades that have elapsed since then. If Yash thinks back, he will probably remember me in 1953 and then 1954, as being unpleasantly fat!

Even before I met him I knew of him by his reputation. The Lal-Pal-Peters papers relating to nuclear emulsion stacks carried up on rubber balloons over India, and the discoveries relating to strange particle physics that were made, had caused significant excitement, particularly when presented by Bernard Peters at the International

Bristol working in the Powell Group; (Cecil Powell had won the Nobel Prize for Physics in 1950 for his work relating to elementary particles observed with nuclear emulsions; that was when I was already there). I have only a vague recollection of meeting Yash in 1953 because on that occasion I was hijacked by Devendra Lal, who was very close to Yash, who carried me off on his motor cycle for a meal

Cosmic Ray Conference held in the south of France, at Bagnères de Bigorre in the Pyrenees in 1953.

Looking back, it is not surprising that the discoveries were made. Homi Bhabha had started rubber balloon flights for cosmic ray research when he was at the Indian Institute of Science, Bangalore. That area became one of the key areas for initial research at the Tata Institute of Fundamental Research.

Bernard Peters was a very distinguished cosmic ray physicist. Along with colleagues, he had discovered the presence of multiply charged heavy nuclei in the primary cosmic radiation. He was an expert on nuclear emulsion techniques. He had been trained under Robert Oppenheimer at the University of California at Berkeley in California. Bernard had developed abilities to ask original questions, as also the way of proceeding in science to answer these, that resulted in important discoveries. Those were the years, from the mid forties to the mid-fifties, when the nuclear emulsion technique was at its peak. It had yielded many pioneering results that were the base for further progress in elementary particle physics.

Bernard Peters had come to India in 1950 to conduct balloon flights. These were in continuation of what he was doing in the United States, to study the composition as also nuclear interactions of the energetic primary cosmic radiation. It may be recalled that, much earlier, the Nobel Laureate from the California Institute of Technology Robert Millikan, who was responsible for the name 'Cosmic Radiation', had come to India to fly balloons.

There was a particular reason why India was important. The geo-magnetic equator passes over the southern part of India. Indeed, that was the reason for the initial selection of Thumba near Trivandrum by the Indian Space Research Organisation (ISRO) as the location for the Thumba Equatorial Rocket Launching Station (TERLS), where today we have the Vikram Sarabhai Space Centre (VSSC).

The Earth has a magnetic field; it behaves somewhat like 'bar magnet' with the two poles (north and south) at the two ends (these magnetic poles are not far from the actual geographical poles). Lines of force connect these two poles exactly as you see when you play with a bar magnet and have iron filings around it, when you can see them distributed along the lines of force. Because of this magnetic field, low and high energy particles come in very easily at the poles, but at the geo-magnetic equator only high energy particles can enter. Therefore, over India it is possible to filter out all the low energy cosmic radiation. The latter may be of great interest for certain types of cosmic ray studies, but constitute a noise for high energy studies. I have gone into some of this background only to outline why balloon experiments over India were important for high energy cosmic ray based studies.

Thus we had a combination of circumstances. Balloon flights and cosmic ray studies being a thrust area for research at TIFR; the advantage of India as a location for high energy studies; the nuclear emulsion technique in its hey day; and most important, because of these, the arrival of Bernard Peters, an expert and a leader in this field. With this background, one can see the soil was fertile for the Lal-Pal-Peters discoveries.

Yash was born two years before me - on November 26, 1926 at Jhang, which is today in Pakistan. It is interesting to remember another very distinguished physicist who was also born in Jhang: Abdus Salam, who won the Nobel Prize for Physics. Abdus and Yash did their Matriculation from Punjab University Lahore; so did I - in 1942.

Yash studied at the Punjab University and joined TIFR very early in its history, in 1949. Homi Bhabha had invited Bernard Peters in 1951 to join as a Professor of Physics at the Tata Institute of Fundamental Research. Bernard Peter readily accepted because he was unhappy in the United States. That was the McCarthy period, when liberal or left-wing leaning was suspect. Indeed, Robert

Oppenheimer, the teacher of Bernard Peters, had been persecuted and investigated. Bernard and his wife Hannah (a medical doctor who found a research position at the Indian Cancer Research Centre in Bombay when Bernard was at TIFR) loved India and its culture. Bernard had seen the rise, before the Second World War, of a totalitarian regime in Germany – fascism under Hitler; indeed he had spent time in the concentration camp in Dachau. It is not surprising that he found the free and easy ways of India so attractive. It is important that we learn to preserve these and nurture them. Those were days when nationalities for such positions did not count. I recall here that one of the Presidents of The National Academy of Sciences, Allahabad was the great physicist and Nobel Laureate, Erwin Schrodinger.

Yash came under the magical spell of Bernard Peters, who was truly his Guru. He was joined in this activity by another physicist Devendra Lal, who was a highly innovative and brilliant experimental physicist. They formed a truly remarkable combination of youngsters who went on to make important discoveries. In Education Times (Dec 12, 2005), issued as part of the “Times of India”, there is a very personal and informal interview with Yash Pal on Bernard Peters, entitled “My Best Teacher”.

From Bristol, where I had met him in 1954, Yash went to MIT to do his Ph D with Prof. Bruno Rossi. His work there was on elementary particle studies at high energies based at the Cosmotron at the Brookhaven National Laboratory; this included the first measurement of the K_1^0, K_2^0 mass difference.

Whilst at MIT he was asked to present at the Fifth Rochester Conference, held during 31 January and 2 February, 1955, the results from TIFR, as the representative of the Bombay Group. Prof. R.E. Marshak, writing in “Essays on Particles and Fields” (M.G.K. Menon Festschrift), brought out by the Indian Academy of Sciences in 1989, had remarked : “Obviously, this was an excellent paper (with its anticipation of the theta-tau dilemma!) and it was

therefore no surprise to meet Goku Menon at the Fifth Rochester Conference as *the* representative of the Bristol Group. Menon gave a fine report on several decay modes of K mesons and hyperons being measured at Bristol (Menon 1955) (including one possible example of cascade hyperon decay, and, in response to a question from Oppenheimer – as to whether there was clear cut evidence of associated production of K particle and hyperon - he quickly furnished a list of a half dozen cases that seemed rather convincing. Goku seemed to be in complete control of all the technical details of the Bristol programme and of the major points of theoretical interest... other reports presented to this conference, on the nuclear emulsion work in strange particles (by Leprince-Ringuet from Paris, Dallaporta from Padua, and Yash Pal from the Tata Institute) were equally meritorious – a tribute to the fact that the Bristol “gospel” had been learned by other good groups throughout the world”.

After his Ph D from MIT, Yash returned to TIFR where he continued his work relating to high energy cosmic ray and elementary particle studies. Some of the areas where his contributions are important were: the pionization-fragmentation model of high energy interactions; understanding of cosmic-ray phenomenology including production and interactions of cosmic-ray neutrinos, particularly their energy versus flux curves; the steady state theory of cosmic-ray propagation in the galaxy; and analysis showing the increase of nucleon-nucleon cross-section at ultra-high energies.

In January 1966, I had taken over as Director, TIFR, following the tragic passing away of Homi Bhabha in the Air India crash. With passage of years, it was becoming very clear to me, that Yash was truly a leader with the ability to apply the scientific method over a wide range of problems. Whilst he was doing first class research at the cutting edge, he was cut out for much broader national leadership relating to science and technology, education and in dealing with complex societal issues. He had already embarked on aspects of science education and its role in rural upliftment,

through his association with the Eklavya and Hoshangabad programs in Madhya Pradesh.

In December 1971, Vikram Sarabhai suddenly passed away in Trivandrum. I was asked by Prime Minister Indira Gandhi to look after the Space program until an appropriate full-time person could be found. That person was Satish Dhawan, Director, Indian Institute of Science, Bangalore, who was then away on a sabbatical at the California Institute of Technology. When he returned, he took charge as Chairman ISRO with élan and great success.

When I took charge as Chairman ISRO, I found I had inherited a large number of institutions both in Ahmedabad and at Thumba of which Vikram Sarabhai had been Director; I had inherited this mantle. I felt that whilst these may have been started with different individual objectives, the time had come to integrate activities at the two locations: namely, an integrated space facility at Thumba and a similar one at Ahmedabad. I was in touch with Satish Dhawan at Caltech and he agreed with the suggestions that I made.

The institutions at Thumba were brought under one umbrella, which today is the Vikram Sarabhai Space Centre. I had persuaded Dr. Brahm Prakash, who was then at BARC, to take charge of this integrated set up. Satish Dhawan was happy with this, since he had great confidence in Brahm Prakash whom he knew when the latter was at the Indian Institute of Science.

I felt that Yash Pal would be ideal to provide leadership to the new integrated set up in Ahmedabad, but did not suggest it to him since he was working at TIFR. At my suggestion, Satish Dhawan invited Yash to be the Director of the newly set up Space Applications Centre at Ahmedabad. It represented a much broader assignment than just continuing with distinguished research in physics. It had at its core the development of advanced science and technology, particularly in the fields of electronics and instrumentation relating to various

areas of application: satellites, tele-communications, broadcasting, remote sensing and the like. It involved areas of relevance to society that would benefit from these applications, such as education, agriculture, water, environment and many more.

The first example of Yash's leadership was seen in the Satellite Instructional Television Experiment (SITE) which involved the ATS 6 satellite of the USA, which was moved to a location overhead India; it was used to demonstrate that it is possible to locate television sets in the most remote parts of the country, have them operated and well maintained, and convey programs which would relate to developmental and educational purposes. Prof. Yash Pal received the Marconi Prize for the success of this effort.

Later Yash was Secretary General of the UN Conference on the Peaceful Uses of Outer Space. From Ahmedabad, Yash Pal moved to Delhi as Chief Consultant, Planning Commission, thereafter he was Secretary Department of Science & Technology; and then Chairman UGC.

Pal has been closely connected with a large number of non-governmental science movements in the country. He has particularly promoted and supported these movements as Secretary, Department of Science & Technology through the mechanism of the National Council of Science and Technology Communication (NCSTC). He was the person who is identified with the science programme on Doordarshan referred to as 'Turning Point'. This has been a highly interactive programme which has been well appreciated. This involved getting questions, comments and responses from people, particularly the younger generation, which were then dealt with in an informal "chat format". When he was Chairman, UGC, Yash had proposed a major possibility of all students devoting one year for a mass programme for national regeneration.

Yash Pal's efforts at "popularisation of science" have thus not remained at the level of

explaining scientific discoveries or knowledge in simple terms for the layman. His concerns have been closely connected with the concept of “scientific temper” that Jawaharlal Nehru and Indira Gandhi had talked about: to look for, and to encourage, innovation and curiosity throughout society; to demonstrate how modern developments in science and technology can be harnessed, not purely in a way imitative of what is happening in the advanced countries, but in a manner in which it would relate to the local needs and cultures. In this respect Yash is not only a “populariser” of science, but one concerned with issues of philosophy, ethics and patterns of development that are sustainable, and relating them to the objective, rational approach and method of science. He is truly one of the most distinguished figures in India in taking science to society at large. For him science is not a mystery to be explained, but an integral part of culture, education and humanism. Few people have understood, far less appreciated, the meaning of the phrase scientific temper, so aptly coined by Jawaharlal Nehru. For me, Yash is one of those few who embody the spirit of it in their activities.

I have known Yash’s wife Nirmal for the past half a century – a completely frank, honest and fearless person. I particularly got to know Nirmal’s

mother with whom I had a special bonding. I think of her and miss her.

Yash was always a free non-conformist: in the institution created by Homi Bhabha, he wandered around in pyjama – kurta; why not? (The latter is as important a question that scientists must deal with as “why”). His colleague Devendra Lal was equally a non-conformist, dressed up in bright and sometimes garish colours – though still as shirt and trousers! He got hauled up by the very proper Deputy Director (Administration) the Englishman, Mr. E.C. Allardice. My habit of going around in kurta-pajama (particularly the trouser replacing the pajama) is what I learnt from Yash!

For me Yash represents Quetta with its earthquake, pre-partition Panjab with its graciousness, liberalism, secularism, vibrancy and aristocracy; steeled in the trauma of a Partition, but retaining all these qualities. Normally elders give their blessings to a younger person; but what is it that a younger can give to an elder; I do not know. Whatever that be, Yash has it from me: very best wishes, always.

Prof. M.G.K. Menon

*Former Minister for Science & Technology,
Govt. of India*

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Success, Thy Name is Yash !

Vasant Gowariker

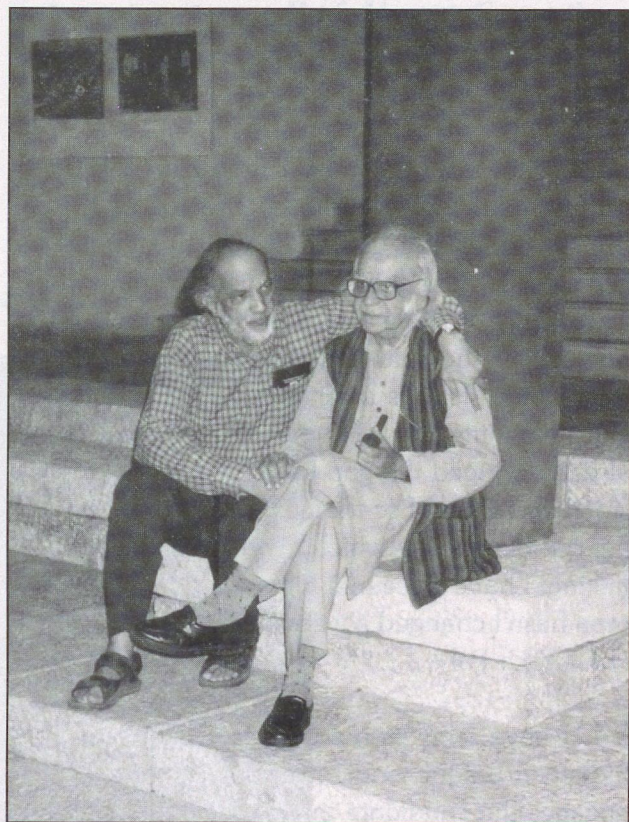


As Yash and also Kalam climbed dizzy heights, they seemed to view the ground and creatures thereon getting closer, not farther. Is it some variant of the Doppler effect in human relations?

I am writing this while I am traveling by train. I merely have a writing pad and pen, and no reference material on Yash. I don't need it, as I know him like the back of my hand. I am aware that many would make the same claim, but mine is unassailable. The trouble again is that many would also make the same *unassailability* claim! What can I do?

The train has come to a halt. Somebody seems approaching me... "Are you Mr. Ali?", he asks. "No Sir", I say. Disappointed, he goes away. And I think of Yash. "You **are** Professor Yash Pal, aren't you?". Yash is tired of answering this question wherever he goes. From among the scientists, his is perhaps the second most familiar face next only to Dr. Kalam's!

To thousands like me he is Yash. To the TV-radio-newspaper men, whom my wife calls Yash addicts, he is *Professor Yash Pal*. They seem always on the prowl to scoop out of him, something related, or sometimes even unrelated, to science! Whatever the subject – earthquake, hailstorm, Halley's comet or Lord Ganesha drinking (or not drinking!) milk – the media folks love to *gherao* him! And he in turn sends them off as a satisfied lot walking on air! His straight,



simple explanation of scientific phenomena expressed in his deep, sonorous voice is music to their ears!

What does he mean to me? An alert scientist? Yes. A brilliant educationist? Certainly. An eloquent public speaker? Of course. But over and above all this he is also something else. For instance, Yash is a great science populariser. He gets the inquirer quietly involved in the probing process. While doing so, he always has some

home-grown similes thrown in for good measure! Even to the uninitiated, he makes science look easy, simple and irresistible. He has cultivated the art of putting across science in a language that his audience can easily assimilate. He is not bookish, which makes students stay with him absolutely glued!

Having said this, I now have a dilemma. People often call all their heroes *good human beings*. This is far too overused an expression, almost to the point of losing its meaning. I don't want this to happen in the case of my hero. So I would like to give reasons why I consider Yash the way I do.

I first met him in the early 1970s in Ahmedabad where he was Director of ISRO's Space Application Centre (SAC). I extended my hand for a handshake; he, instead, gave me a warm hug! "I have heard so much good about you, *yaar*", he said with tremendous warmth. I felt elated. He was a renowned Centre Director, and I was little known and very small. But he had already bridged the gap between the big and the small by his act! For the next hour or so, he took me out of myself – which meant I did most of the talking! I have since met him countless times. The man hasn't changed a wee bit! That's our *Success Pal* – Yash Pal !

I have seen Yash conducting interviews. It is indeed a unique and rewarding experience. He engages the candidate in a homely dialogue and finds out what the candidate is best at. Whether or not the candidate is selected or promoted, one thing is certain. He walks away with something precious – with his dignity not just unscratched but actually enhanced.

I have seen Yash when he *was not* a Secretary to Govt. of India; I have seen him when he *was* a Secretary to Govt. of India. There was no change in him. His warmth, friendliness and demeanour have remained intact. It's as if his position or designation is teflon-coated and he

doesn't get affected by who he talks to, big or small! As Yash, as also Kalam, climbed to dizzy heights, they seemed to view the ground and creatures like us getting closer, not farther! Some variant of the *Doppler effect* in human relations, perhaps?

My mind slips into a live history. After nearly two decades with ISRO, I was at Stanford University for completing my book on *Polymer Science*. I was hardly there for six months when one night Yash called. "I am moving over to the UGC", he said, "Your name seems to be under serious consideration at the highest level as my successor. Please don't say "no", *yaar* !"

I was awake the whole of that night. Yash kept coming back to my mind again and again. What is it that I did for him, I asked my mental search engine, that I keep getting so much of his goodwill, help and support? Precious little or nothing whatsoever, was the answer! There was only one conclusion: *Yash is a good human being*.

I have said a lot about what Yash has been to me. That's symbolic. Surely, there is no reason whatsoever why I should be any different in his eyes from others. He didn't know me from Adams, we are not related, we didn't work together, we belonged to different places and our back-ground is also different. I take it, therefore, that what he has been to me is representative of his universal attitude.

In the early 1990s, my term as Secretary, Dept of Science and Technology (DST) was about to come to an end. I had packed up my things and was somewhat relaxed. There was a cupboard which according to Mr. Gera, my PA, contained some old and out-of-date papers. So I had never bothered to open it. It just occurred to me that I had some spare time, so I might as well clean up the junk for my successor. It didn't take long for me to dispose off the papers, except for one which stayed in my heart! It was a copy of Yash Pal's note to the Prime Minister, making out

a case for the creation of a Special Secretary's post in DST and recommending that I be invited to occupy it! I don't know the outcome of that note or whether it was even sent at all. I knew nothing whatsoever about it throughout my term as Secretary DST. But it was an expression of Yash's goodwill towards me. Never did he tell me what he had attempted to do for me! I wish he had... my embrace would have been even warmer! That thought about Yash still persists with me even after fifteen years!

We are all prisoners of a peculiarly self-patting, self-centered world. If someone obliges another, even in the tiniest little act, no opportunity is lost to let the whole world know about it, till the act loses all its charm. But not Yash. He did so much for me quietly without breathing a word about it to anybody, not even to me!

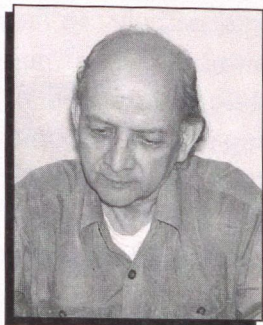
So, between the three events, namely our first meeting at SAC Ahmedabad, his note to the Prime Minister and his midnight telephonic call at Stanford, lies the most fascinating story of our one-way, *him to me*-relationship, and of why I call Yash a *good human being*. Indeed, he is not just good; he is one of the *best human beings* I have ever come across.

At 80, Yash is only middle-aged. He can't think of fading out for at least another 20 years.

Prof. Vasant Gowariker

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Reminiscences of A Multifaceted (pipe smoking) Scientist – Yash Pal

S. M. Chitre

(In conversation with A. P. Deshpande)

Anant Deshpande: When you returned to India and joined TIFR, Yash Pal was already there, was he not!

S.M.Chitre: Yes; Yash was already there when I joined TIFR in September 1967. Curiously Yash Pal was amongst the first few persons from TIFR whom I had met outside the Institute-in fact, in January 1967 at the Texas Symposium held in New York City. I had come from Caltech; Pasadena to attend the meeting and Yash Pal was one of the speakers. Then when I joined TIFR and was walking down the corridor on the 4th floor, I located his office and entered to be greeted very warmly....

Anant Deshpande: Was Peters there in the Institute?

S.M.Chitre: No, Bernard Peters had already left the Institute and had gone back to Europe, but he used to come on short visits to TIFR when I interacted very briefly with him. There was, of course another colorful person, Devendra Lal on the 4th floor. You probably know Lal, Yash Pal and Peters had worked together.

I enjoyed Yash Pal's company greatly - he has always been pleasant, friendly and a warm person. We used to have our tea/ coffee in the West Canteen of the Institute located on the ground floor; you may not believe it, but one of the pieces of work we had done together originated practically while having our coffee. I still remember we were sitting there in the Canteen and discussing what would be the implication if the charge of the electron were to vary with time- that is, if it had a different value in the past from what it is now, what

would be the implications from observational standpoint. We worked it out and submitted a paper to the Physical Review Letters, which was later published.

So you can see it was great fun interacting with these lively minds! I should tell you, TIFR atmosphere in the late sixties used to be quite vibrant. First of all, it was not as big in size as it is these days - I think we were about 1,200 all together and the strength now is probably close to 1,900! We could discuss science freely in the Canteen and write research papers at the end! Pulsars were just discovered then and we would discuss the role of neutron stars in powering radio pulsars. I remember with Govind Swarup and Kundu, I had likewise had done some work on the emission mechanism of pulsars.

That was the era that was! These were all my senior colleagues in the Institute, but they made me feel very welcome and helped me settle in the intellectual environment of the Institute. And I recall just a year or two later, Yash Pal and Nirmal had invited me and my wife to join the party to celebrate their 15th wedding anniversary. I think that was the first social occasion held in the West Canteen of TIFR which we had attended and this was in some sense our introduction to the social milieu of TIFR - Yash and Nirmal were responsible for it.

Anant Deshpande: And how did he use to dress up in those days?

S.M.Chitre: Yash Pal was always very informally dressed, but I don't recall if he used to wear kurta at work in those days. Later

on, perhaps, we would invariably see him in his 'Kurta'!

The Yash Pals had a flat some where near Pedder road. I forget the exact location. We had been there for a Sunday lunch with the family. Occasionally the family would cycle to see friends in the suburbs and stop by our place in Bandra. Yash Pal was indeed somewhat of an iconoclast. We sort of became family friends and later on when we were in New York City in 1970s on sabbatical, they visited us. I think they had traveled from the Boston area. Later in 1972 he left TIFR to direct the Satellite Application Centre at Ahmedabad.

Anant Deshpande: During your period when you met Yash Pal and when he left in 1972 was Ramanath Cowsik there?

S.M.Chitre Oh yes, Ramanath was probably one of the first students of Yash Pal's and was my contemporary. I remember when Fred Hoyle visited the Institute some time in 1969, Yash Pal was the host at the time. I must confess there was a very embarrassing situation for me during Fred's visit! I think it was on the last day before Fred was leaving Bombay, Yash Pal had arranged for a table to have an early lunch in the West Canteen; like a typical rash young man, I went and greeted them. I didn't know that they were having a private lunch in the canteen; Yash Pal, of course, welcomed me to join them! I always enjoyed my social and of course my academic interaction with Yash.

I remember in 1972 when I was at the Goddard Institute for Space Studies in New York City, Al Cameron, a well known nuclear astrophysicist had received a letter from Yash telling home that he was leaving TIFR and moving to Ahmedabad as Director of the Satellite Application Centre. Yash added a post script that he had hoped that people would make a charitable assumption that he is still continuing to do science and retain him on their mailing list.

Later whenever I visited PRL (Physical Research Laboratory, Ahmedabad), Yash Pal would invite me to his home; I recall on one

occasion when Philip Morrison was visiting Ahmedabad, Yash Pal and Nirmal had invited me and my brother, Prakash for dinner at their place. I think Yash was fond of Prakash who is a relativist; Prakash told me when he was visiting Mumbai during 1971-72 and had given a seminar in TIFR, Yash Pal was in the audience and at the end of the seminar, he said to my brother "Bahoat Maja Aa Gaya"!

Anant Deshpande: Where did your brother work at that time?

S.M.Chitre: My brother Prakash was at that time a Post-doc, I believe, at the University of Santa Barbara, California. He later joined the Raman Research Institute, but returned to the U.S. when he found his wife who is a Laser Physicist could not find a suitable job in Bangalore - this was in the late 1970s. Prakash now works for the Communication Satellite Lab - now called VIASAT.

Anant Deshpande: Did you have any paper jointly written with Yash Pal?

S.M.Chitre: Yes, indeed, that's the paper I was talking about earlier which arose out of our discussions in the West Canteen.

Anant Deshpande: I think it would be interesting if the West Canteen starts writing its own history or reminiscences and about what ideas originated in that place!

S.M.Chitre : It would be the most interesting account to read. I always felt that this was the overwhelming advantage of working in TIFR - under one roof you could find Geophysicists, Cosmic Ray Physicists, X-Ray Astronomers, Theoretical Physicists, Theoretical Astrophysicists, Nuclear Physicists, Mathematicians, Computer Scientists and many more experts and of course, then there were Experimental Physicists -the Institute is very interdisciplinary in character. You just had to go up or down one floor and you could get expert advice from colleagues from a variety of disciplines.

That's how we in fact, started working on the

physics of Neutron Stars. The nuclear physics colleagues form the Theory Group, Banerjee, Virendra Gupta and then there was Pandharipande- we were all inspired by a stimulating discussion with Hans Bethe who was visiting the Institute in early 1970. Pandharipande worked on the fluid model of neutron stars, while we worked on solid crystalline neutron matter in the cores of the neutron stars!

Anant Deshpande : Tell me one thing: Yash Pal is going to turn 80 now and you are 10 years younger to him, so did the age difference matter?

S.M.Chitre: No. Not at all! That was Yash Pal. He always made you feel completely at home!. In TIFR you were never conscious of the hierarchy, and Yash Pal was the epitome of that – that's what I enjoyed about the working culture of the Institute. From the intellectual stand point, I found TIFR very satisfying and refreshing because I came across colleagues like Yash Pal, Devendra Lal, Sreekantan and Danial and of course there was the presence of M.G. K Menon until mid-1970s directing the Institute and encouraging us all.

Anant Deshpande: Yash Pal was in Lahore before he came to India after partition. He had to leave that and he came to India - did you find any bitterness in his attitude or behavior because he had to leave Lahore?

S.M.Chitre: None whatsoever, as far as I could tell. I don't think Yash Pal carried any animus or bitterness, at least I did not see any evidence of that. That was one aspect of Yash Pal's personality – he was a very sociable and cultured individual who was very fond of the theatre and one always enjoyed his delightful company; one was ever bored in his presence. I learned a lot from my conversations with Yash Pal.

Anant Deshpande: What we see Yash Pal today as a multifaceted personality, did you find any seeds in his nature even during that period around 1967?

S.M.Chitre: Of course, it was visible in those days!, He was a kind of Renaissance Man with different interests; not just limited to scientific aspects He was always interested to find out what you are working on currently and which are the new discoveries reported in your area. Remember that 1960s-1970s was the Golden Age of Astronomy with a succession of exciting discoveries made.

Yash is a very liberal minded person with a broad vision. I think in some sense he has a similarity with his friend and mentor, I am sure you know that besides being a brilliant scientist and teacher, Philip Morrison was the Book Editor for Scientific American. Yash Pal went on to win the Marconi Award around 1980 because of his contributions to Satellite Communication and, in particular his work in Satellite Education. Clearly Yash Pal has a very polished and sophisticated personality, which comes through when you talk to him, and I have always enjoyed my interaction with him.

Anant Deshpande: That means when you say TIFR is a multidisciplinary institution, Yash Pal was one more example of someone who himself was a multidisciplinary person!

S.M.Chitre: Sure, you can identify Yash Pal with the multidisciplinary character of TIFR, and his multifaceted personality has left its mark on the area of Cosmic Ray Astrophysicists

Prof. S. M. Chitre

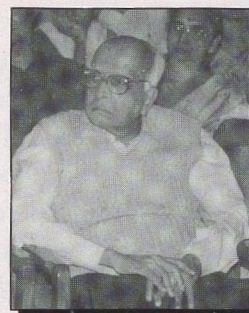
*Emeritus Professor, Department of Physics,
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*e-mail : kumarchitre@hotmail.com
kumarchitre@gmail.com*



Down the Memory Lane, with Yash Pal

B. M. Udgaonkar



Both Yash Pal and I joined the TIFR as research scholars in 1949. However, we had only a limited interaction in the early years. In fact, the only thing I can remember about him from the early years (at second hand) is the story of his encounter with the chief administrative officer of the Institute, Mr. A, a Britisher who had taken retirement from the I.C.S. Yash had one day gone to see him about some work, when Mr. A made some uncalled for comments on Yash Pal's dress (viz. pyjama and kurta, in which he is familiar to most of us) and gave some equally uncalled for advice that he be better dressed. Yash Pal ticked him off, pointing out that what he had on was the national dress, and walked out, banging the door behind him.

Our interaction increased in the mid-sixties, after both of us became members of an informal discussion group of about a dozen scientists, who met once a week in the evening to discuss what we could do out side our ivory tower. The meeting would last a couple of hours, and culminate in dinner in the Institute's canteen.

In 1966-67, the Prime Minister, Indira Gandhi had called a Round-Table of scientists. Yash Pal was an invitee. Yash and I got talking about it, and jotted down what we thought would be worthwhile discussing at the round-table. This resulted in two notes: one on the Development of Interface between National Laboratories and University; and the other on a proposal for Inter-Disciplinary Brain-storming camps on problems that matter. These were presented by Yash (among other things) at the

Round-Table and appeared in *Vigyan-Karmee* (volume 19, 1967)

Both of us continued to be interested in the interaction between National Laboratories and universities in our own ways. I concentrated on efforts at the Bombay University. The university did not have a department of physics at that time. I pointed out to the distinguished Vice Chancellor of the Bombay University and to the Chairman, UGC that if the Bombay University and the TIFR could develop an appropriate mechanism for working together in setting up and running a department of physics involving the TIFR scientists and facilities in a substantial manner, then over night the university could have a world-class university department of physics. I was encouraged by comments of friends like Yash. But universities have their own priorities and ways of functioning. The only concrete thing that could result was the formation of new Department of Physics at the University in 1970 with one of the TIFR scientists as Professor and head. The potentialities that I envisaged remain unfulfilled.

Yash made an important contribution in this area many years later when he became Chairman of UGC, by creating some Inter-University Centers.

In January 1970, Yash was a consultant to a physics study group sponsored by the National Council for Science Education (NCSC) and NCERT. Yash invited Shri B.G.Pitre a teacher in the Doon school and Director of a physics study

group sponsored by NCSC and NCERT, to give a demonstration lecture at the TIFR on a 'New approach to school science education' which some of us attended. The approach looked very interesting. There followed the organization of an orientation camp for teachers in the Bombay Municipal School system at Class V level. This was supported by the National Council for Science Education (NCSE). Next year there was another camp for municipal teachers, for Class VI material, again supported by NCSE. The following year, however, we learnt that we would have to cancel the orientation camp for which preparations were well on the way, because of problems at the NCSE. Yash and I took up the matter with the Minister of Education and the camp was saved. However, I realized that if we were to carry out any activities at the school level in a sustained manner, we could not depend on an outside entity like NCSE. We started thinking of institutionalizing our school science activities and very soon (1974). Homi Bhabha Centre for Science Education got created under the leadership of V. G. Kulkarni, who had played a crucial role in the three orientation camps.

In the meantime, Yash had taken over the directorship of the Space Applications Centre at Ahmedabad. He sought the help of the Homi Bhabha Centre for the earliest films on elementary science for the SITE programme that he had taken up at SAC.

In the next few years, I used to hear exciting accounts of the various innovations Yash was trying through SITE. Unfortunately, I have an impression that the full educational potential of the SITE programme, including its interactive innovations were not realized. The SITE experiment remained an experiment and did not get utilized by the government when creating a national TV network.

Yash and I have continued to share many interests, though our paths have taken us in different directions. For example, when the Bharat Jan Vigyan Jatha (BJVJ) was conceived some years later, the people's science movements which organized it invited me to chair the Organizing Committee for the first one (1987), not surprisingly, when then next one was organized (BJVJ-II), they invited Yash to chair it.

It has been a great pleasure to have a friend and colleague like Yash. Let me wish him good health, success in whatever he undertakes in later years. I would have liked to participate physically in the felicitation function, but unfortunately health problems make it impossible.

Prof. B. M. Udgaonkar

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Govt. Of India
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Navi Mumbai 400 703*

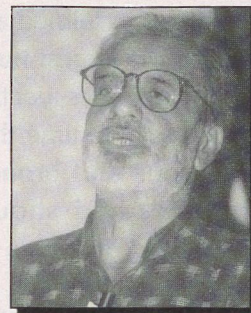


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- Vigyan Prasar, New Delhi

Yash : The Coolest Guy!

Naresh Dadhich



I recall Yash visiting us in the very early days of IUCAA (Inter-University Centre for Astronomy and Astrophysics) as we sat outside the Aditi shed for tea with students, postdocs and faculty. Yash was in his usual informal best but at the same time had no nonsense flair and we talked about various things. Of course, one thing, which was uppermost in our minds at that time, was how would IUCAA come up? Yash plunging into Hindi, which he does when he wants to indicate warmth or profundity, said, "*Ek achchhi cheej banani hai, yaar*", don't worry it will happen. The kind of confidence he commanded and imparted to one and all around was stupendous. After the tea, one of our postdocs at that time, Abhijit Kshirsagar, who is unfortunately no more, said, "He is really cool". And that expression has stuck; for I believe that it is a true and honest description of the spirit and persona called Professor Yash Pal.

I had seen Yash for a long time and like everyone else had admired him from a distance but had interacted and known him only during the building up of IUCAA. It was a fortuous circumstance, which made IUCAA 'happen' so well and so fast. Yash as the UGC Chairman was promoter of the new experiment of the Inter-University Centre as a shared common facility for all universities as well as a world-class institute in the university sector. There came about an excellent combination of Yash and Jayant Narlikar for creation of IUCAA as a world-class facility for promotion and growth of teaching and research in

astronomy and astrophysics. It kicked off marvellously and things happened. As I said earlier Yash has mastered the art of infesting people around him with enthusiasm and confidence, and then he sits back cool and cozy and enjoys seeing things happen.

Yash is a cosmic ray physicist and he has done some important work. I know two of his very distinguished students; Professor Ramanath Cowsik and my colleague, Professor Shyam Tandon who have both apart from doing good science have also done major development projects in their respective institutes. Then, he is a brilliant communicator and has a way with children and layman. That is why he makes an excellent copy for radio/TV. All this is fine but what makes him stand apart (apart from his Fabindia, I suspect he is their brand ambassador, kurtas, an extension of his nose, the pipe and free flowing Einstein brand hair) is his humanism, all encompassing perspective of knowledge and learning and above all his social activism. He was involved with Hoshangabad Science Teaching movement, documentary films like Bharat Ek Chhap and Bharat Gyan Vigyan Jatha as well with almost all cultural and social activities and movements.

Yash has deeper and wider social and societal concerns. He has of late been arguing very forcefully on inclusiveness of learning and broad base of education and intellectual enquiry. He makes the point beautifully and in a very telling manner that

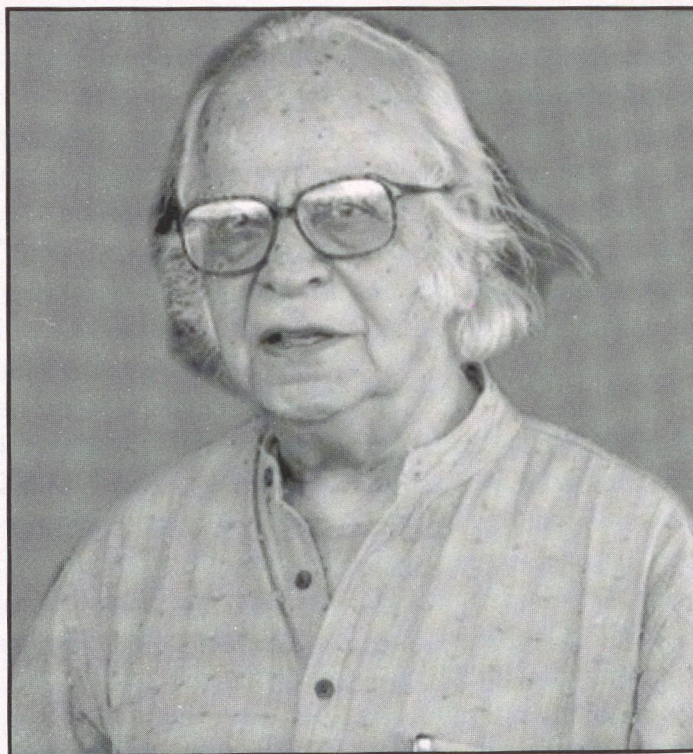
the most acclaimed and distinguished scientists as well as the largest number of Nobel Laureates are in United States, yet they could not prevent the Iraq war. It is high time that scientists be more socially conscious and broad based in their stance and attitude, and should actively participate in discourses on issues of wider social relevance. Or else we run the risk of meaningless and mindless infliction of pain and misery on millions of people through wars and even through some of the development projects. This is the nerve we share and resonate well.

Usually activism and establishment do not go together. However, Yash has been able to ride both horses quite successfully. Despite his support to

movements and outspoken views on many issues, he has the uncanny knack of remaining influential as well as part of the establishment. This is really remarkable and most admirable. Inside the cool and carefree exterior, there is wisdom and foresight, and above all it is perhaps his way with people that wins the day for him even with adversaries.

It has been wonderful having known and interacted with Yash. He is undoubtedly an intellectual in the spirit and mind I look up to.

Dr. Naresh Dadhich,
Director, IUCAA, Pune
e-mail : dadhich@iucaa.ernet.in

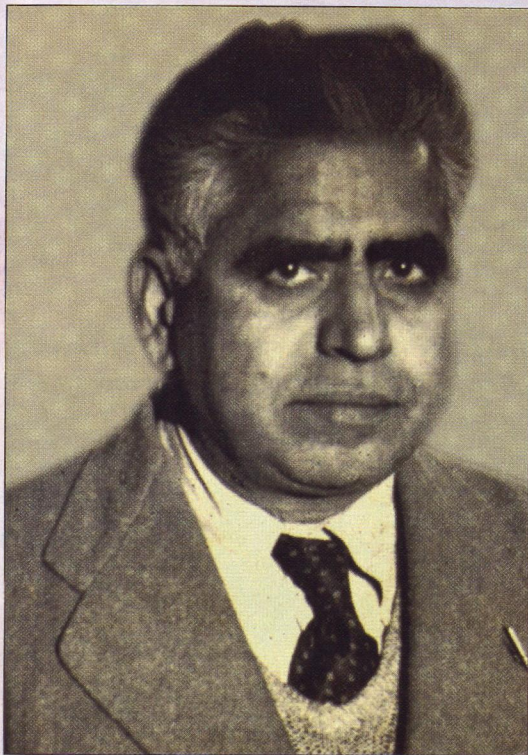


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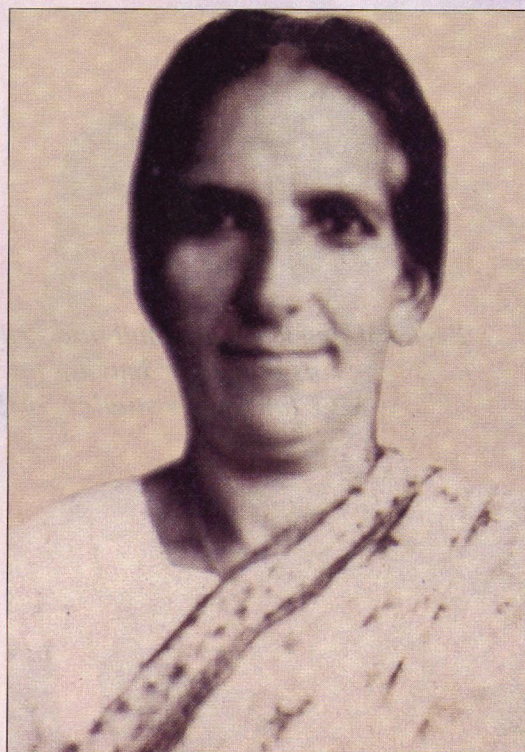
having known
is undoubtedly
and I look up to

Naresh Dadi
rector, IUCAA,
hich@iucaa.ern

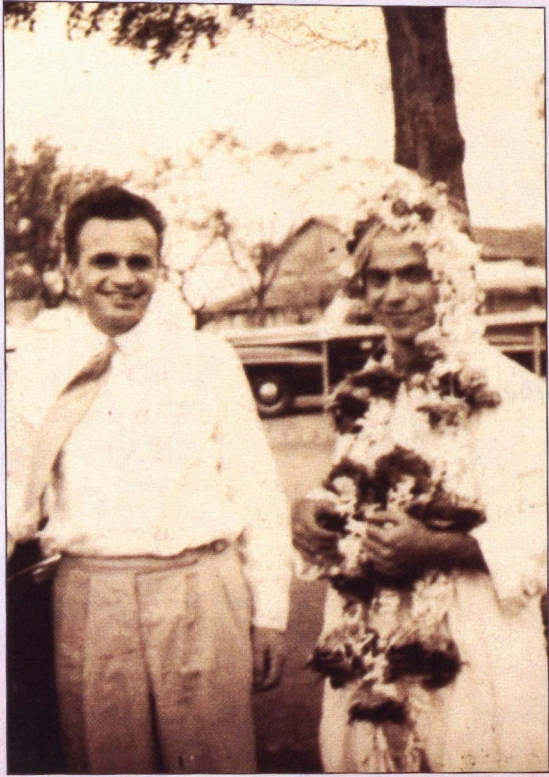
Positive Memories



*Father Ram Piyare Lal
(1949)*

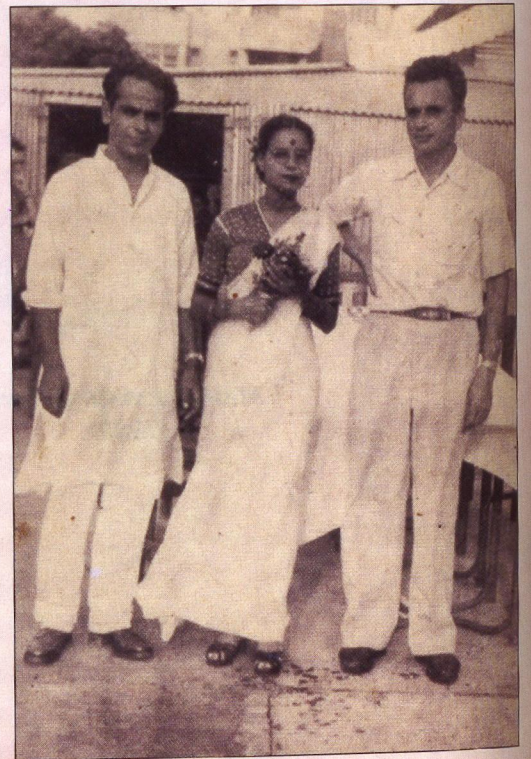


*Mother Lakshmi Devi
(1950)*



*Prof. Yash Pal getting married at Kirkee,
Pune, Bernard Peters was the only one in the
wedding procession (1953)*

*Bernard Peter with Nirmal and Prof. Yash Pal
as they were leaving for
MIT for higher studies (1954)*



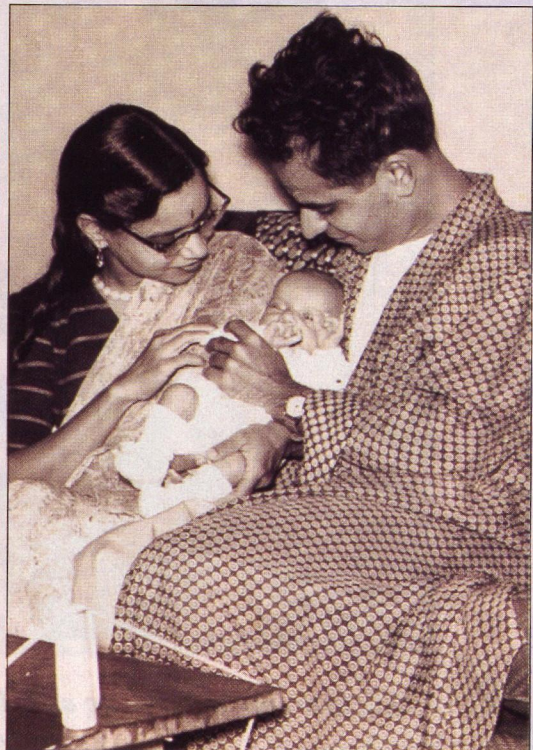
married at Kir...
s the only one...
on (1953)

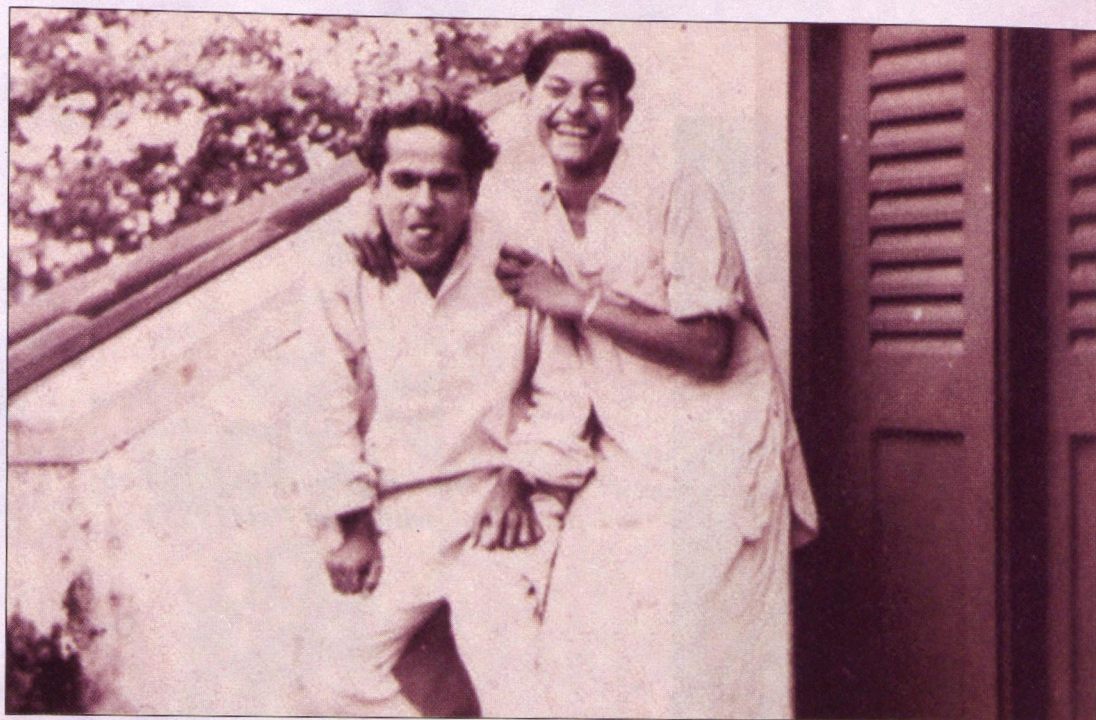


*Nirmal at work in MIT Lab
with Yash Pal (1955)*

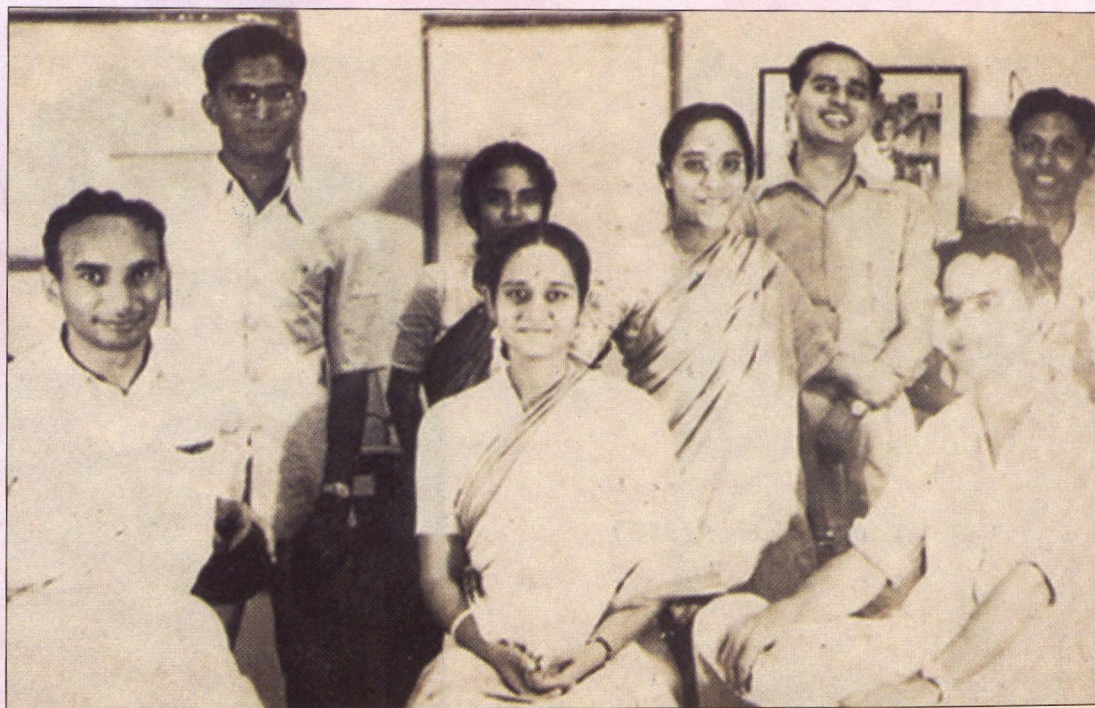


Fond Parents (1957)





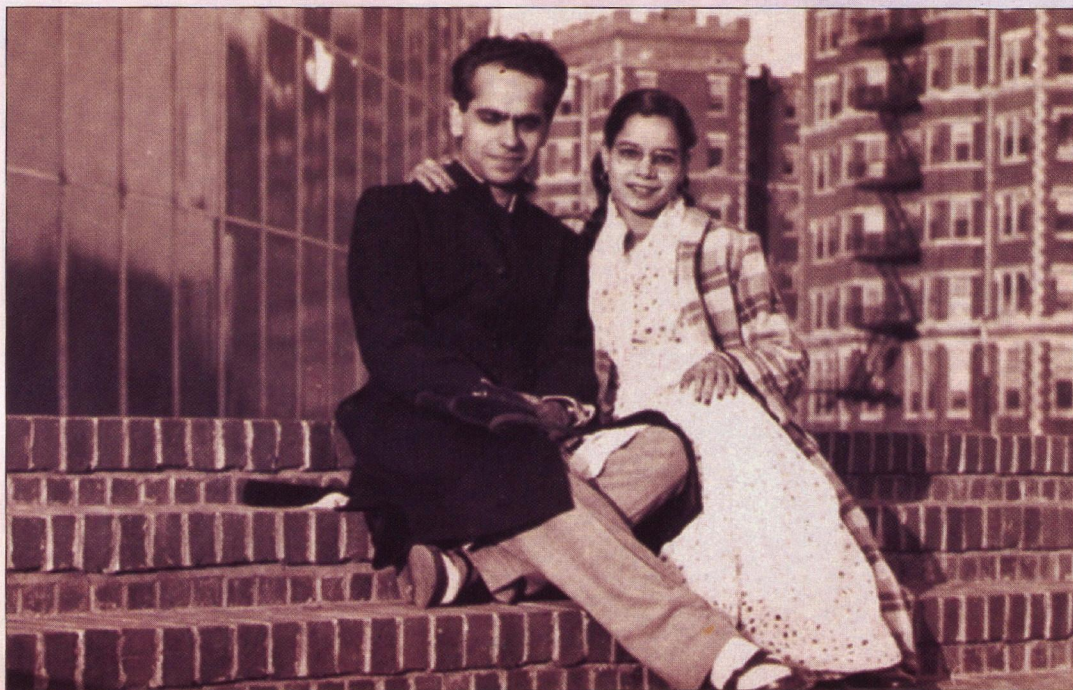
Dr. Devendra Lal with Prof. Yash Pal during Madras Balloon flights (1950)



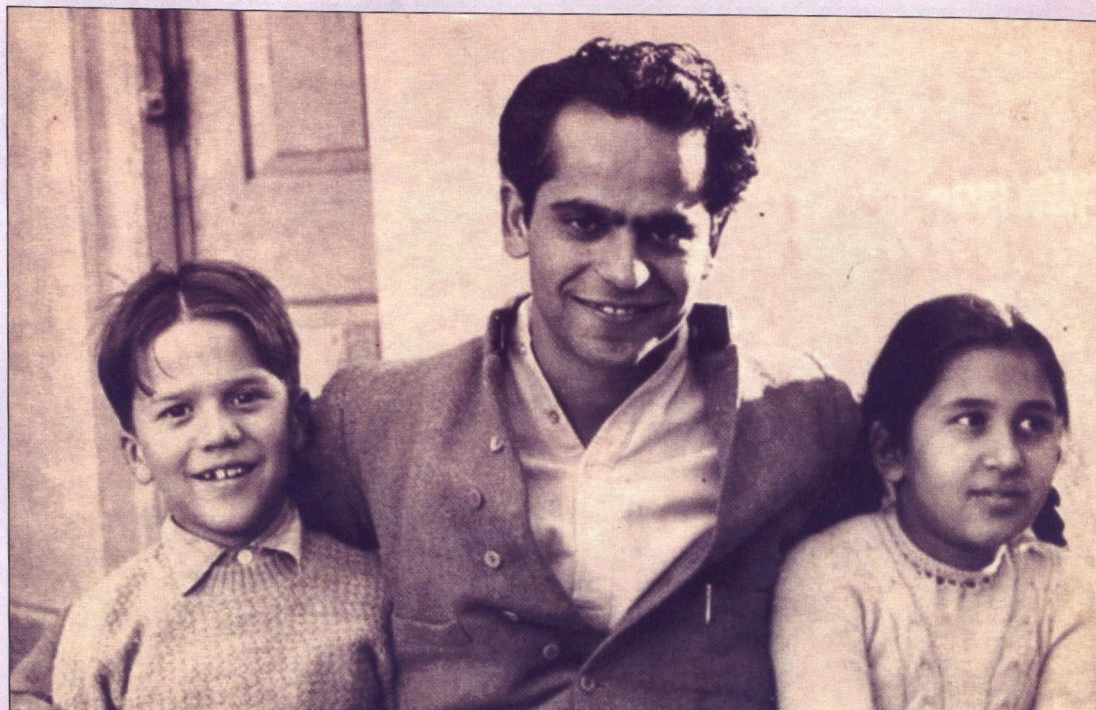
*Nuclear emulsion group at TIFR sometime in 1952, Ram and Roy Daniel can
by seen along with others*



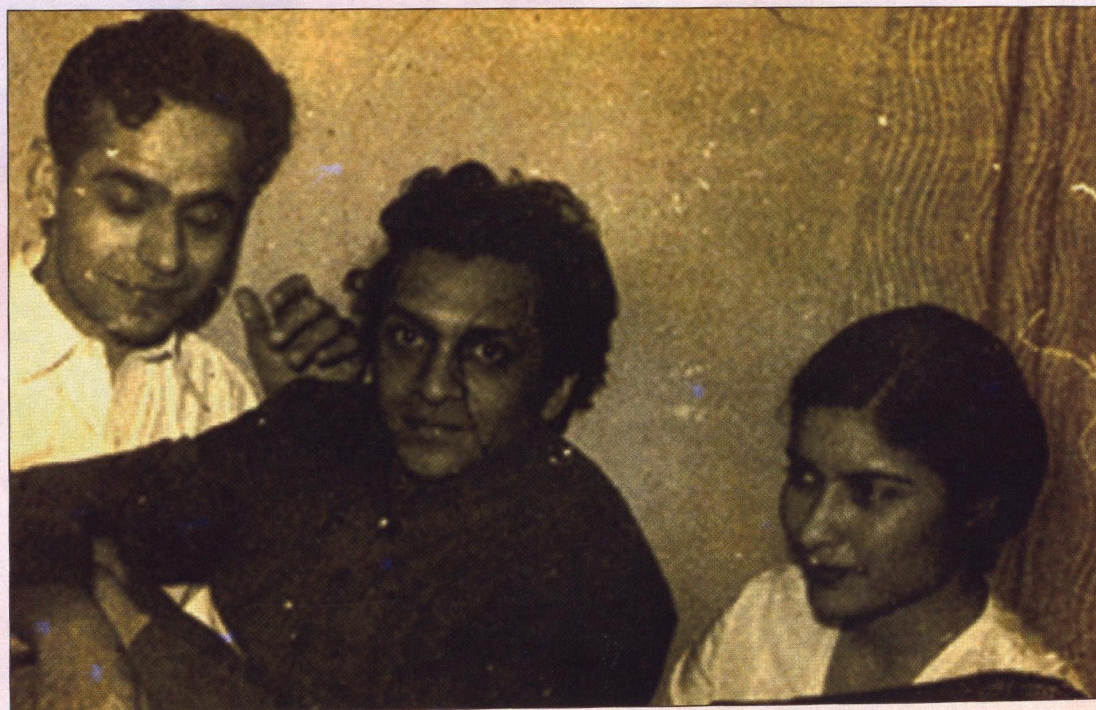
Family Picnic with Mohindra Singh Chadah (1951)



*With Nirmal on the steps of the Kresge auditorium
of MIT Cambridge, Mass. (1955)*



Prof. Yash Pal with children of his friends (1951)



Pandit Ravi Shankar at Prof. Yash Pal's home for a programme organised in Kresge auditorium at MIT (1956)



*Hannah Peters, Vikram Sarabhai, Rahul Pal, Yash Pal and Nirmal
at the Peters' residence Hellerup, Copenhagen (1970)*



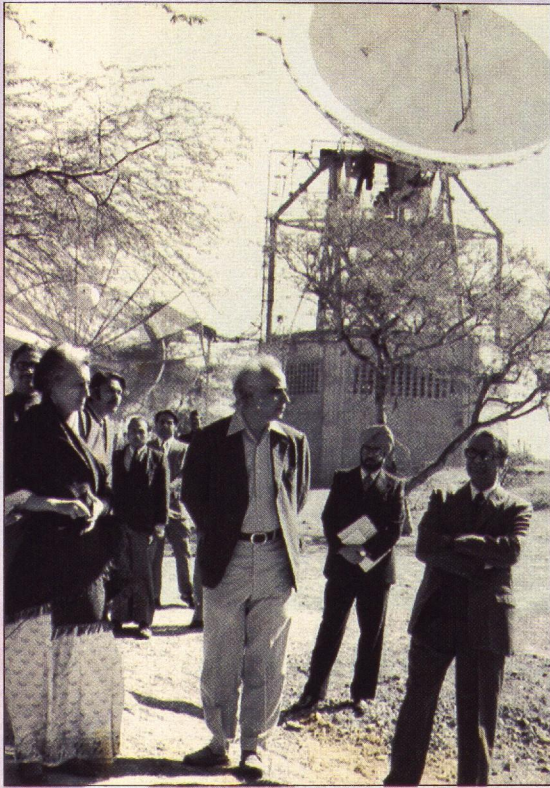
*Arun Devendra Lal, Asia Siddiqui, Obaid Siddiqui,
Nirmal & Devendra Lal at Yash Pal's residence in Pasadena (1971)*



Annual Conference of INSA at Nagpur (1975)

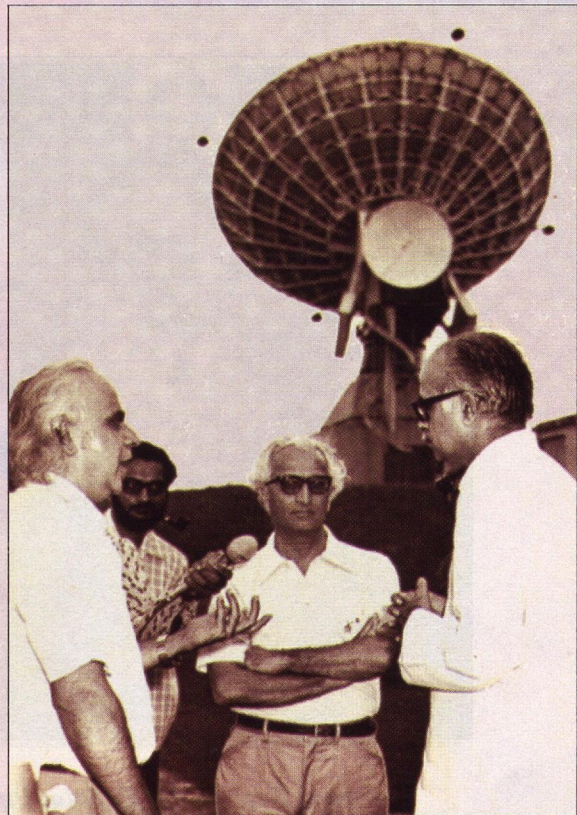


Prof. Yash Pal playing with balloons



*Prime Minister Indira Gandhi
Visits Delhi Earth Station,
P. V. Krishnamurthy, P. P. Kale &
Nilamber Pant are also seen
(1975)*

*With Prof. E. V. Chitnis & Baradi explaining
satellite communication to Mr.L.K. Advani
Minister of Information & Broadcasting
at Ahmedabad (1977)*





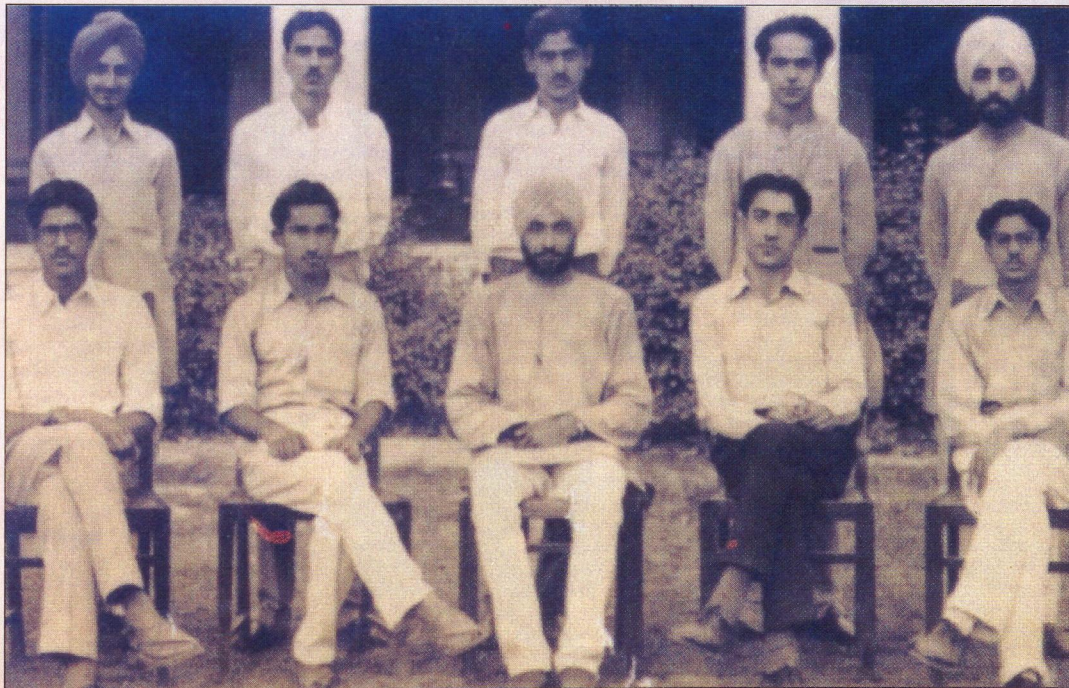
Peters and Feather at TIFR Conference (1950)



*Bernard Peters, J R D Tata, Perin, Blacket & Chief Minister of the then
Bombay State Mr. B. G. Kher at TIFR Conference (1950)*



At an International Conference on Cosmic Rays along with Roy Daniel



Young college students at Lahore (June 1947)



Prof C.V. Raman at the TIFR Confernce in (1950)



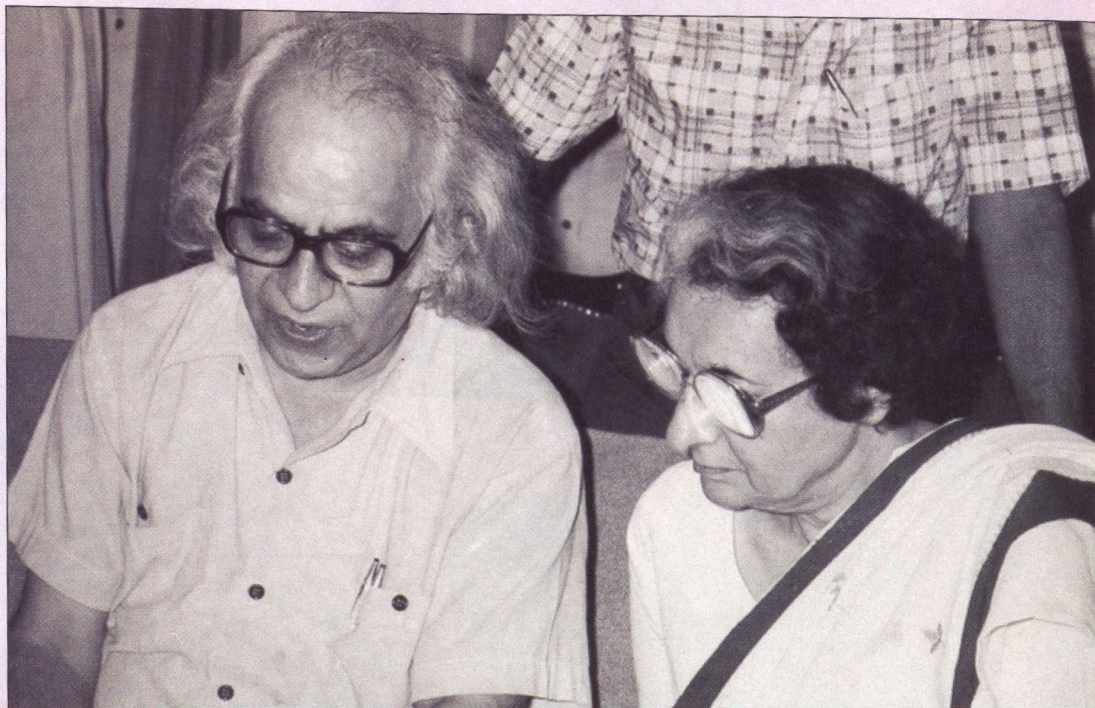
Yash Pal and Nirmal at Star City, Moscow



*Inauguration of SITE by Prime Minister Indira Gandhi ,
Prof. Yash Pal in a pensive mood at PIJ village (1975)*



*Discussing the philosophy of PIJ Television with
Prime Minister Indira Gandhi at Delhi (1976)*



PIJ Television Discussion with Prime Minister Indira Gandhi (1976)



*Dr. Vasant Gowariker, Prime Minister Indira Gandhi,
Dr. U. R. Rao and Prof. Yash Pal at Vigyan Bhavan, Delhi (1984)*



76) *Receiving The Marconi Award in Australia with Nirmal
and Marconi's daughter Joia Braga (1980)*



*Bernard Peters, B. V. Sreekantan,
Devendra Lal & Yash Pal at Ahmedabad, PRL*



Prof. Yash Pal as Secretary General Unispace 82 held in Vienna in 1982



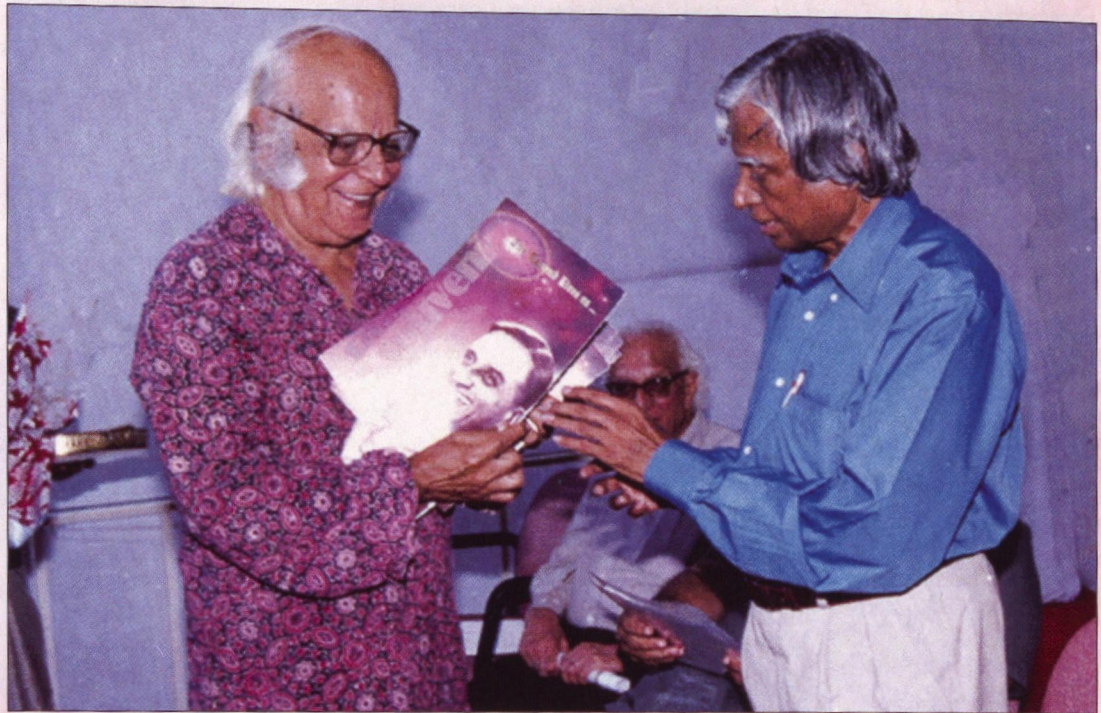
United Nations days - Round Table on alternative space futures (1982)



*With President Venkatraman, Papul Jaikar,
Philip Morrison and Phylis are also seen (1986)*



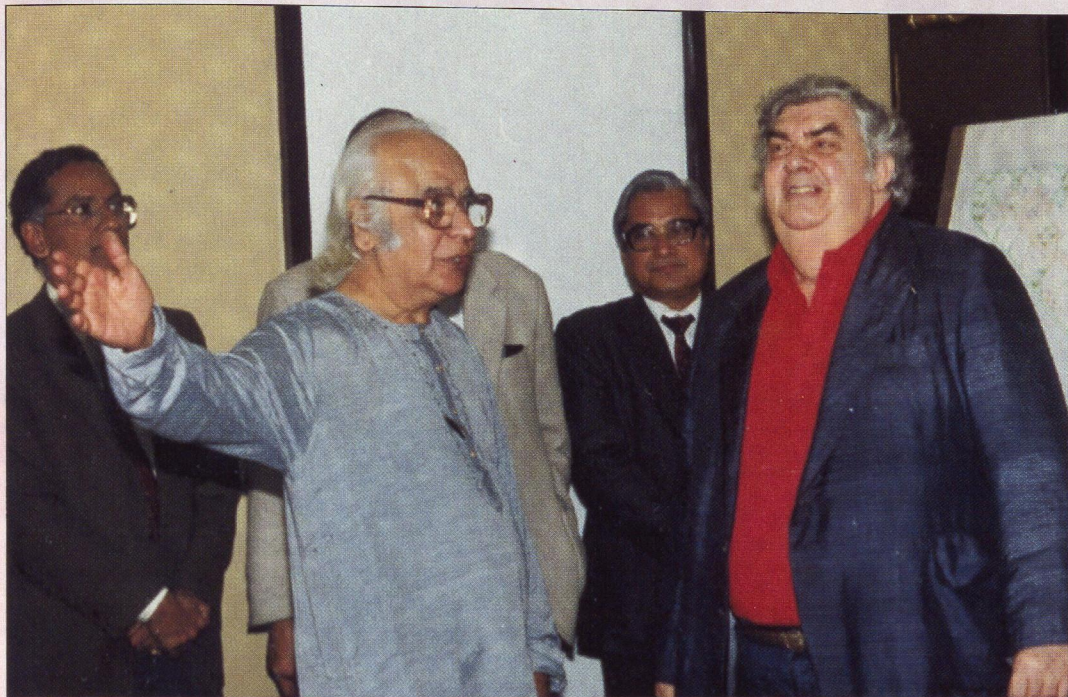
*Prof. Yash Pal with Noble Laureate Dr. S. Chandrashekhar, Delhi (1985-86),
Dr. D. S. Kothari, Dr. Avatar Singh Paintal are also seen*



At VSSC with the President Dr. Kalam (2003)



*Prof. Yash Pal With Prof. Jayant Narlikar
Prof Shridhar Gupte and & Prof. V. G. Bhide*



Prof. Yash Pal with Prof. Geoffry Burbidge



Prof. Yash Pal with Dr. Vasant Gowariker and Dr. Ram Takavale



Along with Philip Morrison at Delhi Science Museum



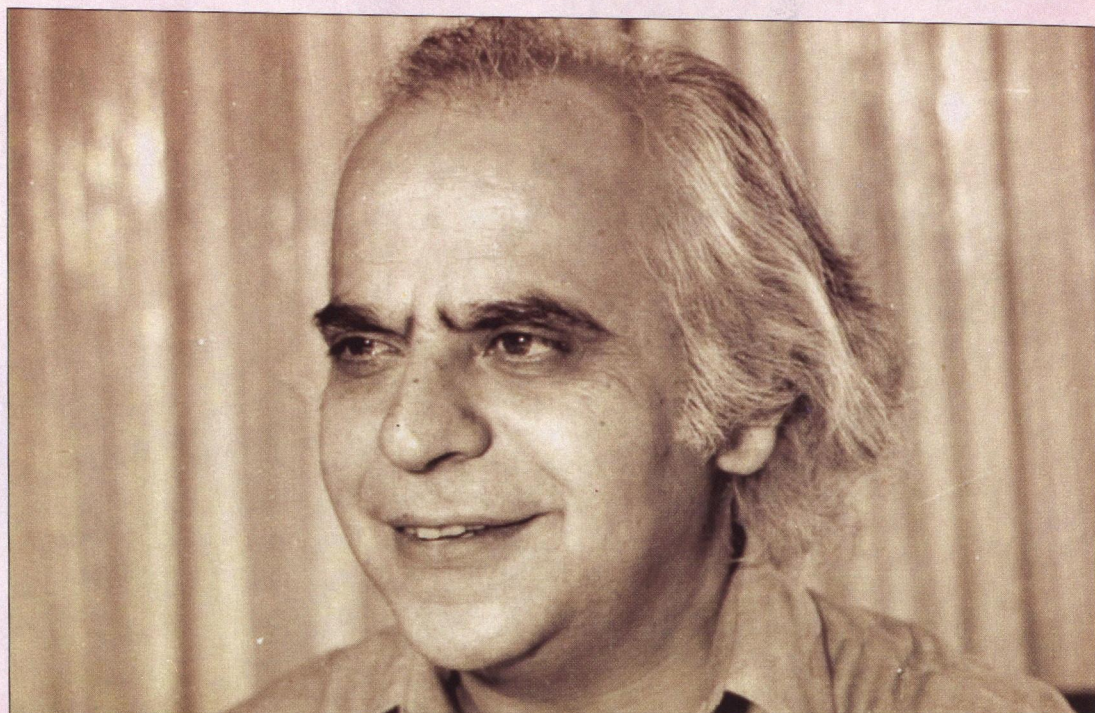
At a get together at brother Om's place



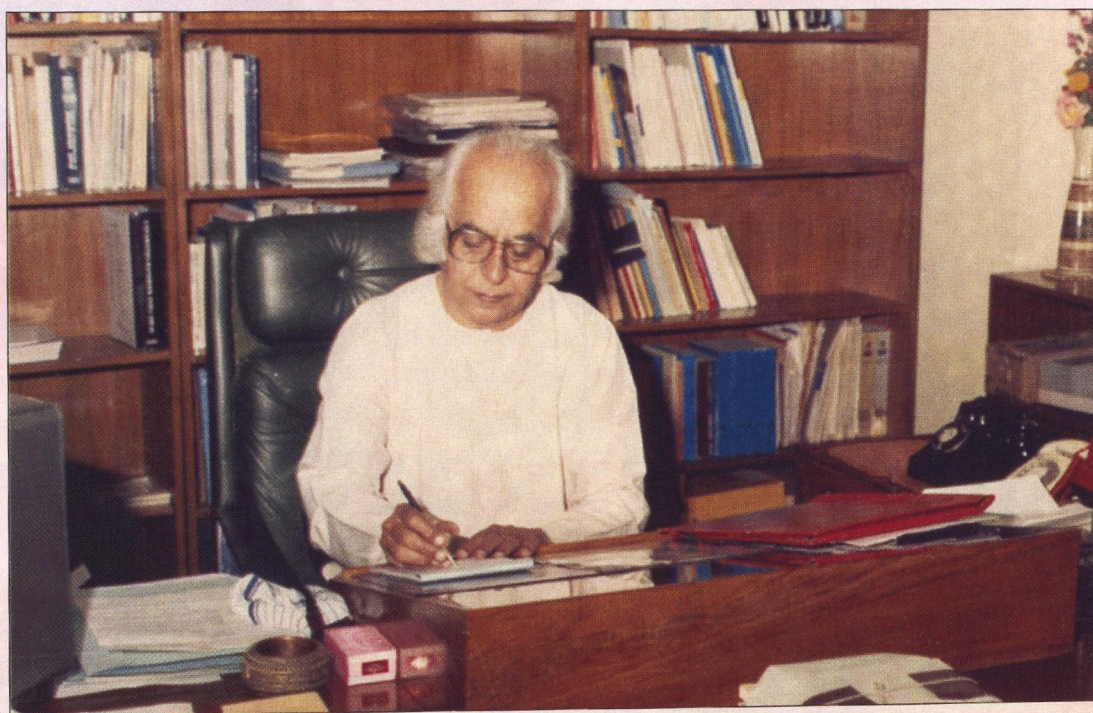
*Nirmal and Yash Pal with Hannah Peters in her home
in Copenhagen around (2006)*



Nirmal with Jyoti, Naveen, Baleshwari and Vasudev at childrens birthday

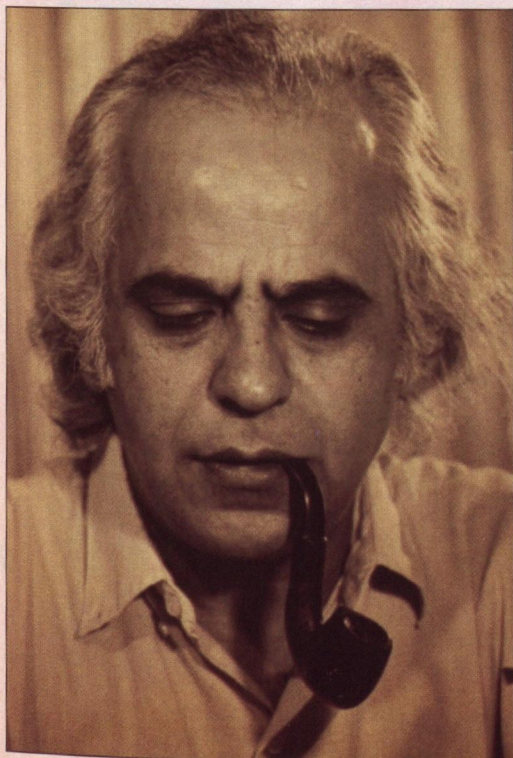
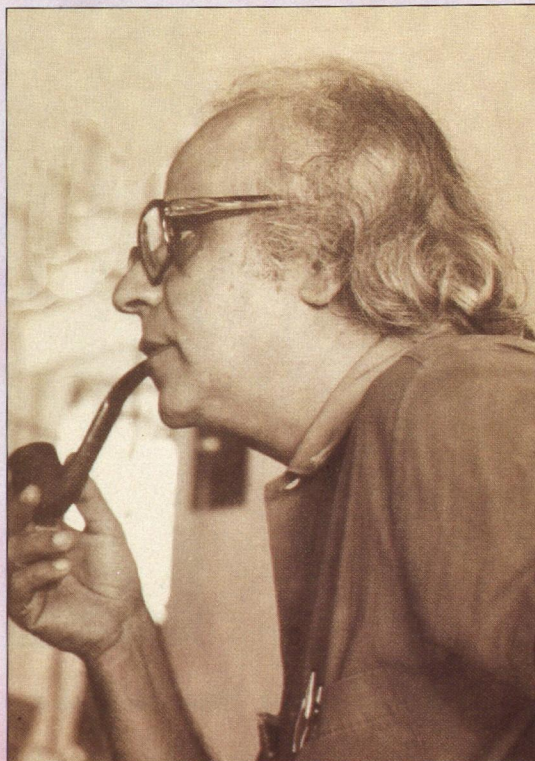


Ahmedabad

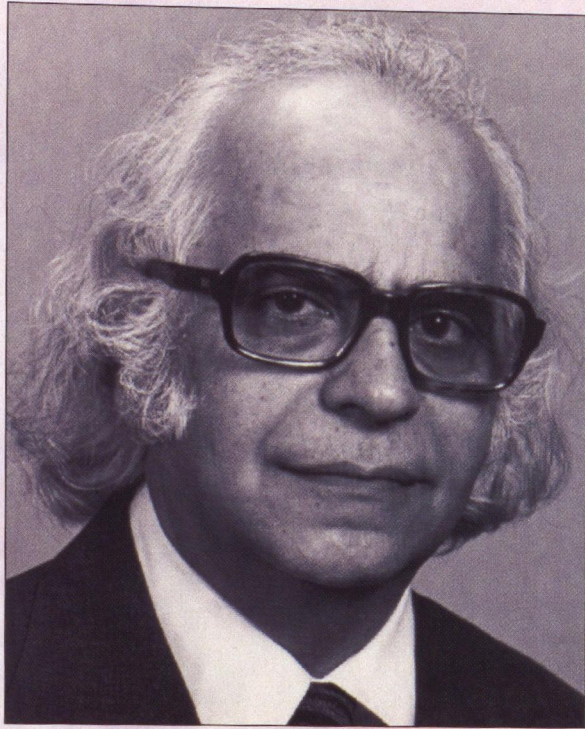


Chairman U G C (1986-91)

*Intence days
at Ahemedabad (1973 - 81)*



*In deep thought working
at his desk Ahmedabad (1973 - 81)*



Prof. Yash Pal look during UN Conference days (1981 - 82)



Prof. Yash pal and Nirmal with grand childrens

India Can Follow A Different Path

Musings

India Can Follow A Different Path

The last few years have seen the emergence of a class of proclamations by leaders in politics and science that I find somewhat disturbing. These proclamations wish, predict and disclaim that in a decade and a half our country would become a “developed” country. Some of them suggest that we are already on our way to becoming an IT power, a biotech power, an agricultural power or a science and technology base of the world.

When we talk of power we always refer to a dominance that would begin to give us the status of a ‘developed country’. It is also implied that we would begin to live and behave like the most powerful amongst the developed countries of the world. We would have as many gadgets as they do, as many rockets, bombs and other weaponry, besides cars, telephones—and loneliness in the middle of a crowd. It is implied that some large corporations, preferably multinational, would supply our water, for drinking and for agriculture, while some other corporations would improve our infrastructure on a “build, own and operate” basis. When we are really developed, only 3 per cent of our population, working for some other corporations, would produce all the food we need and more, and never mind that hundreds of millions of farmers would lose their livelihood because they would be absorbed in the “service sector”.

These or similar proclamations worry me because they imply that we have stopped dreaming of inventing a good life for ourselves independent of what obtains in a few countries abroad. We tend to overlook the difference between our “initial condition” and those of

countries we would like to emulate when we prescribe methodologies for a fast pace of economic progress. In recent years, the only indigenous passions surfacing in this land are connected with horrible disputes over old temples and mosques, making religious conversion illegal, rewriting of history textbooks, and introducing teaching of astrology and karmakand in colleges and universities. I must confess that none of these borrowed images of development excite me. Indeed, some of them would ‘un-develop’ us beyond redemption.

Education

Let me mention just a couple of points regarding our education and research set-up. Our strength lies in the fact that our people still have hidden capabilities, which they acquire on their own. Many examples of this can be given. These are the same capabilities that made this country great in our distant past. The capacity to cope, to self-learn, to innovate, to be able to understand how things work and to master them still drives this country. Our crafts, arts, including music and dance, bear testimony to this. A National Innovation Foundation is a good idea, but the real need is to make the indigenous innovators, which includes all children, central to defining our education system. We should build on what people have already learnt. We should not have mere vocationalisation. An emphasis on Institutes of Management, IITs, and Institutes of Information Technology will only help to create a copycat India. If we want to create a really great India we need to build on what people begin to learn on their own.

The separation and distinction between

universities and laboratories has to be reversed. All new laboratories should be set up within universities, especially those laboratories that do a lot of basic work. Indeed most present laboratories should be converted into universities.

Information technology

There is a great hype about our progress in information technology. This is good and admirable, but we must change track very soon. The present activity does earn us some money and recognition. But it earns many times more for those who we work for, thus increasing disparities between them and us. It is doing little for our own development. That would happen when our emphasis shifts to saturating our country with pagdandis and bylanes of information. Highways are needed but in our condition pathways would be more appropriate and productive.

Networking

We need to network India (information technology can help in this). This might be a way of preserving our diversity and plurality. It might allow us to go our own way together. It might release tremendous energies. It might allow us the possibility that India will show the way to a new world. We must keep asking: How to build an inclusive society? How to have an entirely new type of globalisation? How not to be dominated by centralising influences—international or national?" Networking might save us from social explosions, even from pathologies that breed terrorism.

Portrait of development

This should be an enhancement of what we think is admirable now. It should be from our own world and not a pale copy of what obtains outside. For example, what would we like to add to the already desirable way of living established in Kerala. Isn't Kerala better developed than most of the so-called developed countries? There might be some lacunae. How do we remove those?

In summary, I am afraid of our becoming a developed country like the one in front today. Even with only one of them flexing its muscles one or two countries are under threat of being bombed out every year. If we go that way we will also not be saints. We might be even worse. The world will have a hard time living through the 21st century. The whole world needs to move away from the presently dominant model. We would arrive at the real pinnacle of development if we begin showing a different path to rest of the world. This was not possible in the last century. Now it might be.

We need to develop and deploy our techniques and technologies to make an inclusive India a reality. God knows we need it badly. If we can do it then the whole world can. Are we equal to a challenge this big? To show that we are would fulfill my dream of a desirable and developed India. Becoming a carbon copy of another country, no matter how "developed", is unlikely. I am glad it is so. We should be more ambitious.

*An article by Prof. Yash Pal in
The Tribune, India - 06 August 2003*



Science with Engagement and Passion

It is an honour to speak on this occasion. It is the birthday of that great builder of institutions, an embodiment of restrained aggressiveness, and a supremely civilized human being who persisted in remaining so in spite of the darkening clouds that kept engulfing the country and the world. The industrial world has seldom thrown up a personality as rich in texture as JRD Tata. It was a privilege to have come in contact with him.

The position of a research student at the Tata Institute of Fundamental Research (TIFR) was the only job I ever sought after. I cannot imagine a better beginning of a career. If I am given another life and the TIFR is still around I would like to come back as a research student here – provided, of course, I am accepted. I understand that the competition is tougher now.

Why should one be so sentimental about one's beginnings? After all there are many wonderful places around the world. But then I belong to the world only after my belonging with the earth, the smells, the trials, problems and dreams of this land. The TIFR provided me an opportunity to do some excellent science, but simultaneously its environment encouraged engagements beyond the formal contours of science.

In this lecture I would not dwell too much on the science I did here or elsewhere. Instead I would expose my struggles in which the joys, spirituality and perspectives of science co-mingle with larger issues that demand simultaneous attention to the intimate and the cosmic. My sorrow remains that such a mindset is rare, especially amongst the powerful, the affluent and the dominant. I believe that only those who inhabit the perceptive and

intellectually honest corners like the TIFR can further a way of thinking that might provide the solitary ingress to a world that is secure, to an India that moves ahead to build a peaceful and inclusive society. I will try to explain why.

I was on the roll of TIFR for 34 years. Even after my name ceased to be on that roll I did not feel that I had ever departed. There was an infectious element seeded into the environment of the institute that has stayed with everyone who spent any time here. It would remain a mystery as to how it came about. I am not even sure that it was all planned beforehand. Was it merely the result of a blind faith that the right chemistry would automatically develop if some excellent young people were put together in a free atmosphere and allowed to do their own thing?

One of the joys of having been involved with Indian science and academic world for nearly all of its fifty independent years is that one meets friends everywhere one goes. The surprising thing is that they even recognise you, even though many of them may have no idea of what you have done, or done anything at all. I am embarrassed when, in the Hindi heartland, I am often taken for that famous writer Yashpal; even in print they spell my name as he used to do! I am not so embarrassed when many people think that I am a social scientist - I mean many people who themselves are not distinguished scholars in social sciences. The latter find me out before I have uttered more than a couple of sentences, partly because I do not refer to the work of other *scholars*, but of other *workers*. I hope you would discern the temperament of a worker in what I am going to say today in this magnificent hall full of academics and scholars.

Towards the end of 1972, I was invited by Dr. Satish Dhawan, Chairman, Space Commission, to organize the Space Applications Centre, building on a number of application oriented units of Indian Space Research Organisation [ISRO] in Ahmedabad, and adding a number of new entities as required. This was my transition, temporary I thought at that time, to becoming a space technologist and, simultaneously, some sort of a social scientist.

The most important task ahead was to concretize the dream of Vikram Sarabhai and get ready for the Satellite Instructional Television Experiment (SITE). True, the satellite was to be provided by NASA, with whom we developed a very fruitful collaboration, of a kind rather difficult to imagine now. However, we had to learn to develop and build two major earth stations, design, develop and get fabricated, thousands of direct reception sets, along with their low noise amplifiers and antennas. Not only this, we also had to design and manufacture a large number of solid state TV sets, which had not yet appeared in the market anywhere. All this equipment suitable for the difficult environment of rural India, had to be deployed in several distant clusters, across a distance of a few thousand kilometers and, after deployment, to be maintained for a couple of years. We could not buy most of these systems anywhere in the country, or abroad. We also had a strong motivation to do the development ourselves, because achieving self-reliance in all these areas was an important objective.

That particular period - for me - was the period of immense learning. It was probably true also for my one thousand and odd colleagues, most of them very young, who grew into mature technologists in a short span of time, because of the challenges thrown at them. Alongside communication, the other major application of remote sensing also began at that time. Perhaps a couple of experiences of trying to grow scientists and technologist would be in order.

We had to design the front-end converter for the satellite receiver, to test it and send it to Goddard Space Flight Centre of NASA for checking, before transferring the know-how to local industry for manufacture. We worked in a place that, at that time, had no environmental testing facilities. For high temperature we used the Sun and for low temperature, a rickety old refrigerator. Six units were sent to Washington. Two days later I got a telex saying that all of them had very poor temperature stability and the only way a meaningful development could be done was to send our engineers to NASA. The experiment was coming on and we had no time to waste. I discussed the problem with our engineers and after convincing myself that the problem was understood, sent a telex back to NASA saying, no thank you, we will do it ourselves. Simultaneously I sent telexes to half a dozen of our radio-astronomers, requesting that they drop everything and come to Ahmedabad to review our altered design.

My cry for help was so worded that they all came. They were astronomers and not space technologists. However, I was sure they would be able to understand the requirements. Following this the newly designed units were fabricated and sent to Washington for testing. Back came a congratulatory telegram, expressing surprise at the almost perfect performance of the new design.

I believe that lot of later self-confidence of the engineers in the Centre came from this one incident. If they had been denied the chance of doing it themselves, it would have been difficult to develop the atmosphere of creativity that came to pervade the Centre.

I am mentioning this because in the present day rhetoric of globalization and opening up, some people forget that often it is more important to invent a thing yourself than to get it. Unless a taste for discovery is established early, it will never come. I believe that a civilization that protects its young from the hassles of doing things themselves, also

deprives them of great joy and ultimately leads its society into a state of permanent dependence.

In 1972 NASA launched its first remote sensing satellite ERTS-1. While communication satellites abolished distance on earth and made it possible to choose neighbours independent of distance, remote sensing has enabled us to get a new look at the planetary features and understand their relational aspects - we can see the forests, while on the ground we were only aware of trees. It seems strange, but it is true that there are things we realise only by looking at them from far away. Perspective can't be acquired from close proximity. Incidentally, this applies equally in matters personal, social or political. We also wanted to grow remote sensing at the Space Applications Centre, starting from almost nothing. This was done, and surprisingly well. Indeed we were able to launch our experimental remote sensing payloads into orbit within four years, even earlier than the communication payloads.

I need not go into all these details, except to point to a strategy somewhat at variance with the practice where we keep sending our people for specialised training abroad whenever we want to develop something different. Any physicist with minimal self-confidence could persuade himself that remote sensing technology can't be very different from techniques of astronomy, or even nuclear physics, except in specifics. Hence I started a campaign to persuade three old colleagues from TIFR, one from infrared astronomy, and another from nuclear physics and the third from computer science, to move to Ahmedabad for developing the technology and science of remote sensing. They needed a month to think over and then they came. Many others joined them, scientists and engineers. The result was that by now we have had operational remote sensing satellites whose performance compares favourably with that of others launched by any nation and further, the program has been coupled intimately with a large number of socio-economic programs, including detection of ground water sites. Much of it has been done after I left,

with different leadership. I suspect though the beginnings couldn't have been so bad.

By now you must have become aware of my allergy against standardised training programs so patronisingly offered by some well-meaning agencies. By their very nature they can take you only thus far and no further. In creative fields there is no alternative to starting on your own, making your own mistakes.

Coming back to the growing connection with rural India, via space, my romance with space technology has been a continuing struggle to bend it in a direction of wholesome connectivity. Many a time it has been a losing battle. Even your successes get largely appropriated for purposes that are routine and ordinary, sometimes even profane. I hope something of value has remained.

It was possible, for example, to insist that staying true to the objectives of the SITE experience, one had to really know one's audiences, to assess their needs and in fact involve them in creating programs for themselves. This was an unusual preoccupation for a space centre, but the argument was accepted to the extent that at one time we had nearly 200 social scientists working with us. We learnt to build studios, to modify inexpensive video cameras for fieldwork, involve many fresh people in actual program making. All India Radio, the predecessor of Doordarshan had the prime responsibility in this regard but it was amazing that the job of providing needs assessment and later evaluation of the impact of the experiment was 'naturally' organised by a space centre!

We produced science programs for children with the help of fresh young producers from the Film and Television Institute. I sought help from all friends and old colleagues in this challenging task that demanded that we keep in mind the fact that the only laboratory most of these children could access was their natural environment, their play and their homes. Madhuriben Shah, the then Education Officer of the Bombay Municipal

Corporation responded promptly to a single telephone call to spare two tall rooms near Grant road to set up a studio. I argued that this studio had to be in Bombay because I had friends like the late V.G Kulkarni and Bhal Udgaonkar alongside whom I had worked in Bombay municipal schools to upgrade their science teaching using a discovery approach. Many other friends at TIFR joined in to help and there was a time when many of the scripts for these programs were honed up around the coffee tables in the West Canteen of the TIFR. Besides, many friends in theatre and film world were fired up to be partners in this crazy adventure. Names like M.S. Sathyu, Dina Pathak, her daughters Ratna and Supriya and Habib Tanvir come to mind. Most of it was a labour of love. It was wonderful to discover that when the objective has value and you seek help, worthwhile people consider it a favour that you asked them.

Perhaps one can say with some justification that these efforts produced a culture of audio-visual communication, which has been soaked into the work of many individuals and organisations, most of whom have no connection with space any longer. However, I believe that 'space' way of thinking brought my colleagues and me in close relationship with people, some of which has remained with us. In point of fact, a negative feature of space broadcasting provided the real motivation. It extends your reach, which is good; but it allows the possibility of cultural domination, even indoctrination, even when you are well meaning. Since the reach was precious, we had to spend much effort in ensuring that it didn't become exploitative. In fact we even worked out a hybrid broadcast system involving space broadcasting and low-power terrestrial system for implementation with the Indian national satellite, when it came. The hardware system has actually been implemented. But our suggestion that the local transmitters, with a 20 km reach, be given over to the community, even colleges and universities, to operate has not been implemented, in spite of lip service being paid to the concept that best communication must be a mix of the local and the intimate with the long range

and global, opening windows to the country and the world. I suspect that such a system is not liked by the powerful, whether in administration, or in advertising. So the low power transmitters yet remain slaved to the national and the state programming.

Cable is now sweeping across the country, supported largely by farms of dish antennas grabbing signals from all manner of satellites, including several channels of INSAT satellites. Perhaps, in addition, they would introduce the local element, so necessary for intimacies of dialect language, custom and problems.

- INTERUNIVERSITY CENTRES
- REAL EDUCATION FOR THE REAL INDIA – COUPLING WITH SUBTERRANEAN SYSTEM OF EDUCATION

In this connection, let me share with you a couple of experiences. I am sure you are familiar with the story of JUGAD. This is a vehicle designed by a farmer who was somewhat handy with technology. He used his diesel pump used for irrigating his field, some spare parts from a used vehicle junk yard, built a wooden cart, with four tyre-wheels, springs, and old jeep clutch, a radiator and a sum of 30,000 rupees to build himself a vehicle. This could go 40 kilometers an hour, was inexpensive to run, could carry thirty persons lot stuff and even his water buffalo when there was a need. If any thing went wrong he could fix it himself. And if he did not want to invest in a new pump the same pump could be used for pumping water. Other farmers saw this contraption and they built their own, somewhat different but basically the same.

Support technicians developed and lot of these vehicles started plying, first in the villages of Punjab, then Haryana, Rajasthan and western UP. I have met some of the people who built and used them. They seemed proud and swore about its usefulness. Taxis using these JUGARDS started plying and then the officialdom and other interested parties got into the act. The vehicles were banned from the roads,

because they did not have engine numbers and were not registered. They still ply, but the organised industry frowns upon them. For the big guys there is not enough money in this. Farmers showed the way by demonstrating what was adequate, in their control and affordable.

These are not the attributes that the industrialists like very much. How dare farmers become independent thinkers? It is possible that some educational institutes have done some projects in this regard, but no student is likely to get his masters or Ph.D. on a project like this. I have also encountered other examples of this kind and I am sure you have many more. Such creativity has value much beyond an inorganic technological evaluation of the innovation. Even while applying the most sophisticated things we do in our laboratories we must fold in the intimacies of the local situation.

Let me share another story with you. Some years ago, I along with some colleagues, was working on a report entitled Technical Education for the Real India. In this connection we visited a Krishi Vigyan Kendra near Patiala. I was very impressed with what they had been doing there but could not help asking the scientist there "Do you ever get useful suggestions from farmers themselves: after all they must know something because they were already taking in four crops a year?" He replied in affirmative and told me about a recent conversation with a farmer who was a regular visitor to their Kendra. Apparently the farmer had also planted a large tract of sunflower in addition to all his crops. The Kendra scientists admonished him for having done such a foolish thing; they feared that the birds attracted to the sunflower seeds would also destroy his other crop. The farmer smiled and informed them that he was not such a fool and what he had done was after some thought and experimentation. He had also started keeping a lot of honeybees. The bees visited the sunflower patch and for some reason that kept the birds away.

Whether the birds ate some honeybees or were frightened by them was not clear. But the end result of this innovation was that the farmer had a fifth crop and also, a bonus, lot of honey. Such an innovation cannot be thought of in a laboratory or the boardroom of a multinational seed company.

- PEOPLES SCIENCE MOVEMENTS
- SCIENCE COMMUNICATION – EMPHASIS ON UNDERSTANDING, THE TURNING POINT EXPERIENCE
- BESIDES OUR BASIC HUMANITY, ONLY THE PERSPECTIVES OF SCIENCE CAN PROVIDE THE SOCIAL AND PERSONAL VALUES – SCIENTIFIC TEMPER

To summarise, following are the few areas with which I have tried to engage with some passion. I confess that the degree of success in each of them is perhaps inversely proportional to its importance. There is a long road ahead, at least for some of these areas. The end may never be reached. But I do believe that being engaged in these aspects is a 'Karma' no scientist can avoid. In retrospect I could say that my passion has been to replace the impenetrable walls and boundaries with two-way permeable membranes.

1. Walls between Universities and Research Laboratories, between Industry and Academic Institutions.
2. Walls between the Subterranean Learning and Innovation and Formal Education and Research.
3. Walls between Disciplines and resulting Infertility of Information.
4. Walls between Instructing and Learning from Children: How not to imprison ourselves in Disciplines.

The Thick Wall between Intellectual Understanding and Societal Brainwashing.

*Public Lecture By Prof Yash Pal on the Birthday of
JRD Tata, 29 July, 2002,
Homi Bhabha Auditorium, TIFR*



Understanding is the Supreme Joy

One of the joys of growing old is that everybody you meet is a friend and you see them on many occasions. This hall particularly contains so many wonderful people without whom I could not have imagined my life. The organizers had no money, no resources and yet they have managed very well. Looking at the presence of many well-known science communicators, this unique event will be remembered many years to come. It is a remarkable effort.

When you get an invitation to inaugurate an event you tend to get worried because most events are inaugurated by public figures, such as politicians and if you have ceased to be of any consequence in any field, then you are asked to inaugurate a function. You are not supposed to say anything meaningful because you are not taken seriously. In spite of the fact that you asked me to inaugurate this meeting I am going to say a few things. Firstly, I would request all of you to remove the word or phrase "Science Popularization", from your vocabulary. Whenever I think of popularization, I think of Colgate toothpaste or Coca Cola and usually it becomes a sort of simple awareness which is like brainwashing science communications. Secondly, there is this greatest need at the moment to communicate science to scientists of other faculties. This is because anybody who is called a scientist has surely acquired certain standing in public; with the administration, with the Government, with the politician and may be with a great scientist to be called another great scientist. Generally you need to really work into your grave to be called one. However a large fraction of the scientist fraternity is happy only when they are working in their own field. We work professionally specifically in a particular area but we forget that

there is a whole lot of universe around us. We feel that the concerns of recent day world are not part of my responsibility.

The most important thing about science to me personally, that understanding is the supreme joy. Unfortunately communicating and popularization does not often concentrate on understanding. The quest for understanding starts very early in life. Therefore, we should learn from children what they want to learn. Ask them about which are the important questions. Why do all planets rotate? This is a very common question. Why the sun and the moon? Why are they all round? Why not triangles? These are kind of questions to the school where they are told not to waste the time of the class.

"When I record my voice on cassette / tape recorder and I listen to it, it does not sound like me but when we hear the recordings of somebody else like, it sounds O.K. Why does that happen? This is one of the many common questions that are asked by children. The schoolteacher says that this is not a school question. But the process of learning starts here. People do not give a patient hearing and this becomes a habit that stays with them all their lives. What is a understanding? Understanding is the joy, when your eyes light up. What brings about this understanding? And for this there lies great job for a scientist.

Why do you want to popularize science? Is it because you know some science? It has become a habit. People in future may say that they can make a large number of inventions. Ultimately new technology can ensure that things, which were done earlier, can be done more efficiently now. In the

last century, people were not as happy as they are now. Yes, in terms of overall happiness. I think the world has progressed very much. But think about the hundred million peoples who were killed during the last century in wars and genocide. Must you have problem like Kashmir, Nagaland & Bodo land in one country and Iraq and Bosnia and all kinds of things that are happening in Africa? Here you will say that this is not my department. It is not my concern; then whose concern is it? Is politician concern or the economist's concern? This indeed is tragedy. What can we do? We can not carry flags and just march in the street. The only thing that people like us and many people like you could do; is to try to bring about certain persecution. Persecution is like science and is the perspective of all science, whether it is astronomy, or geology or biology.

Perspectives are important to create a new ecology built by knowledge and modify our behavior. There is a danger of losing to a teaching kind of mode but all the same, if the length of this page were to represent the total amount of time life has been on this planet it is good to remember that humanity came during the last one Millennium. We are lucky that we have this capability. There are many small groups who do not interact with each other and yet they wonder how they develop language independently or even influence each other.

Whenever we wonder we ask questions, we learn to encode, and we learn to live according to our environment. We develop different fool habits, clothing and everything. We have so many fantastic normal wonderful examples of we have done on this planet. Then how is it that it becomes a cause of concern and not a cause for celebration? Can understanding of this deep understanding of things having to happen in a certain way bring about in us a certain change in the way we think?

Every civilized country knows a great deal of sciences and science can have to find a way to solve problems. Looking at the environmental

problems, scientists seem to have done a great deal. It should be clear to everyone that ultimately it is the fate of the whole humanity that is going to be the same. We do not seem to connect the popularisation of science with the ultimate humanity or with the joy of living. I think efficiency in Science and Technology will help ensure that we can fly faster that we can drive faster that we can have goods. We can do this if you go in the same direction and we do not have to change the way of humanity. All the new powers whether they are in space or Technology, electronics or communications are going to take us the wrong way.

We are very proud of building and highways in our country. We proudly declare that we are going to set off the largest number of information highways or these concrete highways make it possible for people to walk on them. Modernization means large highways. Science plus the fact that we happen to be human beings has to come together. So the real problem of the present time which science has not addressed is confronted by social psychologists, sociologists, philosophers etc. As scientists, we need to address it, being human means belonging to some group, some human collectivity, developing music, dance, language, literature, humor and culture. You are writers most of you, you understand that all this out grows out of intimacies of collective living in small groups. If these get threatened they get wiped out, there are humanities which do get wiped out it is a real problem to which we have not found any solution; the problem of the modern times. The other characteristic is that we are all so closely connecting that now we influence each other, we dominate each other, we brain wash each other, we threaten each other much more closely than we could do in the past.

The global village, which people talk about, the so-called globalization, is no global village at all. It is not one community so this is a trend to uniformise, to wipe out the things, which comes from the intimacies. We all drink colas of various

types. My friend Kiran Karnik once coined phrase "Colonization". Colonization has gone but "Colonization" has taken over. So this is causing tremendous problems and tensions whether it is between religious groups, ethnic groups and language groups. Bengal is the most cultured place in the country. Not only Bengal but people from many other states in the country have a right to say so, and we have to grant this right to everybody else.

Now, can our perspectives and our understanding largely arise out of scientific investigation? We are the part of the whole cosmos and so were our ancestors many thousand of years ago. This kind of awareness is a part of ecology, which also becomes a part of your brain. The problem of communication still persists. I think the only way we can learn is to create for every human being on this planet, a canvas or a template of cosmic consciousness on which you situate all these intimacies in equal majesty. And to create such a template of consciousness if you like understanding, perspectives should be the primary responsibility of the people who communicate science. Nobody else can. Once you do that and situate all these intimacies on this template and then you abolish the very idea of centre. You abolish the very idea of a metropolis. Each place is a centre, each place is a metropolis. Can we move in that direction?

I posed a thought to many philosophers that Mahatma Gandhi perhaps came one century earlier. He should have come at this time. Let us not freeze Gandhi and his ideology and philosophy. When he talked of Gram Swaraj (village independence) he did not visualize that any system in which there is a directing centre or some centre far away, ultimately there will be exploitation, there will be non-understanding of the needs and there will be alienation. He had a great deal of wonderful

things to say about education, working, intimacies, all kinds of things, production by the masses and not the mass production of all kinds of things. Gandhi's ideas were not sustainable at that time, when he was giving them. I suggest to you, possibly, perhaps now the ideas have become sustainable largely through the work of technologists and scientists. It could be or it may not be and that is how we can stay interconnected in the smallest communities with each other by which I do not mean broadcasting I mean interconnectivity like Internet. Then in various languages through works, through oral communication, through visuals, through all kinds of micros and so on we can not only stay connected but can also produce things at a distance of high quality in principles. There are technologists amongst us. The agenda that we should set for ourselves is not to communicate or to spread out jargon to impress poor locals and villagers but to listen and to be a part of them.

We can network the country and the world. And if we do that we possibly make a transition to the ethical societies, which Gandhi talked about. But we have to work hard. You cannot just get experts from Chicago to come and set up information highways. To make this happen we have to set up systems. It will not happen automatically so there is great deal to be done. We all have to get involved in this. Do not confine only to the narrow objective of communicating this piece of science or that piece of science that is important to bring about the understanding of science. But the large perspective is something for which true communicators are required and who are within the fraternity like this. And I have great pleasure now on inaugurating this conference.

*Inaugural address by Yash Pal at First international
conference for science communicators
Pune- 2000*



Basic Challenges Today

I am sure there were times in human history when mankind had gone mad. There was exploitation, anger and injustice. There was in human behavior, there were horrible wars, and there was social aggression, fights between tribes, organized armies fighting each other to the finish; when countries were subjugated, civilian populations were killed, even women and children were sacrificed in large numbers. After the World War II it was generally believed that such things would never happen again. It was felt that we had had enough of barbarism, we had grown up and in days of increasing understanding a civilized world would never allow any such thing. Many people believed that a new global consciousness was beginning to take birth. From now on force and military conquest would never be accepted as legitimate ways of settling human differences; it would not be possible for leaders of a few national entities with military power to sit around a map and draw lines defining their zones of influence, suzerainty and colonial ownership.

The coming in of the United Nations and simultaneous burst of the de-colonization promised a future filled with hope. There was good deal of talk of a new Information Order, a New Economic order and host of other things that kept the dream of a new dawn alive. Non-alignment was a symbol of independence of countries that were economically and militarily weak. Even though there was craftiness and dominance on the part of the powerful, even that had to be hidden.

All that is past now. No need to hide anything. If you have the muscle power anything you do is legal at least in our own eyes. Recently Bush, Blair

and a few others could manage to buy, cajole or coerce to go along with them. They have broken all rules of civilized international behavior. Through their unprecedented military force they have led to war in a matter of two weeks, a country they accused of possessing weapons of mass destruction. They are still looking for those weapons and do not even feel ashamed that they have not found any. Meanwhile their weapons of destruction have been eminently successful. Now they are busy trying to administer Iraq while making plans to rebuild the country using its own wealth and prime contractors from their own countries!

A new direction for apex level free enterprise has been discovered. Destroy the civilizations along with hundreds of thousands of men, women and children and start rebuilding it using its own resources with lucrative contracts to your own corporations. Of course, there is no charge on these corporations to bring back the humans laid to dust or the riches of one of the oldest human civilizations destroyed or vandalized.

Why such civilized countries are acting the way they are. They have deep scholars, poets, sociologists and above all the best scientist in the world. Why they can not influence the way the powerful in these countries act? Why can't they understand that they will not assure the peaceful future for themselves, in spite of their enormous power and weaponry using the urges of the middle ages, even of those that held sway till the last few decades of the millennium gone by.

One of the gifts of the twentieth century was the global soaking in of a consciousness that all humans have the same rights and military

conquest does not provide legitimacy to the victor. People no longer accept without a seething a resentment that only a few powerful entities will condition and they must remain amongst those who will be only conditioned. Globalization has proceeded in a direction where this has been consciously or sub-consciously promulgated. Policies that increase disparities have been vigorously pursued internationally and through the advice of international organizations, also nationally.

The economic system has been so configured that the rich are getting richer and the poor relatively poorer. Disparities are increasing. Indeed the new system seems to be specially designed to increase disparities, even when the overall GNP keeps increasing. This is happening not only between countries but also within countries. Advancement has been defined as a trip along the same track as laid by the footsteps of those who have gone ahead. Autonomy of social and political entities has been severely limited.

One should have expected that such a situation in the present day worked is not sustainable. It is almost explosive. Even mediocre social psychologists should have been able to forecast this. The powerful countries have a large number of wise thinking individuals who would have realized this. But this kind of scientific temper is not determining the conduct of the powerful in most societies around the world. Where markets and digital casinos; we call them stock exchange, reign supreme sustainability of social structures or fate of the world a few years hence is completely outside the dominant agenda.

Thus we find ourselves in most countries, where power is still in the hands of those who are amongst the least sensitive. They still operate on the paradigms of the 19th century or earlier and have not appreciated that after centuries of turmoil people every where feel violently affronted when not given the status of earth citizens- they have been infected by the global consciousness as I mentioned earlier.

The affronts they now feel sometimes make them psychologically sick and we them mount unprecedented crusades to root out terrorism. It is not surprising that such crusades often multiply the "disease" and we end up being more vulnerable.

It might be tempting to put forth the paradoxical hypotheses that exponential growth of science and technology might be leading to an eclipse of scientific temper! After all there seems to be a correlation. Technology leads to power and superlative power encourages tendencies to dominate, coerce and conquer. I plan to argue that this correlation can be and should be broken. Science does not permeate the folds of the technologically dominant societies, any more than it does amongst those who are technologically backward. An exhortation to move towards temples, mosques and churches is not the answer. The answer lies in the understanding and the non-denominational spirituality of science itself.

Receding scientific temper and flourishing science

Many politicians, also many scientists, have projected visions in which India will become a developed country by the year 2020. They claim that we will be a knowledge superpower, an IT superpower, an atomic weapons power, missile power and so on. Power, power, power... Why is there such a preoccupation with power? Will our country be the most humane society in the world? Will we begin to care about our neighbors as much as we would about ourselves? Would our children all be in school? Would all child labor have been abolished and a social security system introduced to look after those who are out of worker too infirm or old to work? Would we have abolished all the crime against women? Would we laugh at, and be ashamed of, the time when we used to fight about temples and mosques? Would we begin to celebrate our diversity instead of just tolerating it? Would disparities be reduced and not increased as they have been in the recent years?

We have entered an era in which the formulae that have made a few countries dominant are being superficially imposed on all the countries. That is silly. Even mathematical equations are useless unless the initial conditions are the same or similar. We did not amass enormous capital through colonizing others. There was a time when these developed countries had their known patent and intellectual property rights, suited to their economic and industrial position. But now they are the powerful ones, they impose a system that will perpetuate their advantage.

We could have resisted it if we had exercised our own right to define a good life for our country. We did not because a significant fraction of our decision-makers and members of the upward mobile middle class could not think in any way different from the one for which they had been brainwashed. There are few basic thinkers left in this field. Susceptibility to brain washing is an important consequence of a receding scientific temper. But where has science been going for the last so many decades?

When I scan through the few disciplines of science I can understand a little, my first reaction is to feel envious of the younger generation. So much is happening. There is an enormous churning in biology, astronomy, astrophysics, cosmology, geology and geophysics, physics and that large area where you do not know whether you are dealing with physics, chemistry or biology. There are amazing developments in condensed matter science, computer science and technology, the communication revolution resulting there from, medical technology arising from a combination of techniques derived from many other fields of science and technology. But then I remember that the basic principles and deep ideas in many of these fields were already visible half a century ago when I was a young researcher. And I feel grateful that I grew up in an era when all this was happening.

But much of that science has advanced beyond

its early glimpses. The areas of astrophysics and biology have led to many insights about the way this world and this universe came to be and how magnificent and mutually connected everything is. What a privilege that an ordinary human can dare to comprehend some of this and actually succeed? Besides the joy of understanding, the sheer spirituality of science is deeper than any experience one could ever wish for.

It does seem strange that I should speak of a deep spiritual experience through understanding, an understanding that can be shared by all humans, that does not depend on revelation. I do not quite understand physiology or biochemistry that converts mere understanding into a spiritual element of my life- not just that, but also a deep ethical component. Perhaps someday we will. I am sure we will, or rather, the young of today will. For the time being I am satisfied by the argument that this is so because we are human. We do not need any other allegiance or loyalty beyond understanding in addition to our humanity.

One would have thought that even a general framework of today's understandings and the long perspectives they provide would have made a basic impact on the social and political behavior of us humans. Unfortunately it has not. That for me is a personal sorrow. I believe that we scientists have let down humanity. We have preferred to become mere tools. Perhaps we have been so immersed in the crevices of our specialties that we have not even looked at the broad landscape that has emerged. It seems, sometimes, that in a sense we have become even more parochial than earlier. Otherwise it would be difficult to understand the growth of astrology, fights over religion and ethnicity, nationality or race. While the complexity has increased, and capabilities have reached great heights, and means of establishing contact and staying in contact have been revolutionized, the basic agendas of humans have not altered much. Inclusive visions are as inaccessible as ever- sometimes it seems that they are receding.

Drinking water

Let us consider one development. Drinking water is already supposed to come out of plastic bottles, no matter that countless people depend on women walking 10 kilometers to bring home one "ghada" of water for drinking from sources that often dispense only polluted water. Solutions would be seen in providing safe drinking water that will cost an amount equal to the total income of a person for his one day's requirement, forget about his whole family. People would forget that a possible solution might lie in cleaning up all sources of water.

The insensitivity and vulgarity of a recent television advertisement amazes me. A rural child, a goatherd, is shown in a delightful dance and play, in rain and mud, against the background of a truck bearing the name of a well-known bottled water and soft drink company, carrying drinking water into rural India! This ad will probably win a prize in the clever world of brain washers and image builders. There are a couple of other clever images in the ad. A baby breaks into a bewitching smile when sprinkled with a few drops of the magic water from the labeled bottle and another child is seen emptying a similar bottle in its fish tank while its mother smiles lovingly at her child's caring gesture towards the fish it loves. Every one will absorb the message that clean water can come only in bottles. That is written in the architecture of the world God designed! It's too bad for millions whose clean water has been messed up while manufacturing the very same bottles or other industrial activity. They also are part of the inclusive society.

Agriculture science and technology

It is generally recognized that the future of the world is tied up; with the way agriculture develops. There is much talk of the revolutionary developments in genetic engineering and biotechnology. I have no intention of becoming rhapsodic in my remarks about these areas. But we do have to pay serious attention while not being swept off our feet. Many of the things that make headline these days are

related to the national and international activities in this field. The aspect that concerns me the most is an implicit assumption by many educated persons and decision-makers that the ultimate configuration of agriculture in our country is bound to be the same as in North America.

It is taken for granted that the natural destiny of the planet would demand that, everywhere in the world, agriculture should become a mega-industry, with only a few producers and innovators and all the rest only consumers. The producers would hawk their standardized goods, using seeds engineered in a few private factories. There would be competition, but only between powerful gladiators capable of exploiting economies of scale. The produce will then be marketed around the world using the same means as currently used for selling soap, beauty creams, motor cycles, cars washing machines and much else. There would be programs like 'Antaksharis, kaun banega crorepati', and perhaps half-naked girls playing in mounds of wheat grain or rice and many other creative versions. Hidden in these programs would be overt and subliminal messages to brainwash the consumers. Some of it is already happening but the mega-corporations have not yet taken complete control. The modernists put forward a picture in which the initiatives of the individual farmer would be completely irrelevant because he would be turned into a classic consumer. Our farmers would cease to be a part of any inclusive vision.

Let scientific temper rise as science flourishes

It is easy in the present day world to go off on crusades to seek chimeras of progress and modernity. The easiest avenues are those where some of our bright young men and women are weaned away from science and humanities by joining sectors broadly under the label of "IT enabled services". There are financial gains in the short term in becoming the much sought after service agents. Global masters who set the agenda and seek cheap services, such as those for medical transcription, define these sectors. The more we

succeed in this venture, further behind we will find ourselves. We will reinforce the habit of assuming that all new initiatives for the emerging world must necessarily come from far away—the metropolitan areas of the country sometimes, but most often from abroad.

The last fifty years held the hope that true independence would begin to light up the lives of all humans within a single century if not earlier. Of late we have been brainwashed into believing that the dream of making an India of our own concept was not only wrong but also downright stupid. Perhaps we were rather sluggish and inefficient, but we still had dreams that some day there shall be an India that would be truly independent, even in terms of defining the parameters of a good life. Now we are told that that particular road was inherently misconceived and the best way is not to strike out on our own but follow in the footsteps of those who seem to have gone ahead. Even when we are not convinced that the so-called leaders are really ahead, people point to their power and affluence. It has become silly these days to suggest that power and economic dominance do not necessarily define a good society. It is a pity that we cannot even think of any other measures in this regard. There was a time when we still could.

This brings me to the second strand that I want to take up today. That is the basic element. Even though it might seem to contradict to what I have said earlier it is important to understand that this basic strand should be the foundation on which the first should stand. The fundamental flaw in our education and research has been that it has been a decoupled system. Decoupling has been pursued as a virtue. We have been decoupled from the grass roots knowledge and current exploration, from the industry around, from our research laboratories, from other disciplines of knowledge and from the life of the people at large. Every time we wanted to develop any specific area we set up a separate institute, college or university for that purpose. Paradoxically, in doing so we made sure that very few worthwhile things would develop! Real life

issues and problems remained un-addressed. Our education and often our researches tended to become inorganic, non-fertile. Diversities of issues and problems remained unrecognized. Our craze for uniformity ensured that our work did not resonate with any real area or real people. The problems to be studied did not come out breathing or crying.

The real issue of the modern times-for India and the World

Let me at the end of the discursive arguments largely around the Indian situation come to the basic question impinging on the architecture of an inclusive world. There is no future for a civilized existence without that. That such architecture would necessarily demand a change in the way of thinking goes without saying. I will not demand that every one on this planet should become equally affluent. Inclusiveness should not be so much about equality. Nor should it include any element of charity. The driving force has to be an enlightened self-interest. Without meaning to sound pontifical I would summarize my exhortation to the world and to us, my formula, in the following words:

No individual, no human collectivity, no country, no professional, no corporation, indeed no one shall : be *only*, or be made into *only*, a consumer.

A few implications of this statement are the following:

How to make the Gandhian way of thinking sustainable? Without that globalization, servitude, disparities, fundamentalism, terrorism and genocides are inevitable. Without that environment cannot be saved for the future generation. In the last century Gandhi was not sustainable. With today's technology he can be. But the technology will have to be developed towards that end. The concept of 'gram Swaraj', the thought that no one should only be a consumer, that true education full of values and understanding and scientific creativity, would come only when we are coupled with society. All consumers have a fundamental right and responsibility to be creators or producers.

Gandhi's slogan "Production by masses and not mass production" can now be realized. If the world needs a "jihad" then it should be to make people understand that this seems to be the only way to give fulfillment to individuals. Such an enterprise would need the best of technology. People would not live in their wells. They would be connected and yet in control. Can India itself use and then sell this vision to the world? That needs a major upheaval. I do not know who would be equal to this challenge. Perhaps Gandhi came a century too soon.

To summarize, the Basic challenge of today is the following :

As the world globalizes, the intimacies feel threatened. Intimacies are essential to being human. They have produced music, culture, values, language, art, literature, and even humor. A quick assault on these seems to be an assault on human entities and their own existence. The resistance is almost automatic and sometimes most virulent. This has increased in parallel with the process of globalization, with superficial uniformisation of the world, with 'colonization', as

a friend has said. Besides the cultural assaults there are also economic consequences. All this seems to have been foreseen by Gandhi.

Now it should be possible to have a different kind of globalization, without assaulting the economic and cultural autonomy of human collectivities. Globalization should be subsumed in a deeper global consciousness. On this substrate of global consciousness, call it new globalization if you like, human collectivities could live an autonomous existence, in control of themselves, not in a well any more but networked with the world and the universe. The techniques and technologies for doing this have now become possible. This is the architecture for a truly inclusive society that I would commend. This can be brought about if, in addition to our basic humanity, we soak the world in a glue of scientific temper. Mere creation of insulated scientists and engineers won't do. It might be even counter productive.

*Keynote address by Yash Pal at
Second International Conference for Science
Communications - 2003, Mumbai*



How does Aspirin know whether to go to the head or the toe?

Mysteries of learning and education in schools

"I hurt my toe 2 weeks ago and my mother gave me Aspirin. Yesterday I had a headache and mother gave me Aspirin again. How does the tablet know where to go?"

Children often ask questions that are awkward and often difficult. Most of us have evaded questions like this one by telling the child that he / she would find out the answer when they grow up. Such a tactic can bail us out of a tricky situation with our egos intact, but do we kill the child's curiosity and his hunger to learn?

When renowned scientist Prof Yash Pal got a letter from a young girl confused about how a tablet could possibly know whether to go to the head or the toe, he saw it as a chance to enlighten the little student. "You cannot get a better opportunity to explain the central nervous system to the child. Such opportunities present themselves all the time and teachers must take them," he said to a 300-strong audience of dignitaries, teachers, teacher trainers, NGO representatives and Education department officials. Prof Pal was delivering the keynote address at the inauguration of the 3-day National Learning Conference organized by the Azim Premji Foundation in Bangalore on October 22. The theme of this year's conference was '**Autonomous and Accountable Teacher for Quality Education**'.

Joys of Understanding

The wise professor quoted examples to show how learning can be achieved outside the curriculum by encouraging students to think and by quenching their curiosity. "The emphasis in learning must be the joy of understanding," he said while making a strong case for sweeping changes in the education curriculum. "Why should children memorize currencies of 20 countries or the first line of the national anthem of 10 countries," he asked. "I don't even remember the currencies of countries I have visited and I am doing quite alright," he added with sarcasm.

Prof Pal shared a letter from a young student who wondered why her one toe was shorter than the next. "My grandmother had one short toe too, but my mother's toes are normal," her letter read. Though many in the

audience had no clue about the size of toes, the professor was making a vital point to all involved in education. "The teacher and student can explore and learn together," he suggested, opening up a new dimension to education that is not restrained by a syllabus. "Learning can never be delivered, it has to be acquired, constructed and assimilated," he stressed. About the toes, the answer lies in Mendelian genetics, a topic taught in junior college science, a decade after the child first thought about the peculiar shape of his body parts.

Don't tell me how to think

While evaluating answer papers, teachers use a model answer paper, which specifies the correct answers to a question. This system brings uniformity in marking and ensures standard rating process. However, it does not allow room for innovative thoughts or ideas. Bright students have historically had a problem with teachers trying to tell them how to think. Prof Pal narrated a famous anecdote of a Dutch student believed to be Neils Bohr who frustrated his teacher by coming up with alternate answers to a question but not the one that she expected of him.

Professor Yash Pal also talked about the admissions process calling it, "industrial production of graduates tested on a machine called the common entrance test" as if they were producing uniform ball bearings with little individuality of their own and created specifically to fit into a bigger scheme. His views were later echoed by other speakers at the conference who felt that the kind of information taught to students in the name of learning does not stimulate their minds nor gives them food for thought. Students today spend several months in coaching classes where they memorize chapters specifically to pass the entrance test. "That bit of information which is not connected to any other information can be sterile, harmful, toxic and dangerous," said Prof Pal about all the data that students cram up.

Report on the Keynote address

by Prof Yash Pal at the National Learning Conference

2005 - SHIBU JAGADEVAN, Bangalore

- October 22, 2005

Some Faces of Indian Science – Its Present And Its Potential

Let me start by talking of the visible aspects of Indian science. Some of the areas that come to mind are connected with a few institutions that have been major players for some time. There has been significant progress in the field of atomic energy, including a movement towards achieving a fast breeder reactor. Use of thorium as nuclear fuel might actually happen. There are many hurdles and challenges in front but also a hope that we might get there within the next decade. While the technical achievement in the area of atomic energy has been of a very high order, the total amount of power delivered to the country has not been very significant. This lacuna has been due to the requirement of high investment in this area as also political decision-making. Environment considerations and reduced availability of cheap oil and gas might change the situation in future.

There have been other spin offs of the atomic energy program. They include nuclear medicine and development of capabilities in a host of technological areas.

In the area of space technology there have been some brilliant achievements. The Polar Satellite Launch Vehicle (PSLV) has proved to be a reliable workhorse. Building on the basic design of PSLV and adding a cryogenic stage has led to a Geo-stationary launch capability.

This would soon lead to operational systems capable of launching two-ton payloads into the Geo-stationary orbit. Satellite technology has been demonstrated in several launches, both for communication and remote sensing. We now have about 120 transponders available on Indian INSAT satellites and our meteorological and remote sensing

satellites are proving to be of excellent quality and great use to the country. Offer of channels for education and science is a welcome outcome of the success achieved in the design, manufacture and deployment of space hardware.

Atomic energy and Space are two areas where major developments have been made by the public sector without critical technical assistance from abroad. This is important to remember. Rising up by pulling on our bootstraps can lead to endogenous and self-confident development that can survive even during years of outside embargoes.

In the area of chemicals and pharmaceuticals the country has moved significantly forward. We are beginning to be recognized as a significant power in these fields. There are a large number of capable people available and their number is growing. Young persons come into research laboratories and industry with much greater competence and self-confidence.

Industry has been coupled with laboratories to a much larger extent than in many other areas close to physical and medical technology. Biotechnology is now much in fashion, even in the school curriculum! I cannot help feeling that the current hype is louder than the tune, even though one feels that great things lie ahead. We do have a great vaccine, namely that for hepatitis-B which would be highly expensive if it had to be all imported. One is highly pleased by the manner in which some Indian companies have been able to fight

The multinational pressure to supply Anti-aids drugs to Africa. Smell of ethics emanating from this highly competitive and bottom-line conscious

industry makes me feel proud of my country. Of course, this is not enough to cancel the shame of the burgeoning business of spurious drugs that our crime fighting agencies are not able to control. It would be a big gap if one does not refer to a rising effervescence in the area of information technology. Bulk of this major explosion comes from the fact that India has developed to be a major destination for off shore information services. We are basically providing service functions to outsiders.

We have to keep remembering that while we are acquiring technical competence in many areas by working on tools invented abroad, and while it is true that some of that competence is also beginning to improve the efficiency of some of our operations and services, this is not great original science. Science must contain elements that have been originally thought of and progressed through our initiative. What is happening is exceedingly useful, but it should not lull us into a mindset that we have become scientifically innovative or creative.

We might also remember that the more we use the gadgets that are mostly invented and manufactured abroad and the more we succeed in doing such business for others the greater would be the disparity between us and them. I meet lot of young people these days. I am thrilled by their basic quality. It is not true that they are not interested in science. They observe, they experiment and they seek answers. Those answers are usually not available in the disintegrated, didactic and overloaded curricula of their schoolbooks. The teachers are also wrapped around the same curricula and pressured to "finish the course" and not waste.

Their time on things not likely to figure in examinations. Many discovered questions of children therefore remain unexplored and unanswered. And soon after that begins a phase when such questions are consigned into "no need to know" bin. The world does not have to be understood. Brainwashing and slogans begin to take predominance. And when the State itself

begins to provide respect to Astrology as a science to be taught in universities, the story is completed. But all this is not immutable. This can be easily altered and we can begin allowing the hidden and natural talent amongst the young of this land to emerge and change the scene within a few years. I suspect some of this is beginning to happen.

I see another change in the science scene of the country. Information systems are finally getting introduced in our colleges and universities. It has taken a long time after the Inlibnet was established by the UGC over 13 years ago. I am sure it will make a difference but only if we use it to increase the dimensionality of education and not go on making new prisons we call syllabi. Lot of learning will happen from living and taking varied courses, from colleges or the net. We would need to develop respect for the gifted dropouts and not keep stamping them with a failure label. Education will not be finished in schools, colleges and universities but in work places that should stop looking only for formally educated people. If we start transitioning in that direction then we would be surprised that we already have an enormous learning system in the country from which we had cut off relations when we set up our formal systems about a century ago. Contexts might get seamlessly connected with formal education and research. I am sounding overly optimistic about these possibilities, but this is so because I find more and more people who begin to think this way.

The experts within the established system are likely to be the biggest opponents of such a change. Because if this comes about all the prestige attached to the administrators of competitions and controllers of examinations would be difficult to maintain. Large centralised examinations can be justified only if contexts are neutralised and dimensionalities are limited.

Examinations are best administered in prisons of thought and competency. The success and vibrancy of a number of Inter University Centres and Consortia like the Nuclear Science Centre

(NSC), the Inter University Centre for Astronomy (IUCAA) and several others gives me personal satisfaction. We should proliferate such a culture in multiple ways. A number of institutions like the TIFR, PRL, IISc, CCMB, NII, and several others have not shown any signs of decay while some others have come up. One begins to see some movement towards a proposal made 15 years ago that some of our national laboratories should start functioning like universities.

Several universities like the JNU, Poona, Hyderabad and a few others do occasionally scintillate but most are still caught in the quagmire of ill-administration and orthodoxy. But excellent people are found everywhere often un-noticed, even though shining. A number of marvelous facilities have been set up for research and exploration. There are many places now with first-rate facilities for chemical and biological research – not just facilities but also competent people who know how to make use of them. In physical sciences the setting up of an excellent telescope at Hanle at an altitude of over 15,000 feet is a significant event. This telescope can be operated remotely from Bangalore and in principle from anywhere in the country.

Coming in of this instrument is beginning to the growth of several young astronomers and many observation proposals have already been accepted. The meter wave giant telescope, GMRT, is fully operational and is already giving first class results in astronomy. One does have a slight dearth of young people with visions of doing science in preference to management and commerce. This is worrisome and needs to be addressed in a cooperative way. It should not be difficult to persuade brilliant young people that there is deep fun in discovering a new pulsar, the spawning of a new planetary system or engaging with questions like “why the universe is as it is and why did it bother to exist”!

Selling of soap, cosmetics, colas or chocolates might fetch more money but cannot be intellectually as challenging or spiritually as fulfilling. One is delighted that we also have organizations and collectives of scientifically competent and concerned individuals who analyze, critique and even crusade for the greater good of society. I refer here to institutions like the Centre for Science and Environment, and people like Vandana Shiva. It is a wholesome development in our country. Another development that might have a far-reaching impact in making India a humane and scientifically literate country is the increasing recognition that innovators of all kinds are sprinkled liberally in the folds of our society. We need to respect their efforts and build on them.

The work of people like Anil Gupta and the setting up of a National Innovation Foundation might be a dawning recognition that in order to give contextual validity to our efforts to soak science and technology into the interstitial layers of our society we have to set up a two way transaction between elite science and the grassroots talent and ways of learning and doing.

Resonating with these efforts are a large number of people's science movements whose diversity should not blind us to their basic urge to establish a two way conduit between people as they are and the way they might develop without being sucked into a cauldron of revivalism. In the end we have to remind ourselves that we are still the world's most illiterate country. Not more than 1 % of our people get to study rudiments of science at college level. Unless we do something about this all dreams of India becoming a great scientific power would remain somewhat hollow.

*An article for the special segment of the Tribune on
the occasion of the Indian Science Congress
Session at Chandigarh.*



Learning Without Burden

Dear Arjun Singhji,

I have great pleasure in forwarding the report of the National Advisory Committee, you had set up quite a few months ago.

We have applied our mind to the fundamental question posed in our terms of reference: To advise on improving the quality of the learning while reducing the burden on school children. We have had wide-ranging consultations, all over the country. We have talked to teachers, curriculum designers, textbook writers, various School Boards, scientists and academics, book publishers, headmasters and principals- and several others. We have analysed the textbooks in different parts of the country. We have looked at the letters received from a number of people in response to our newspaper and TV requests. And after much discussion, and a fair amount of drafting, We have produced all analysis of the problem and some recommendations.

On a personal note I would like to add that this has been a difficult report to write Not because we had a great deal of trouble understanding the problem, or that we had lot of differences amongst ourselves, or even developing a conviction that something has to be done. The difficulty for me personally has come from my inability to persuade myself that the "state" of our school education is an independent variable - that it could be altered without altering lot of things in our social set-up! Indeed, it is not only the setup in the country, but also the defective interpretation of the external scenario, that finally impacts out young students, robbing them of a wholesome growth and depriving the country of what they could contribute. Nevertheless we have made a number of recommendations which should help.

In regard to the burden on children, the gravitational load of the school bag has been discussed widely in media, even in Parliament. After this study I and most of my colleagues on the committee convinced that the more pernicious burden is that of non-comprehension. In fact the mechanical load on many of our students in Government and Municipal schools may not be too heavy, but the load of non- comprehension is equally cruel. In fact, the suggestion has been made to us that a significant fraction of children who drop out may be those who refuse to compromise with non-comprehension- they are potentially superior to those who just memorise and do well in examination, without comprehending very much! I personally do believe that "very little, fully comprehended, is far better than a great deal, poorly comprehended".

I suggest that the analysis of this report and its general recommendations should be exposed and discussed as widely as possible. Without claiming revolutionary, new insights, or things which may not have been said before, I do believe a concerned discourse on some of the fundamental points made in this report would be good for our future. The report should certainly be published, not only in English and Hindi, but also in all the regional languages. It should be widely circulated, so that a large number of teachers. parents and students can begin to discuss these matters.

Finally, I would like to thank you for bearing with us while we struggled to draft what to us appears to be a reasonable set of recommendations.

With regards,

Yours sincerely,
YASH PAL

Introduction

Concern regarding academic burden on students and unsatisfactory quality of learning has been voiced time and again in our country during the past two decades. The question has been discussed extensively by several committee and groups. The Ishwarbhai Patel Review Committee (1977), National Council of Educational Research and Training (NCERT) Working Group (1984) and National Policy on Education (NPE) Review Committees (1990) made several recommendations to reduce the academic burden on students. The curriculum development agencies are generally in agreement with the recommendations of the committee and assure the public that these would be kept in view at the time of the forthcoming revision of curricula. But the problem, instead of being mitigated, becomes more acute when a new curriculum is introduced. This has happened in the case of new curriculum introduced in the wake of implementation of NPE (1986). With a view to have a fresh look on the problems of education, particularly with regard to the problem of academic burden on students, the Ministry of Human Resource Development, Government of India, set up a National Advisory Committee in March 1992 with the following terms of reference

To advise on the ways and means to reduce the load on school students at all levels particularly the young students, while improving quality of learning including capability for life-long self-learning and skill formulation.

Before starting its work, the Committee decided the parameters of its work and also the methodology for completing the task entrusted to it. With a view to keeping a national perspective in view, the Committee decided not to confine its work to the Central Board of Secondary Education (CBSE) or NCERT syllabi and textbooks but to take into account the textbooks used in different states and union territories also. Secondly, the Committee decided to base its recommendations on the data obtained through perception surveys. wide-ranging

consultations with teachers and analysis of textbooks and other instructional materials. Thirdly, the Committee decided to look at the work of agencies/organisations doing innovative programmes.

The process of consultation was initiated with a meeting with a few faculty members of NCERT followed by meeting with teachers and principals working in different states at four places in the country, namely Delhi, Thiruvananthapuram, Pune and Calcutta. The consultation meetings were also held with voluntary organisations engaged in innovative programmes, syllabus and textbook writers, private publishers, and Chairpersons of Boards of Secondary Education. Some members of the Committee organised meetings with parents, teachers and students at Bombay, Nasik Baroda and Calcutta. Surveys to ascertain the opinions of teachers and parents were conducted with the help of questionnaires at Bombay and Delhi.

To involve the whole country in this exercise of looking at the problems of school education from the perspective of mechanical load of studies on children, views and suggestions were invited from the students, teachers, parents and general public through advertisements in the newspapers and special announcements by All India Radio and Doordarshan. The Committee received more than 600 memoranda, letters and write-ups from students, teachers, parents and professionals interested in children's educations.

The wide-ranging consultations with knowledgeable people, analysis of the existing instructional materials and reactions of the teachers and students have enabled the Committee to understand the functioning of the present educational system which forms the basis of its recommendations.

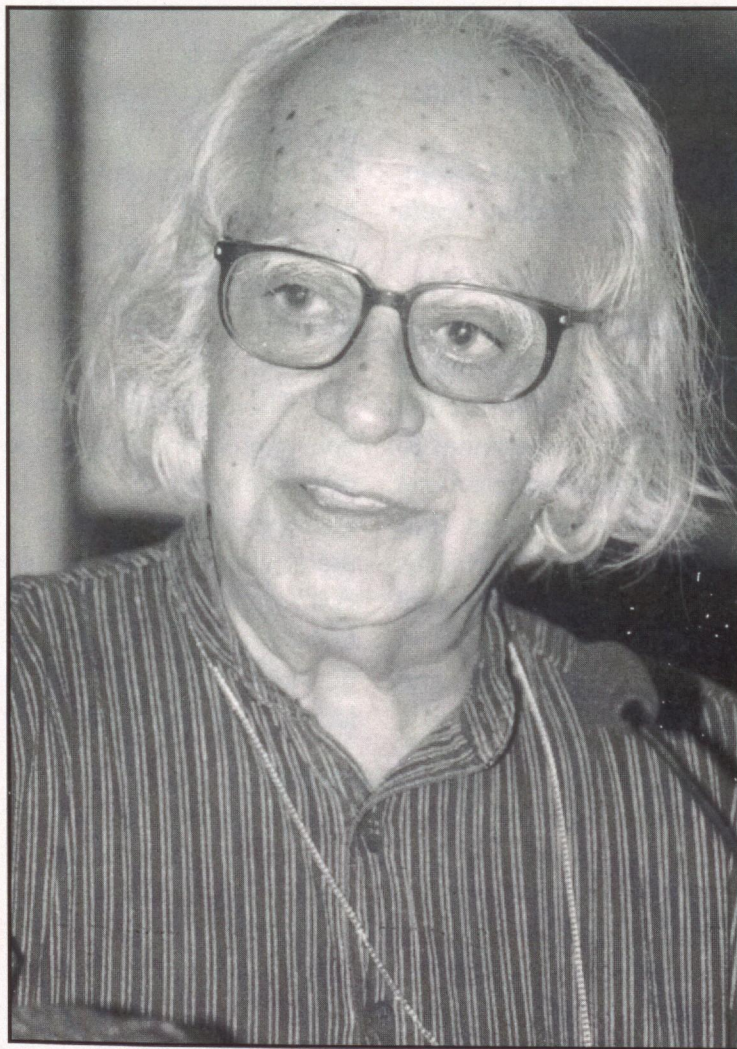
In its work, the committee received cooperation from a large number of teachers, principals, syllabus and textbook writers, organisations, associations and departments. We

gratefully acknowledge their contribution in our work. Particularly, we are grateful acknowledge their contribution in our work. Particularly, we are grateful to the State Council of Educational Research and Training (SCERT), Delhi, where the Committee's office was located, for providing all types of administrative support, which tremendously facilitated our work. We are also thankful to NCERT and its Department of Social Sciences and Humanities for providing finances and other facilities for holding meetings of the Committee. The education departments of the states of Kerala, Maharashtra and West Bengal, and the NCERT Field Advisors in these states deserve appreciation for hosting the regional consultation meetings held at Thiruvananthapuram, Pune and Calcutta. Special thanks are due to voluntary organisations,

Alla Rippu, Digantar and Eklavya for sharing their experiences with the members of the Committee. We express our sense of gratitude to the authorities of Doordarshan and Akashvani for making special announcement requesting the audience to send their views and suggestions to the Committee. Above all, we are extremely grateful to hundreds of parents, students and teachers who responded to our invitation and sent their views in writing, in many times after holding meetings/workshops at their places.

**Report of the National Advisory Committee
Appointed by the Ministry of Human Resource
Development**

**PROF. YASH PAL , Chairman, 15 July 1993
To Shri Arjun Singh, Minister for Human Resource
Development, Shastri Bhawan, New Delhi 110001**



The Marconi Fellows

The Marconi Prize is awarded annually to individuals whose scope of work and influence carry on the legacy of Guglielmo Marconi, recipient of the 1909 Nobel Prize for his pioneering achievements in wireless technology. The Marconi Society recognizes its Fellows for their lasting contributions to human progress through the invention and application of communications technology.

1980 - Professor Yash Pal
Space Applications Centre, Indian Space Research Organizations, India

"To recognize wise and humane leadership in applying modern communications technology to meet the needs of isolated rural villagers in India"

Presented by: His Excellency Sir Zelman Cowen, Governor General of Australia, at the Sydney Opera House

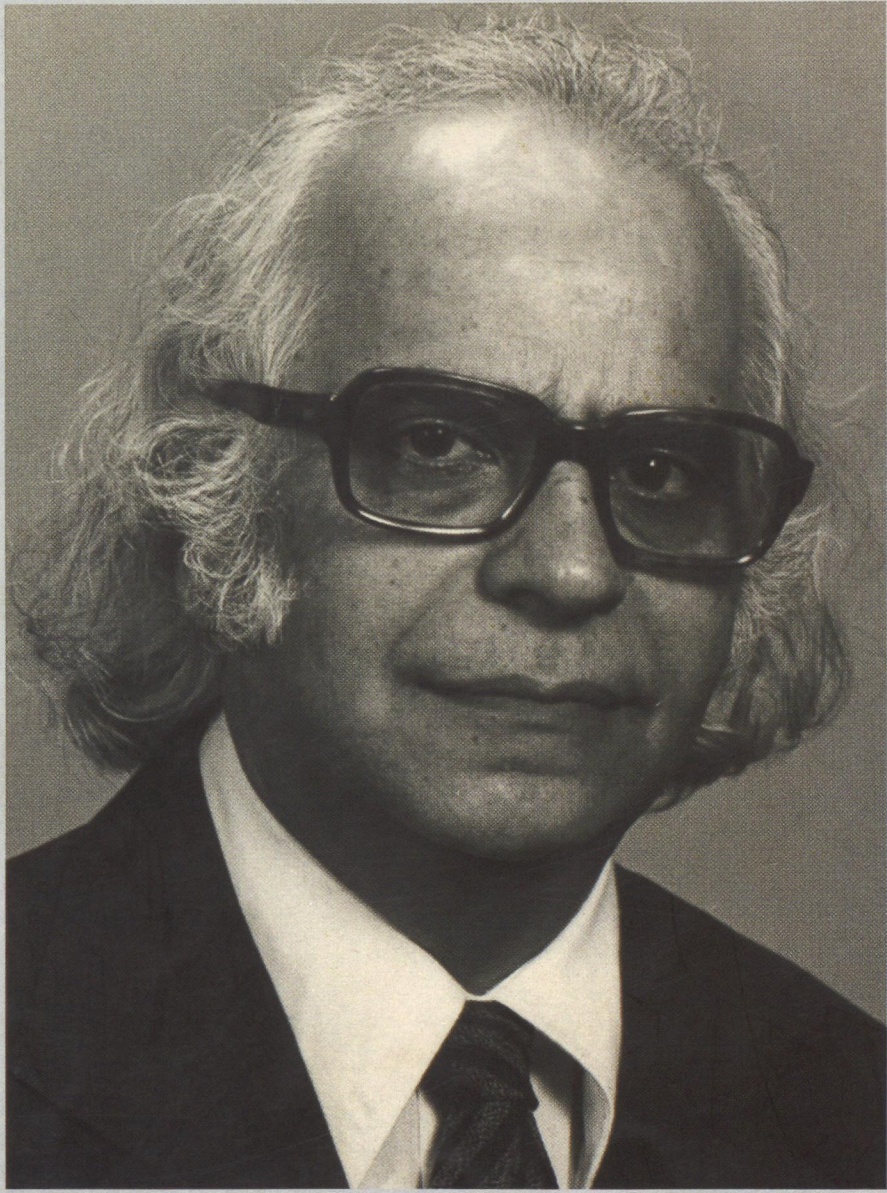
Professor Pal is the creator of the Space Applications Centre at Ahmedabad and served as its first director. During his tenure, Professor Pal conducted a major socio-technical experiment to ascertain whether a satellite-based direct television broadcast could be used for education and development in rural villages of India. Currently, Professor Pal is National Research Professor of India, occupies the Jawaharlal Nehru Chair in Technology of Punjab University, Chandigarh, and is the Chancellor of Nagaland University.

Some Faces of Indian Science - Its Present And Its Potential
Prof. Yash Pal

Let me start by talking of the visible aspects of Indian science. Some of the areas that come to mind are connected with a few institutions that have been major players for some time. There has been significant progress in the field of atomic energy, including a movement towards achieving a fast breeder reactor. Use of thorium as nuclear fuel might actually happen. There are many hurdles and challenges in front but also a hope that we might get there within the next decade. While the technical achievement in the area of atomic energy has been of a very high order, the total amount of power delivered to the country has not been very significant. This lacuna has been due to the requirement of high investment in this area as also political decision-making. Environment considerations and reduced availability of cheap oil and gas might change the situation in future.

There have been other spin offs of the atomic energy program. They include nuclear medicine and development of capabilities in a host of technological areas. In the area of space technology there have been some brilliant achievements. The Polar Satellite Launch Vehicle (PSLV) has proved to be a reliable workhorse. Building on the basic design of PSLV and adding a cryogenic stage has led to a Geo-stationary launch capability.







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(FELICITATING PROF. YASH PAL)

26 - 28, NOV 2006, NEW DELHI

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To,

chandita mubherjee
mumbai

Sub: Souvenir of Special Reminiscences About Prof. Yash Pal

Dear

It gives me an immense pleasure to send you a copy of the Souvenir, containing your article, published at the hands of the **President of India Honourable Dr. A P J Abdul Kalam** in the **80th birthday felicitation of Prof. Yash Pal** on 26th November, 2006 at the auditorium of Indian National Science Academy, New Delhi.

Your article has brought out special reminiscences about Prof. Yash Pal, which he and others will certainly cherish.

We thank you for your kind co-operation.

Thanking you,

Truly Yours,

(A.P. Deshpande)

Chairman

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