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The Challenges and Rewards of Creating and Managing a Scientific Institution

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It is indeed a great honom and privilege to be asked to deliver the prestigious N ayudamma Memorial Lectme, before this august audience. I recall the tragic death of Dr Nayudamma and other passengers, when the ill fated Kanishka Aircraft was destroyed by sabotage. The act of violence which resulted in the loss of precious human lives brought a deep sense of shock to all of us. The loss of a creative personality like Dr Nayudamma was ill-affordable by a nation that greatly needs enlightened direction in charting its comse in an environment when science and technology are the driving forces all over the world. This lectme series provides us with an opportunity of paying om tributes to a great personality. However, I was not

certain that working in the field of astronomy and astrophysics, which takes you away from the Earth on a journey of the vast universe, I possess the right qualifications to be a speaker in this series: for Dr Nayudamma's was a down to Earth practical approach in administering the interaction between science and industry. Fmther, here I am to talk to those who specialize in administration. Do I have anything to tell which will interest this audience?

So I was on the point of declining the invitation, when an idea struck me. Even though, in the popular mind, science is an exalted form of enquiry into Nature and Nature's laws, even though the practitioners of science are believed to be objective, rational and systematic in their approach to the problem, reality is often otherwise. In particular, in a scientific institution, where scientists work together in large groups, several problems can arise. For, scientists are also human and cannot avoid problems of human relations. Of course these problems ma) be superficially different. but the basic aspects may interest those of you who deal with management. So why not air them through this lecture?

In this lecture, I will therefore begin with a few general remarks on the evolution of science and its institutionalization. I will then discuss mainly two scientific institutions which were created during my academic career and with whom I have been closel) associated. The creation of one I saw as a bystander, whereas I was personally involved \\ ith the creation of the other.

Scientific institutions: the evolutionary trend

Although science in its present form took off from the times of Issac Newton more than three centuries ago. Organized science. that is, large groups of scientist> working under one roof, is a phenomenon largely ofthe twentieth century. Take physicists w ho made pioneering contributions, like Newton, Huygens, Farada). Helmholtl, Maxwell, Kelvin, etc., ortake chemists like Priestley, Lavoisier. Mendeleev or Avogadro, or biologists like William Harvey, Lazarro Spallazani, Ed\\ ard Jenner or Charles Darwin, the ans\\ er is the same. The) were individuals who worked under their own personal compulsions, inspired by the challenges facing them.

Even in the first four decades of this century. Although several mathematicians, physicists, chem ists. etc. were found to prosper in groups in places like Gottingen in German), Pari" in France, Cambridge in England, these groups largely got together under the personal charisma of a few

scientists of distinction. like Hi Iber\, Mme Curie, Rutherford, etc. Accounts of those exciting day; \\hen ne\\ epoch making discoveries were in the air are inspiring to read even today.

Perhaps a different culture of work in the research field was introduced for the first time in the 19405 hy the Manhattan Project. the mammoth enterprise put together on a war footing by the Allied Powers, to produce the Atomic Bomb. In retrospect and by hindsight, it is now real ized that the motivation for the project rested on wrong prem ises, namely the fear, shared by many at the time, that the Germans were close to making the Atomic Bomb as they had scientists equally capable in that field. Even Albert Einstein who had written to the U.S. President Roosevelt urging him to initiate a project making the bomb for this very reason, later regretted the step. For, very likely, Einstein's letter turned the scales in favour of making the bomb. Had the atomic bomb not been made at that time, would we have been spared the agonies we are facing today - of our survival in a future nuclear holocaust? It is hard to answer the question; but probably the answer is "No". The cold-war atmosphere that followed 1945, and the momentum of scientific research, would inevitably have led us along the path of nuclear weapons.

However, this may be a debatable issue which I do not want to be labour here. What is beyond debate, however, was the demonstration by the success of the Manhattan Project that an organized goal-oriented scientific research can pay dividends. And so the post-war era saw a proliferation of research institutes and laboratories where specific goals brought scientists together along with experimental equipment required for supporting that research.

It was also becoming clear with the progress of time that this instrumental back up for advanced research was going to be increasingly more expensive and complicated. The pioneering work of Rutherford demonstrating that one atomic nucleus can be transmuted into another required a piece of apparatus that he could hold in his hand. It was made by the laboratory technicians and cost no more than £100.Today's frontier level particle physics requires accelerators costing billions of dollars, occupying several kilometres and requiring a colony of technical staff to manage and maintain it.

This aspect of management and maintenance has become a nontrivial component of any scientific institution today. So that scientists may work without worrying about the working enviromnent, an infrastructural staff is needed to provide the necessary support. For example, complex instruments require technical staff for maintenance and

operation. Other non-technical staff is needed to deal with problems related to the pursuit of scientific research which is the basic goal of the institution. Thus expensive apparatus has to be fabricated or ordered which requires experts in purchase. As already stated, big budgets are involved - which requires a competent accounts staff. Likewise, if large humanpower is involved, the personnel department has to work efficiently. Scientists travel to interact with visitors from other places, and so one needs staff to organize travel. Finally, although this is not essential but may be desirable, the staff including scientists as well as those providing support for them may benefit by having staff quarters, preferably close to the institution.

Thus we have the picture of an institution which outwardly resembles that of an industrial establishment of people, equipment, and output coming from a dedicated campus. There are, however, differences between an industrial complex and a scientific research institute, - differences which are significant enough to be well appreciated and allowed for. In the same way there are significant differences often not appreciated and allowed for, between a scientific institution and an administrative department of the govermnent. In the course of my talk I hope to highlight these differences .

The Institute of Theoretical Astronomy

Let me begin ,>lith the first of the two institutions which I mentioned in my introductory remarks, namely the Institute of Theoretical Astronomy in the University of Cambridge, fOlmded in 1966.

In the early sixties when I was a research student working under the guidance of the distinguished astronomer Fred Hoyle, theoretical work in astTOnomy at Cambridge was canied out under the faculty of mathematics. A tradition which dated back to Issac Newton and had such distinguished names to boast like John Couch Adams, Arthur Stanley Eddington, James Jeans, Joseph Larmour, Robert' Henry Fowler and Subrahmanyan Chandrasekhar now had such stalwarts as Raymond Lyttleton and Fred Hoyle.

Nevertheless, in the early sixties, research in astronomy was moving into higher gear, with the advent of electronic computers and data coming from better telescopes optical as well as radio, with space astronomies soon to come. No one appreciated the implications of these new developments better than Fred Hoyle who felt that the individualistic approach for which Cambridge had made its name needed to be

supplemented and supported by an organized approach.
For example, with the greater need for meetings and discussions of astronomers to interpret the new observations, the need for access to fast computers, the need to attract YOWlg talent to the field; all these needs could not be met by the prevalent easy going and infol1nal atmosphere in Cambridge. There was a need for a research institute where focussed and concentrated action could be taken. Which in turn required adequate funds and autonomy of operating its academic programmes. The prevailing rules in the university hardly helped in this respect!

Surmounting the obstacles

There were several obstacles. however. on the way to success.
These in one fonn or other always turn up when setting up a new institution, regardless o[country or place or subject. as will be clear when I go through those which Hoyle encountered.

First, the peer-jealousy and feeling of insecmity! 111e Department of Applied Mathematics and Theoretical Physics to which Hoyle belonged, felt that if a new institute is created and it becomes successful would it not draw away the cream of talent from the Department? Other departments felt that the provision of an autonomous institution for astronomy alone was a lux my. Why should other subjects be left out?

Second. the university itself was lukewaml. raising issues like where the funds would come fi'om and would it not diveli government umding [rom the university to the institute?

A different consideration weighed with the u.K. Government.
There had been a growing feeling in the country that because of the long distinction they enjoyed, the universities of Oxford and Cambridge were always getting special treatment from everybody including the Government. An affinnative action towards upgrading other. lesser knovJ11l1ew universities was therefore called for, rather than providing additional lustre to Oxbridge. The U.K. Goverrunent therefore was not very supportive of the Institute proposal. either. In fact in 1964 Hoyle was offered the headship of a national astronomy centre which the Government proposed to set up in Sussex, not too far from the Royal Greenwich Observatory, a proposal which Hoyle

politely turned doVJ11.
For. he had answers to all these objections. The strong astronomical tradition enjoyed by Cambridge was one reason why astronomy called for a special treatment. And the reputation enjoyed by Cambridge attracted the top end of student talent which was therefore a strong reason why an advanced research institute would prosper there.

However, having encountered these difficulties from the University and the Government towards funding, Hoyle decided to approach private foundations for support. In the end, he was able to persuade one foundation to proyide money for the institute building and another to provide support for running it for the first five years. He felt that if the new institution achieved international reputation during that period, its survival \vould not be a problem. If, on the other hand, the perfonnance of the institute did not come up to mark. he for one would not shed any tears if it were wound up.

As you will see f)'om this attitude, merit was the prime justification for setting up the institute and merit was the sole criterion for its survival. That he was able to attract private funding was solely due to his own merit as a world class scientist.

The importance of students

There is another revealing incident, which I now wish to narrate.
Which holds a moral for most of our own research institutes of excellence.
While the proposal for setting up the Institute of Theoretical Astronomy (IOTA - hereafter) was being discussed in the University in a public debate of its academics, a view was expressed that the research scientists at IOTA should not be allowed to teach the mathematics undergraduates at the University. As a young postdoctoral fellow, I thought that this was a great blessing, since those who do research at IOTA would be spared the burden of teaching and examining.

Hoyle, however, interpreted this view negatively. He felt that if you lecture to students, you can motivate them to do research and with luck attract the bright ones to the Institute. If you are prevented from lecturing, you may find talented students being diverted elsewhere. Indeed, in the early years it did become hard for IOTA to attract good graduates coming from Cambridge's prestigious Mathematical Tripos Examination. I will return to this episode later in the talk. Perhaps I should record here that I myself had been motivated towards opting for my career as an astrophysicist because of

Hoyle's inspiring lectures when I was a Tripos student.

The Institute was duly established in 1966 and its buildings inaugurated in 1967. Although Hoyle could not extract as much autonomy for the institute as he would have wished, IOTA soon established a name for not only its academic research but also for its administrative smooth-running. Since the University provided the back up for accounts, purchase and personnel, IOTA itself had a very small support staff. Apart from Fred Hoyle as Director, it had a Secretary who managed all administrative matters and hardly two or three typists or stenographers.

How well did IOTA do in its initial 5-6 years? There are several criteria by which it could be judged and these are indicative of how the success of a scientific institution is measured. I mention the more significant ones. These can be applied with suitable modifications to any scientific institution.

1. Its research output was published in high profile journals in the field of astronomy and astrophysics.
2. A number of its young scientist staff members later occupied professorial chairs in the u.K. and other countries of the world.
3. Much against the opposition from the Computer Science Department of the University, Hoyle bought and established a state of the art computer, which became so successful that eventually University academics began to line up for its usage.
4. As the first five years of the Institute were coming to an end the university decided to take charge of its running with some funds coming fi.·om the u.K. Government. Thus not only were the initial sceptics won over, the University suggested enlarging the IOTA to include the Observatories next door. With the observational astronomy also brought into its fold, the letter 'T' was dropped from IOTA: the institute's name changed to the 'Institute of Astronomy'.
5. Recall that the U.K. Govenunent had initially suggested to Hoyle to set up his institute in Sussex, because then it would be near the venerable Royal Greenwich Observatory. Two decades later the Government decided to shift the RGO. Guess, where? Next to Hoyle's institute in Cambridge, which had by then become a highly reputed international centre for astronomy!

In spite of the successes of IOTA, even his close friends will confess that Fred Hoyle was not the best of administrators! He was too much of a scientist and individualist to make a good' committee man' with the patience and diplomacy to carry others with him in whatever he wishes to do. Even today, at the age of84, he continues to be proli fic in generating scientific ideas. However, the skills needed

to solve problems at the frontier of science are different from those required to deal with the complex human problems that arise in an institution. When he was outmanoeuvered in one such committee he lost patience and resigned, not only from his Directorship but also

from his prestigious Plumian Chair at Cambridge. He withdrew from all interactions with the academic and went on to live in an isolated but picturesque part of the Lake Disttrict in the North-West England.

It would be hard to find a parallel to his character and career.

IUCAA: the motivation

I now come to my second example. that of the Inter-University Centre lor Astronomy and Astrophysics. nO\v more commonly known b) ib acronym IUCAA. I have been associated with its genesis. and have seen it gro\\' over the last ten years.

In 1972. I left Cam bridge and returned to r nd ia to join the Tata Institute of Fundamental Research (- or more briefly, TIFR). Unlike the lOA. the 1'1 FR had been a much larger and relatively older institution. ~ hich had thenjust celebrated its Silver Jubilee. Although its founder Homi Bhabha was no more. his stamp was there to be seen in various ways, in how the institute functioned academically, in how it maintained its premises, in how it strove to streamline its administrative procedures. etc. I had joined the institute with a mandate to grow its activities in theoretical astroph) sics, and over the sixteen or so years there. I had the satisfaction of seeing that objecti\ e accomplished. Although I v.as happy with m) work, other issues were beginning to weigh on my 111 ind, issues that were to take me on an adventurous journey away from TIFR. Let me briefly highlight these first.

The TIFR was set up *by* Homi Bhabha to help create and strengthen the base for fundamental research in the country. The expectation was that scientists trained here would contribute to applied re"earch in related fields and to universities by enriching their

faculties. The first happened to some extent, e.g. through the setting up of major scientific establishments like the BARe. SAMEER, NCST, etc .. b~ the talent dra\\ n from TIFR. The benefits expected for the university system. ho\\e\er. did not materialize. Although in 1946 when the TIFR was set up the conditions in a typical university were academically reasonable. these declined sharply in the 1960s. For various reasons including this circumstance, there was no significant transfer of faculty from TI FR to Universities. Except for the School of Mathematics. there was no significant collaborative venture between the TI FR and 80m bay University

Indeed in the 1980s there was a growing realization that while a large IILUII bel' of research laboratories. scientific institutes or centres of excellence had come up outside the university sector. there was hardly any comparable investment within the sector. The need for creating its own centres of excellence within the university sector was felt by the UGc, because over the years there had been no significant benefit derived by the universities from the national institutions. (In this sense, the experience with TIFR was typical.)

IUCAA: the initiation

To address this issue. the UGC decided to create ih own centres of e:-..cellence, the '1 nter-LJ n iversity Centres'. particularly in those subjects wherein the support available to universities \vas minimal or non-e:\istent. The first centre was set up in the Campus of Jaw aha rial Nehru University. It dealt \\ ith the Pelletron accelerator and came to be kno\\ n as the uclear Science Centre.

The second centre under consideration \\as the Inter-University Centre for Astronomy and Astrophysics (I UCAA) deal ing with the nucleation and grov-th of teaching. research and developmental activities in Astronom) and Astrophysics in the university sector. Because a major radio obsen atory was coming up near Pune under the management of the n FR. it was suggested that the I UC AA may be housed in the campus of Pune University.

This was when I was brought into the discussions on planning of the proposed centre. Over the years I was becoming somewhat restless at the TIFR where life as a research scientist was smooth as ever, perhaps too smooth to generate any exciting challenges. The widening gap between a research institute and a university, that I have referred to, was also disturbing. Perhaps it was a symptom of the deliberate isolation of research institutes from universities that the former were finding it difficult to attract good students to research. Before I proceed with my narration of how the IUCAA came into

existence, I would like to spend some time on this symptom.

To a large extent, the success of the continuing scientific momentum in the West has been due to the fact that one generation of motivated research scientists replaces another. Students and postdoctoral fellows of today will share the main load of S & T infrastructure ten years hence and will be the guiding policy makers another ten years further on. These young inputs of today had been trained and nurtured in universities, where they became motivated towards science by observing scientific research flourish in their university campuses. For, in the advanced countries the universities carry out a major part ofR & 0 activities. Having seen and attended lectures by top scientists, some of them of the level of Nobel Laureates, students do get strongly motivated. Even at the less exalted level, research can be exciting and intellectually satisfyingand seeing it happen around you can be very inspiring.

By isolating research institutes from the mainstream of students, and by insisting that the university dons carry a heavy burden of lectures with research relegated to a negligible level, our educational system ensured that the sciences (- for that matter, other scholarly areas also -) hold out no research attractions to students. With the result that the research institutes began to find it increasingly harder to attract students to science. Here I recall Fred Hoyle's concern when the rival dons insisted that the research scientists at his institute should not teach the university undergraduates.

Returning no\\ to IUCAA. I saw here a fresh opportunity of rejuvenating at least astronomy and astrophysics within the university sector Can we create a centre, which acts as a resource not only of material faci lities, but also of intellectual stimulation for the facult) and students of un iversities? Although the projected setting up of the Giant Metrewave Radio Telescope near Pune was one reason for bringing I UCAA into existence. I felt that even without it, enough exciting challenges existed, challenges that I was missing at the Tl FR. So when at some stage (I think. it was in January 1988) I was asked by Yash Pal, the then Chairman of the UGC to take on the FounderDirectorship of I UCAA, I agreed without hesitation.

There was a mixed reaction to my decision. The optimists "\elcomed it, saying that it "\as a step in the right direction. The pessimists felt that I \\as taking a grave risk in leaving a well run institute to start up something out of nothing - a venture that may fail. I recalled a similar spectrum of opinion in 1972 v •. hen I had planned to leave Camhridge to return to India. As on that occasion. I decided to face the challenge.

[n fact. when I had planned to return to India in 1972. some friends had suggested that I should set up an institution with the sponsorship of the Government of India. Having seen the trials and tribulations of setting up the Cambridge institute as well as hearing the gory tales of government bureaucracy. I had haulked at the idea then. Nor had I been a believer in applying preciolls national resources to create institutions to boost personal ego. An institution should be created only if a national need is felt for it.

Such a need was being felt in 1987-88, while none had been perceived in 1971-72,at least in my personal recollection. Also, in the earlier period I was in my early thirties whereas in the later one I was moving into the fifties. The priorities of a scientist when he is young and in the high-momentum phase of research are, at least ought to be - different from those when he is more advanced in age. It was thus a different ball game for me in the late eighties when I chose to leave the TIFR.

The basic requirements

The setting of a scientific institution requires three important ingredients for a successful recipe. The first and foremost is the basic set of rules and bye-laws that do justice to the aspirations behind the formation of the institution. The second is the creation of a campus that provides the right environment for the fulfillment of those aspirations. And finally, last but not the least, the staff - the humanpower - that will be needed to achieve that fulfillment.

I think it is important to stress the order in which I have stated these ingredients. Often the order is not followed, the ingredients are missing and the result is disaster and frustration.

When formulating the rules and bye-laws the experience of bureaucrats is certainly essential to provide the basic framework. But their visors, with all due respects to their maturity of experience and integrity of purpose, are often narrow. If they have been practising a set framework of rules, they will prefer to continue following it, dreading any innovations. Follow this tried and trusted framework, or else face chaos, they warn. Strong academic directions are needed to emphasize that the world of science is different from that of administration, that evaluation and working environment of scientists must reflect those differences.

Even amongst scientific, or in academic institutions in general, there are differences and unless these differences are reflected in rules and bye-laws, there will be chaos and

frustration. The bureaucrats will warn you, "If you are given a special set of rules, all others will ask for it and this will lead to an impossible situation". It requires a strong personality to tell them: "Look, volleyball, badminton and lavm tennis are all games requiring a court and a net: but they are played differently. Astronomy and nuclear physics are both parts of physical sciences, but they are studied and researched differently".

The Tata Institute of Fundamental Research set a pattern for institutions that came to be known as "Autonomous Research Institutes of the Government of India" . Even earlier during the British Raj, universities had been founded on the principle of academic freedom and autonomy. During the 1942 freedom movement, the Government ofIndia wanted to send security forces into the campus ofBanaras Hindu University. But, Dr Sarvapalli Radhakrishnan. the then Vice-Chancellor of BHU put his foot down and opposed the move. claiming that the universities must manage their own affairs. The Governor of U .P. respected that sentiment and backed down. I need not elaborate on the contrast between that episode and the prevailing conditions today. where. the VC is forced to move with anned escort.

The autonomous institutions fare no better. ~Vith a few exceptions the majority prefer to sacrifice autonomy in favour of conformism with the govel11mcnt rules, with the 'safety' they bring. Very fev,; Directors have the guts to protest against some government missive sent by a desk officer, if it goes against the grain of autonomy or academic freedom.

The IUCAA rules and bye-laws were formulated in 1988 and we were fortunate to have enlightened senior bureaucrats to advise us. Indeed I have pleasant recollections of those discussions. One bureaucrat even advised me "If you have a procedural query special to your field, please take your own decision. It will set the norm. If you ask us, we may not be able to advise you properly".

I think it is here that the senior administrative staff of a scientific institution has opportunity to show its mettle. The purpose of administration is not 'to rule' but to create an environment in which the scientific pursuits of the institution can be carried out smoothly. The rules and bye-laws are never written in a great deal of detail. Even the clarifying guidelines are often vague enough to allow some flexibility. The administrative staff has to see how one can operate within the flexibility available, so as to successfully

proceed with the proposed scientific project. Rather than d ism iss a proposal by saying 'it can't be done as per allowed guidel ines' , the adm inistrator has to find ways and means of achieving the desired end within the allowed guidelines. Recall thatthe dictionary meaning of the word 'adm inister' is 'to dispense, supply, give, etc'. Thus the administrator has to be supportive rather than obstructive.

However, ultimately it is the Director, or the Head of the institution that must practise full autonomy and take the crucial steps, to really 'direct' the institution along its proposed path. Often one hears of complaints of lack of autonomy, whereas the real complaint can be traced to unwillingness *to practise the autonomy that is already available.* Many universities suffer because their yes have willingly surrendered their powers to the bureaucrats, within the university or to those in the government. The fact that the university registrar often becomes the centre of power is ample indication of the misplaced priorities between the academic vs administrative battles. If the university has been created to nurture and disseminate knowledge rather than encourage the growth of political centres of power, then academics must have priority over adm inistration. The great contribution of Homi Bhabha was to underline this premise in the institutions he created.

IUCCA:the campus

Coming now to the second aspect, the actual campus consisting of research fac i I ities as well as staff quarters, I had again been guided by Fred Hoyle's institute in Cambridge and Homi Bhabha's TIFR. Given that a building is being built within the government sector, all the checks and controls required to ensure efficient use of government funds must naturally be followed. Despite these checks and controls, one has only to look at the sorry state of government buildings and those in universities to realizelhat they don't work. The question I faced was: Could one build a beautiful, user-friendly building using the same cost per square metre that is considered reasonable in the government sector? The answer is 'yes' but it has to cross a credibility gap, because in the present ambience, the 'poor and shoddy' is considered 'simple and cost saving' while the 'elegant and user friend ly' is considered' ostentatious and extravagant'.

While initiating IUCAA's buildings we were again fortunate in having an enlightened Chairman of the UGC in Yash Pal, and a GO\erning Board which recognized this aspect and permitted us to use the services of an internationally acclaimed architect and a construction

management consultant of proven integrity. Both at half the cost of what government agencies charge for the same services. The result was an elegant set of buildings at a cost no higher than that prevailing for government-built buildings. When you looh. at the I UC AA bu i Idings you may find this incredible, but figures speak for themselves.

In this instance, one important lesson I had learnt from the examples of Fred Hoyle and Homi Bhabha was that the head of the institution must personally show concern for the construction project, checking its progress regularly. This way the message goes to the architect, the supervising agency and the contractor that their joint efforts are considered important for the well being of the institution.

Cost over-runs can he controlled by "deqll<lte "upn\ ision at all le\ els, releasing paymenb '" hen due and h.eeping time-bound deadline~. We hear of projects dragging along. \\ell past their stipulated time because offailures on all these counts. And of cases where the contractor has abandoned work pending his payment. Of cases sent to court where they remain static. All these lead to gross over-runs of projected costs. These are excellent examples of being penny-wise and pound-foolish.

Finally. the recruitment of staff. At both levels, academic as well as non-academ ic, the staff at a scientific institution is the main factor deciding the reputation of the institution. At the academ ic level, the very credibil ity of the institution is at stake. Fori UC AA to be effective as the nodal resource centre for universities, its academic staff had to command impeccable reputation for research and creativity, to be judged at the internationalleve!. Its scientific staff had to be manifestly competent in maintaining its facilities like the computer centre. the data centre, the instrumentation laboratory and the library at high Ie\ el of efficiency. And the administrative and support staffhad. as stated earl ier, to be ever ready to provide full support for the centre' s academ ic programmes.

None of these purposes could be met by overstaffing the centre.

Small is beauti ful. A Ithough the I UCAA projected t\\oenty research scientists \\orking as core academic members. we did not rush in to fi II up twenty slots. Rather, following the Bhabha approach we looked around for suitable scientists with demonstrated creativity and reputation, and then created slots. At this stage we ha\e around 60% of

the total projected core strength. With this cautious approach it may take a few years to reach the full quota. However, we are then sure of quality, which is essential to a centre of excellence.

The scientific facilities are wntinually in need of up gradation as technolog) advances. Persons \\ ith fossilized ideas, hov,soever, experienced in present da) techniques v\ ill be inadequate if they are unable to imbibe new ideas from new technologies. Likewise, the administrative and suppor1 staff have to carry the 'service' motto rather than see themselves as hierarchy minded rule-enforcers. For keeping such staffmotivated, it is essential for the institution to have a merit-based promotion pol icy. [n a small organ ization, a staffmember should be encouraged to take on different duties under rotation, and the promotion policy should be such as to reward an exceptionally gifted and dedicated individual.

Unfortunately, the government has not recognized the difference between the big and the small, and has insisted upon using its 'tried and trusted' promotion policy based on vacancies. That is, a person is promoted only if there exists a \ acant slot which that person can move to under promotion. In a small organization, vacancies are rare and this slows down promotions. thus adding to frustrations. I do hope that better sense will prevail eventually, so that small organizations will have available a more satisfactory route for advancement of their support staff.

The problems of human relations are not confined to the infrastructural staff alone. The academ ic sta ff. the key com ponent of a scienti fic institution, a Iso contributes to the Director's headache! The issues can be traced to the human ego, especially so since here one is dealing with a set of creative persons with original minds. For example, is the institution recognizing these very virtues? Is it giving academ ic freedom to its staff members? I recall that once we invited a scientist to give a colloquium, and she had to take permission from her Director to accept it! Scientists, howsoever objective they may claim to be, are after all human and are subject to the same prejudices and emotions that others are. So there may be rivalry, jealousy, or a holier-than-thou attitude between colleagues and more often than not the Director has to be the buffer in petty squabbles. This can be the most taxing thorn in the Director's crown.

Time management

I have heard many people complain that administration or management of an

institution takes up so much time that one cannot do anything creative. My own experience has been otherwise: I discovered that by letting your colleagues share the burden through delegation of responsibilities, you can find more time for your cherished activities, in my case, for research, teaching and writing. Even so, it becomes important how one manages the twenty four hours that all of us are allotted every day and night. In this instance, I heard an excellent anecdote which I wish to share with you, as it reflects the strategy I myself have been following in this regard.

Once a teacher brought a jar to the class, along with stones, pebbles, some sand and water. He proceeded to fill the jar with big stone pieces. When he could put no more in, he asked ifthe jar was full. "Yes", said the class. "Wrong" replied the teacher as he proceeded to put in small pebbles which went into the many interstices. When he could put no more pebbles he repeated his question. "No" roared the class, this time aware that there was still some space left for the grains of sand. After filling as much sand as he could, the teacher asked again: Is the jar full? Again the class answered, "No". "Correct" said the teacher as he filled the remaining space with water. "What do you learn about time management, from this experiment?" The teacher asked. TIle class answered: "In between your major tasks there is always time available to carry out your many minor duties." "Excellent!", said the teacher. "But there is more to it", he said and proceeded to perform another experiment.
This time he started filling the jar in the reverse order, first with sand and then pebbles. However, when he came to the stones, there was no room left for them! The moral? "If you spend more time on your smaller tasks, you may find that you have none left for your big and important activities!"

So it all boils down to getting your priorities light and then fitting all things big and small in the right order! In this context I may tell \ou of a Sanskrit sWoka I saw written in the Devanagari script in a metro station in Kyoto, Japan, which essentially says that time is a precious cOlmnodity, which once lost, does not return and hence should be spent with due thought and planning.

A Sense of satisfacrtion

Fred Hoyle resigned and left Cambridge at the time when the first six years of his institute were over. The institute, combined with the optical observatory next door, reemerged in a larger form. Homi Bhabha had two decades at the helm of the TIFR during which period the institute grew in strength and moved to its present premises

Jl1 the shores of the Arabian Sea. I am sure both these founders had a sense of satisfaction at achieving something of lasting value, something which generations of scientists and students can benefit from. A Founder Director of a successful institution has this enviable sense of satisfaction.

There is always a feeling ofinsecuJity when the Founder Director of a successfully run institution moves away from the scene. The Founder may have contJibuted enormously to the institution, from its genesis to its state of glory; but the real test of achievement lies in how the institution has performed *after* the Founder is gone from the scene. This is when its inherent strength would be tested. The best of scientific institutions like the Cavendish Laboratory in Cambridge. College-de-France in Paris, or the Institute in Gottingen, have had their ups and downs, as science itself goes tlu'ough wavecrests of high excitement and activity interspersed with relatively fallow and dull periods of modest productivity.

These ups and downs should not be judged in the same way. as the profits and losses of an industrial unit. The essential feature to look for is whether the institution has an inherent strength, a group of first class research scientists, state-of-the-art facilities and a competent support staff all covered by rules and bye-laws that are intelligently designed to help fulfill the basic aims and objectives of the institution. Given these basic sh'engths, the organization will ride through the fallow periods and once more attain peaks of glory.

Much though people, who have been fortunate enough to create successful institutions, enjoy being at their helm, they are even more fortwlate, if they wisely transfer the responsibility to younger shoulders when the time is ripe, and watch the progress of their creation from a distance in a detached mood. The Karmayoga advocated by the Bhagavadgita shows the way for a graceful exit.