

I cannot say I know in detail how the administration proposes to move forward on this. The President made it clear to the Indian Foreign Minister when they met, that we continue to have a keen interest in environmental issues and on the issue of global climate change. Our concern was that the Kyoto Treaty, in the President's view, did not seem to be a balanced treaty. There is considerable work to be done to satisfy the President and his advisors that the present framework can serve our national interests along with the global interests. I think you will see an ongoing interest in environmental issues on the part of the United States, considerable work on science related to the environment, so we understand how to address environmental issues effectively. I think that will continue to be a high priority for the US.

On other matters

Your reminiscences and feelings of your stay in India, both as Special Assistant to the American Ambassador to India in New Delhi for four years and now as an Ambassador yourself to India.

When I left in 1967, I knew that India was always going to be part of my life. The four years I spent here were enormously important to me. I think for two reasons; one, the man I worked for, Chester Bowles, became the most important influence in my life. Two, I learnt a great deal here in India. I learnt about the importance of agriculture in economic development. In watching the green revolution at work, I saw this interaction of government, universities and industries in action. I also became, in a sense, part of an Indian family and that's very much my family still. So, that's been part of the joy of coming back here. In many respects, the recent tour has turned out to be beyond any expectation that I had. I never dreamed when I was here in the 1960s that I might come back as Ambassador. I suppose, if I were writing a novel, I would have said, 'Oh, of course, I dreamt about it every day and this is a fulfilment of life's dream'. I never thought about it and my wife suggested to me that what I really ought to do was to become Ambassador to India. But coming back here was an opportunity to fulfil many of the dreams that I shared

with my Ambassador back in the 60s, to see the United States and India move much more closely together, to have a sense here, and even more importantly in Washington, that we really ought to be partner countries. We really ought to work together in ways that benefit both of our citizens. In many respects S&T cooperation is a kind of symbol of that or an emblem of that. So, I have found there has been a chance to try to make some institutional contributions to our progress by the creation of the Forum and work at how we reorganize the Embassy.

What are your own plans for the future when you leave India?

I do not know. I am going to spend some time thinking about the future. I can tell you one thing for sure, whatever I do, India will be some part of it.

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COMMENTARY

Beyond mere competence*

Yash Pal

Vikram Sarabhai was a humane and passionate visionary. He was an institution builder who accomplished an enormous amount in a short span of his working life. He deeply influenced the lives of all those who came in contact with him. He was a scientist who did some excellent work in the field of cosmic radiation and solar terrestrial relations.

He founded a remarkable institution, the Physical Research Laboratory that has contributed significantly to the growth of science in the country. Here

*Text of the Vikram Sarabhai Memorial Lecture, IETE, Shimla, India

he guided several Ph D students. But there came a time when he was so busy that some research students could meet him only during one of his frequent train trips from Ahmedabad to Mumbai. It was not infrequent for a student to accompany him in his car to the station and, if the conversation was not over by the time the train had to leave, the student would often travel with him up to Baroda and return later to Ahmedabad. I do not think any of the students resented this inconvenience, because they got an hour or two of real quality time with their guide, a period when Vikram would cut-off from a thousand other concerns and become completely im-

mersed in the problem at hand. I was personally very taken with this aspect of his character and capability. His ability to switch off and concentrate on one thing at a time was extremely impressive. All other worries were forgotten. The urgent decisions to be taken next morning, his scheduled meetings with the high and mighty, or the deadlines of an impending space launch, all of these disappeared. When you were with him he was totally yours. He remembered your problems and your worries more than his own. He was not just courteous. He was truly involved and seemed grateful that you involved him. Everyone came out refreshed and enhanced,

and not because he gave his blessings or false encouragement. He had an uncanny ability to make you realize that you were more than you thought you were.

He was instrumental in the setting up of the Indian Institute of Management (IIM) at Ahmedabad. Yet I doubt if his style and methods of management have influenced the pedagogy of management education. One does not even know the procedure one would adopt for framing a curriculum. I doubt whether his ways of working would meet the approval of present-day yuppie managers, perhaps not even of the professors of IIM, Ahmedabad.

There is no question that Vikram was a very competent scientist. But his special imprint came more from other facets of his personality – features that moved him way *beyond mere competence*. He had a love affair going with the whole world. This is what I heard Mrinaliniben say at a meeting in Mumbai in early 1972, soon after his death. And I fully agreed with this assessment. It was an activist's love affair, not mushy. His affection enhanced everyone on whom it was showered. People were surprised by the confidence he placed on them. Ordinary humans moved by his irresponsible confidence, rose to fulfil his vision. In turn they acquired a shine on their own personalities that no one, including themselves, had suspected was hidden within them.

It is nearly thirty years since Vikrambhai left us. I would like to remind you of some of the things he conceived and came to do – things that seemed to lie outside his formal responsibilities.

He was Chairman of the Atomic Energy Commission. He had already taken on the responsibility of developing space activity in India. Our country was passing through a phase where we lived ship to mouth, with large imports of grain from the US. Green revolution had not quite happened, but it was clear that unless we did something to grow more food, our future would be bleak. Amongst other efforts, the need for communicating with the farmer became most urgent. Vikram thought about television. There was skepticism. Even if money could be found, what was the assurance that the programmes would have any impact? That is when the experiment of community television was born. The initiative came from Sarab-

hai, who managed to network with All India Radio, Ministries of Agriculture and Rural Development through the good office of the Planning Commission. TV sets were acquired by the Department of Atomic Energy and the programme was planned and executed through a group of experts. That is how television came to India. Since there was only one transmitting station available, it was installed in Delhi and the villages were spread out within the reach of the transmitter. The programme was 'Krishi Darshan' and it is a marvel that it is still going on under the same name. There have been arguments about the extent to which the programme succeeded. But this programme made a clear statement that if a powerful technological development comes on the scene there is an ethical requirement that it be crafted into a form that gives power to those who are most powerless. To give substance to this vision many additional innovations are needed and many new capabilities have to be developed. Even when the basic technology is obvious, methods of social communication and evaluation do not fall from the skies, nor are they directly taken over from those trained in the culture of advertising. All these categories began to grow and in every aspect of this adventure one could see the intense involvement of Sarabhai.

It was this way of thinking that drove Vikram to the belief that India should have a space programme whose basic drive force would be societal. The blue prints of the Satellite Instructional Television Experiment grew from this source, as did the final configuration of the Space Programme. The boldness of Sarabhai's vision was truly astounding for a time when we had no experts, little resources and no international precedent. But his stance and passion were so infectious that he gathered enthusiastic young people around him and was able to persuade the government to accept this as a programme. He was also able to persuade a hard-nosed organization like the NASA to collaborate. And it was collaboration of a kind hard to imagine in the world of today. Perhaps NASA of that time already had a few stary-eyed people like Sarabhai, perhaps they also got infected by the vision, charm and enthusiasm of this unique human being. They agreed to modify for our purpose and commit for

our use their most ambitious technology satellite of that era, a satellite that was still on the drawing board when Sarabhai talked with them. There was no transfer of funds. They provided the satellite and involved our people in ensuring that the component that we would use was according to specifications jointly developed. We were responsible for the technological development of the ground segment – earth stations, community receivers, including the low noise amplifiers, and deploying and maintaining them in thousands of villages across the country. We also had the total control and responsibility for producing the software and for the extensive social and technical evaluation of the 'greatest communication experiment in history', as Arthur C. Clarke called it. It is not my purpose here to give any details about how this experiment was done, what was achieved and what it led to. It is enough to say that though the actual experiment happened four years after Sarabhai left us, his spirit fuelled this mad enterprise. I call it mad because, beyond dreams and a passionate desire to do things oneself, we did not even have a project report. We just had a broad budget, but the directions we chose and things we accomplished were influenced by what we learnt as we went along. If we had prepared a detailed project document, we would have felt imprisoned. We did follow all the management practices, with milestones and PERT charts, but they were for components of the project. But we felt free to adjust the components so long as the objectives of technology development and the social goals were only enhanced, never sacrificed. In this regard, every participant was an internal auditor.

Sarabhai did so many things and gave the vision for so many others that happened after he was gone that it is not possible to discuss most of them in this short presentation. However, I would like to mention the episode when he fought to get the responsibility for building India's first Intelsat earth station at Arvi. India had no track record of building large antennas. The station was to be imported and the responsibility for this area was with the Communications Ministry. On the face of it, the Department of Atomic Energy had no business butting in. But that would not

stop Vikram. He sought out people from defence, from academic institutes like the TIFR and also from the Ministry of Communications to show that the job could be accomplished in India, using the academic and industrial capabilities already existing and those that could be developed. When people went to the Prime Minister to argue against taking a risk like that he asked her, 'If our own country does not give us challenges, who will'. That clinched the issue. Arvi was built and lot of capability developed for things to be done in future. In these days of liberalization and globalization, wanting to do it oneself has ceased to be a convincing argument. Shop windows or arsenals full of global things from outside hide the fact that we are designing and building less and less ourselves. Indeed the difference between 'bringing in' technology and 'creating' technology is not even understood anymore.

This is what worries me even in regard to communication and information technology or, for that matter, the whole area of electronics. We seem to have given up on establishing a base for ourselves. We are much too impressed and overawed by what others have already done. We think that nothing is left and if it is, then it is not our responsibility. In between there was a period when the C-Dot got initiated and pushed. The hurdles on the way were overcome, but the progress has certainly been delayed. Similarly the initiative of Jhunjhunwala of IIT, Chennai remains incompletely utilized. I do not know why we start nitpicking when something local begins to develop beyond a threshold. I am sure there are other influences, but a conviction that something beginning to grow here is precious is also absent. Such a conviction is the precondition for ensuring that new communication and information technologies do not end up increasing dependence in the long run. If we are going into globalization, then we have to claim at least a small part of the globe for ourselves. This cannot be done only through cheap labour, using the IT-enabled service sector route.

I have always believed that being engaged in technology creation is like a 'karma'. Any society not so engaged is bound to become a permanently dependent society. There is no content in an independence where some of the

crucial elements of the technological support systems are not designed and built within the country. God has not ordained that every thing new must come from outside. Without ever alluding to the Tehelka tapes, we are all aware that there are powerful lobbies whose interest lies in getting things from abroad. This is not new. Our technological establishments and our industries like to ride on the popular brand names – made popular through advertising, through brainwashing and by word of mouth of middlemen. If our experts do not go all the way, if they do not find enough support from industry or the government, they end up being agents and touts for things produced abroad. This particular enterprise has gained additional respect in the name of globalization. That is why I would like to go on stressing the need for going *beyond mere competence*.

There is another reason why I have become a little wary of narrow experts. This applies not only to us, but also to the rising influence of super-specialists all over the world. It would be best if I express my ideas in this regard by quoting from my remarks at the valedictory session of the Space Generation Forum, organized at the time of the Third United Nations Conference on Peaceful Uses of Outer Space held in Vienna in 1999. That was addressed to one set of experts. With due modification the remarks might be relevant to the experts within the IETE community. Here goes:

Space Generation Forum – Closing lecture by Yash Pal

Space is about perspectives, the long vision, both in space and time. So is science in general, especially astronomy, geology, biology and archaeology.

Those who get hooked on space should get more connected with the planet and its inhabitants, not separated or alienated.

As for many other technologies, in space also common solutions do not work for everyone.

Even the laws of nature cannot provide you results unless the initial conditions are entered in properly. The classic example is long-range weather prediction.

We have to realize that the world is very unequal and getting more so every

year. This is a formula for ultimate disaster.

In devising our solutions, we have to introduce specificities. This is seldom done. If the common solutions do not work, we blame society! That is arrogant.

Everyone has a right to be a participant, not just a spectator or a potential beneficiary.

To give a few examples: The Gramin Bank of Bangladesh could not have been thought of or planned in a corporate boardroom. A couple of other examples from India are the programmes of the self-employed women's association and the milk revolution brought about through the dairy cooperatives following the example of Amul.

Specificities get in automatically if we engage in a number of end-to-end programmes, or missions. This is particularly required for space projects that are meant to ultimately benefit the common man – or woman. This may often require meddling with things that are not in your department. Do so.

The building, intensification and widening of the super highways of information and communication are important. However, the world cannot be all super highways. That would be drab, uninteresting and diminishing. We need a large number of footpaths – tracks and trails. These are made by people walking, along slopes they can manage, in accordance with their whims, needs and inclination. How to make walking easier, more attractive? Depends on the terrain. This is different in different geo-social territories. So we come back to Specificities.

Specificities will always remain. They should remain. The human animal grows in intimacies. It requires intimacy.

The challenge is to situate these intimacies in the global template we now have become aware of. And those we will in near future.

Without a cosmic vision, the space vision, intimacies can become, have become, parochial, adversarial and, often destructive.

I have come to a paradoxical conclusion. Intimacies are vital for human flowering, but they become sustainable only when there is a cosmic vision. In a cosmic vision, cultural diversity would be treasured. It would be celebrated, not feared or offended. It would be seen as

a heritage of whole humankind, a heritage to delight in. Those who would 'cola-nize' the world, and make it uniform, do not understand this.

Just look at some of the conflicts in the world today – Ireland, Albania, Serbia, Kosovo, many in Africa, the Middle East, India, Pakistan, Sri Lanka, East Asia, also Americas. Most of these have arisen because intimacies feel threatened. Much like living organisms, they respond with unduly strong immunological responses. This often exacerbates the situation even further. And the cycle continues.

We have to realize that globalizing efforts to rub out the intimacies will make the situation even worse. We have to learn to place them on a global canvas, a cosmic canvas, with space vision.

Who would bring in the world of space vision? You can, but on one condition. Do not become mere experts. Design and build your space systems,

go to the moon or Mars, build solar power satellites, bring in ever new and cunning devices to improve communications, and many more things. But do not become mere experts. Such people can be rather dangerous. This is not to say that those who are not experts in anything cannot be dangerous, besides being redundant. Many academics, politicians and diplomats also belong in that category. There are moments when I wonder whether I am also a member of the same fraternity.

Your vision comes through your expertise and your passion, only if you are not imprisoned by your expertise. Do not be seduced into believing that the well-being of this earth, including the spiritual and ethical climate of the planet, is a concern that belongs in another department.

This is not just an evangelical sermon. I have observed your enthusiasm, your striving spirit, your capacity to

dream and your capabilities. There are innovations waiting to be discovered, science to be done and technologies invented. Engage in all this, but do not let go of your space vision and a deep respect for specificities. If you do let go you may still have a successful future, but your success will be limiting and not up to your real potential. I urge you to seek your potential.

You belong in a group that could begin the task. There is a possibility of unprecedented personal fulfilment in this venture. I commend it to you.

Remember. The space vision implies that from now on the whole earth is the responsibility of the whole earth.

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SCIENTIFIC CORRESPONDENCE

Comparative antifungal activity of essential oils and constituents from three distinct genotypes of *Cymbopogon* spp.

Essential oil distilled from field population of three distinct genotypes of *Cymbopogon* spp., namely *C. martini*; *C. flexuosus* and *C. winterianus* was evaluated for antifungal activity. Also four oil components, namely geraniol, citronellol, citronellal and citral were simultaneously assayed for comparative activity. The comparison indicated specific activity profiles. Invariably *Microsporum gypseum* was found to be most sensitive to these oils/components. Activity-wise, lemon grass oil was most active followed by palmarosa oil and then citronella oil. This study on oils distilled from stable genetic populations provides dependable criteria for selection of high value oil combination(s). The possibility of using these oils/components in combination to obtain antifungal formulation is also obvious.

Essential oils from various aromatic plants are known to show a wide spectrum of anti-microbial activity against both plant and human pathogenic mi-

croorganisms. The essential oils have been evaluated for antifungal activities from palmarosa^{1,2}, citronella³ and lemon grass^{4,5} and also for constituents like geraniol and citral^{2,6}. *Cymbopogon* species represent a wide diversity in phylogenetic relationships⁷ and hence the chemotypic variation in their essential oil composition is genetically traceable. We utilized essential oils from well-established genetically stable and uniform genotypes of three species, namely *C. martini*, *C. flexuosus* and *C. winterianus* for comparative bioactivity evaluation. In addition, based on their chemotypic constitution, four of their constituents were taken for comparative bioactivity testing. These included citral, geraniol, citronellol (rascemic of d and l-citronellol) and citronellal (aldehyde) isolated from the essential oils of lemon grass (*C. flexuosus*), palmarosa (*C. martini*) and citronella (*C. winterianus*). Four human pathogenic fungal strains were used as the biological

screen to compare the levels of activity in these oils and some of their constituents with the objective of identifying plant substances for future antifungal formulation(s).

The elite genotypes used in the oil extraction were variety Pragati of *C. flexuosus*⁸, variety CIMAP/PRC-1 of *C. martini*⁹ and variety BIO-13 of *C. winterianus*¹⁰.

The per cent purity of the isolates was determined by GLC analysis showing citral (94%), geraniol (95%), citronellol (rascemic, 90%) and citronellal (aldehyde, 90% pure). Four human pathogenic fungi, namely, *M. gypseum*, *Aspergillus niger*, *Candida albicans* and *Sporothrix schenckii* were used as screen. These four clinical isolates were procured from Uma Banerjee, All India Institute of Medical Sciences, New Delhi. Sabouraud dextrose agar/broth invariably was the medium used for culture maintenance and the bioassays. Antifungal activity testing was done