

Some reflections on the life and science of Sir C. V. Raman

G. VENKATARAMAN

ANURAG, RCI Campus, Mamidipally P.O., Hyderabad 500 005, India.

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It is a privilege to speak about Raman, especially in this Institute where he spent a crucial period of his life. This being the year of his birth centenary, the essential details of his life are now better known than before. In view of that and the fact that on an earlier occasion Prof. Ramaseshan has delivered a memorable lecture on Raman here in this very hall, I shall not discuss Raman's life in the usual sense of the word. Instead, I shall concentrate on some of the lesser-known aspects, in particular those associated with the period he spent here. Nevertheless, the requirement of completeness demands that I provide at least a rapid thumb-nail sketch of Raman's life, which I shall now proceed to do.

Raman was born near Tiruchirapally on November 7, 1888. At the age of four, Raman's father moved to Visakhapatnam to serve in a college there. Thus the early childhood of Raman was spent in what is now a part of Andhra Pradesh and not surprisingly Raman could speak Telugu fluently, a fact that is hardly known. Being an unusually gifted student, Raman raced through school and college and, at eighteen, emerged not only with an M.A. degree topped by several prizes, but also with a passion for physics. But in those days, a career in science for Indians was unthinkable and Raman did what was expected of him namely, enter government service as an administrator. That was in the year 1907.

The government job took Raman to Calcutta which was then the capital of India. There, working in his spare time, Raman studied many problems in physics, particularly in the area of acoustics and optics. The pursuit of science was made somewhat easy for him by the facilities provided by the Indian Association for the Cultivation of Science. It is a matter of history that though the Association was founded on the model of the Royal Institution in London, it did not function in that style, at least during the life time of its founder. The Association sprang to life only after Raman joined it and took charge.

A major turning point came when, in 1917, Raman resigned from the government service to accept the Palit Chair for Physics in the University of Calcutta, an act which was hailed by all lovers of science, particularly by Sir Asutosh Mukherjee who publicly

applauded the sacrifice Raman had made in giving up a highly lucrative career in government. The second decade of Raman's stay in Calcutta was truly a glorious period. No longer had he to work alone in the Association for he now had a big gathering of highly talented students drawn from all over the country. In fact the reputation of the Association spread even overseas, so much so the great Arnold Sommerfeld once remarked that

India had suddenly emerged in competitive research as an equal partner with her European and American sisters.

The high point of this period was undoubtedly the discovery of the Raman Effect, which brought fame and glory both to the discoverer as well as the institution he worked in.

Success also breeds envy and Raman's success was no exception. As a result of several painful incidents, Raman had to leave the Association. Fortunately for him, precisely at this time there was an invitation to become the Director of the Institute of Science. When Raman left Calcutta, it was said by the noted geologist Sir L. L. Fermor:

Calcutta's loss will be Bangalore's gain. At present Calcutta may be regarded as a centre of scientific research in India but with the transference to Bangalore of one of our leading investigators, she will have to guard her laurels.

Bangalore was no bed of roses as I shall shortly describe in detail. Nevertheless, Raman made many important contributions both as a scientist and as a leader. Unfortunately these are hardly remembered because the controversies that he was involved in eclipsed his accomplishments. In 1948 Raman retired and adjourned to the Institute he himself had founded, *viz.*, the Raman Research Institute where he spent the remaining years of his life. This last phase was also rather a sad one, and will receive some attention later in this lecture.

I now go back to the early thirties, that is the period just before Raman took charge as the Director of this Institute. At that time he was a member of the Institute Council, having been nominated as a representative of the Eastern Group of Universities. Twice during this period he was warmly felicitated by the Council, once when the Knighthood was conferred upon him, and later when he won the Nobel Prize. Sir Martin Forster was the Director then, and his term was coming to a close on April 1, 1933. In anticipation of that, the Council appointed in July 1931, two committees which would submit names of suitable candidates for a successor. The committee in England was convened and chaired by Sir William Bragg and had Sir William Pope and Sir Robert Robertson as the other two members. The Indian committee consisted of Sir Samuel Christopher, Sir T. Vijayaraghavachariar and Sir M. Visweswarayya, the last mentioned being the Chairman and the Convenor. Both the committees unanimously favoured Raman for the post, and in July 1932 the Council recommended to the Viceroy that Raman be appointed the Director.

There was trouble right from the beginning when Sir P. C. Ray and Meghnad Saha opposed some appointments proposed by Raman. Although the opposition was notio-

nally on technical grounds, historically speaking one sees an extension of the animosity that sprang up during Raman's Calcutta period.

Upon assuming office in April, 1933 Raman did three things, namely, bring a new Physics Department into existence, restructure some of the existing departments, and finally reorganise the workshop. According to Raman, all these were for the better of the Institute but unfortunately for him, every one of these actions boomeranged.

To organise a new department, one needs money, staff and students. Raman had no problem in attracting students but he did have difficulties in finding money and in making staff appointments. The seed money he had been given was woefully inadequate to meet salaries, studentships, cost of journals, books, equipment, etc. Raman therefore reapportioned some of the Institute budget to aid the fledgeling Physics Department, an act which later invited charges of embezzlement!

Raman was firmly wedded to the view that excellent work comes from excellent people. He was quite dissatisfied with the performance of the existing departments, and strongly felt that the Institute needed fresh blood. Luckily, an opportunity for inducting new talent was presenting itself, since many eminent scientists were fleeing Hitler's Germany just then. Why not bring some of them over to the Institute? As we shall soon see, one particular appointment which he pursued with enthusiasm created a huge problem.

The reorganisation previously referred to antagonised both the Professor of Chemistry as well as the Professor of Electrical Engineering. Raman found that the Physical Chemistry Section was engaged mainly in studies relating to magnetism. Back at the Association, magnetism was one of the strong points of his research group. Feeling that the Physical Chemistry Section was somewhat isolated in relation to the other activities of the Chemistry Department, Raman decided to strengthen it by making it a part of the new Physics Department, especially since the merger would provide the chemists concerned with opportunities for constant and profitable interaction with other colleagues having allied interests. Prof. Watson, under whose care the Physical Chemistry Section had functioned earlier, was deeply offended and he resigned. Likewise, Prof. Mowdawala of the Electrical Technology Department opposed Raman's idea that the Institute Workshop, instead of merely training students, also assist research workers by building equipment for them. Mowdawala also became resentful and chose to leave. The sleepy campus was coming alive with controversy, and pretty soon it would be time for the Council to sit up and take notice, which is exactly what the opposition wanted.

The Born episode brought things to a boil. Like many others, Max Born left Germany in the early thirties and found for himself a temporary berth in Cambridge. At that time he received a letter from Raman asking for the names of bright theoretical physicists wanting to leave Germany and who could be considered for appointment at the Institute. Born replied that he could not recommend names without knowing about the conditions in India. Raman understood Born's position; so why could not Born come to Bangalore for a while and see things for himself? The Institute Council approved a temporary Readership for Max Born (as it also did for Prof. Hevesey). Born accepted the offer,

especially as his Cambridge appointment was drawing to a close. Further, Rutherford advised him to try out Bangalore as the salary was better!

In the autumn of 1935 Born and his wife Hedi sailed for India. Soon after they arrived in Bangalore, a professor of Electrical Engineering named Aston came from England. He was Mowdawala's replacement. The Astons stayed with the Borns till their own bungalow was ready. Later, Aston actively worked against Raman and also attacked Max Born.

Raman developed a great liking for Born, despite the difference of opinion he had concerning theories of lattice dynamics. He was very keen that Born should continue in the Institute as a permanent member but first he had to persuade the Faculty to accept the idea. Accordingly he proposed to the Senate that it recommend the appointment of Max Born as the Professor of Mathematical Physics. In his speech supporting the motion, Raman strongly eulogised Born but nevertheless the motion was not received well by many. As Born describes,

Aston went up and spoke in a most unpleasant way against Raman's motion, declaring that a second-rank foreigner, driven out of his country, was not good enough for them. This was particularly disappointing as we had been kind to the Astons. I was so shaken that when I returned to Hedi I simply cried.

Meanwhile the turmoil on the campus continued to grow, and in July 1935 the Council recommended to the Viceroy that a Review Committee be appointed. Unlike in the past, the Council this time spelt out in detail the various items the proposed Committee should address itself to. The list was heavily loaded against Raman and his protests were over-ruled.

Unmindful of all this, Raman continued to steadfastly campaign for Born's appointment and in fact in November 1935 the Council even accepted his suggestion that a professorship in Mathematical Physics be created. But then the Irvine Committee came in the way.

The Review Committee appointed by the Viceroy or rather the second Quinquennial Review Committee as it was officially called, consisted of Sir James Irvine, Vice-Chancellor of St. Andrew's University, Dr. A. H. Mackenzie, Pro Vice-Chancellor of Osmania University and Prof. S. S. Bhatnagar. Irvine was born in Glasgow in 1877 and practically grew up with St. Andrew's University, having been associated with it successively as a student, Lecturer, Professor, Dean of the Faculty of Science, Principal and finally Vice-Chancellor. Bhatnagar was at that time in Lahore as the Professor of Chemistry in the Punjab University. As for Mackenzie, he seems to have been included mainly on the strength of his administrative background.

I do not have the time to analyse the findings of the Irvine Committee; those interested in such details may find the same in my book. It suffices to observe that the Irvine Committee did what it was supposed to do, namely, slay Raman.

That this is not an idle accusation becomes evident when one reads a letter written by Max Born to Lord Rutherford in October 1936. After returning to England, Born was

quite silent about the affairs in Bangalore, and it was only when Lord Rutherford insisted that Born decided to speak out. Let me now quote a few passages from Born's letter. Borrowing from Richard Feynman, one can describe this letter as an outsider's inside view of the Institute affairs! This is what Born says in part:

Raman came to the Institute with the idea of making it a centre of science of international standard. What he found was a quiet sleepy place where little work was done by a number of well-paid people. My wife and I met an English couple — the man was a retired official in Ootacamund. When I said I was at the Indian Institute of Science, Bangalore, this man said laughing 'Ah! That is a nice sinecure where people draw high salaries'. Similar expressions we have heard on other occasions. Raman's mere speeding up of the entire pace at the Institute was bound to look like criticism on the former work. Add to this that he made a heavy mistake in not waiting a year or two before starting actual reforms. Naturally he got into troubles with the professors who were at the Institute before him. Two of them left the Institute during the first year — an Indian Mowdawalla, Professor of Electrical Engineering and Watson, Professor of Physical Chemistry. The latter case seems to me one of the main sources of difficulty Raman was to encounter later. Watson's friends and he himself may have expected that he was to be the new Director after Sir Martin retired. Certainly Watson did not like to continue as a Professor under an Indian Director. I was told this by some of his English friends. It is easy now to make the loss of Prof. Watson a point against Raman but it is certainly not just. Openly the real reasons for Watson's leaving the Institute were not known; only the given reason was known, namely, that Raman's manners had driven him away. I know that Raman's manners can cause serious grievances but in Watson's case they were but a pretext.

Elsewhere in the letter Born says:

I want to show you by a few examples that all this is not a matter of mere assumption. Three weeks after us arrived the new Professor of Electrical Engineering Aston at the Institute. Immediately after his arrival the open revolt amongst staff and students began and he became a centre for collecting ever so silly complaints against Raman. We wondered very much till one day Mrs. Aston said to my wife that her husband had been made to accept the post by his English colleagues in charging him with the definite mission to clear up the Institute. Aston had been received in Bombay by the Tatas, had been their guest and got instructions.

Incidentally, Born also points out that Aston failed to get a Professorship in England. About the Irvine Committee, Born observes:

I have no right to criticise the attitude and proceedings of the Committee but I must say that it seemed to me rather surprising. Instead of visiting the Institute and studying the work done in the laboratories, they sat in a government building some four miles away where they behaved like a law court. It was

evident to me from the beginning that they had received instructions beforehand. They examined chiefly Raman's opponents, even students. All the dirty affairs were treated in detail but no voice was raised to take into account the good intentions of Raman or his achievements at the Institute.

Let me now continue with the narration. The Irvine Committee submitted its report in the middle of 1936 and when it was discussed in the Council, Raman was severely attacked for his alleged infringement of rules and procedures. Only three people namely, the Dewan of Mysore, Prof. B. Venkatesachar and Dr. Bawa Kartar Singh spoke on behalf of Raman. Encouraged by the support given by the Council and the adverse report of the Irvine Committee, Raman's opponents now stepped up the campaign and finally on June 1, 1937 Raman wrote to the Chairman of the Council:

Having considered all the circumstances, I feel it would be best that I offer to terminate my contract of service with the Institute as its Director.

Along with his resignation letter, Raman submitted a lengthy memorandum regarding his work at the Institute and defending his actions. The Council resolved that Raman's resignation be accepted, and acceded to his request for a special retirement allowance. It also recorded that the settlement should be regarded as final and amicable. As events transpired, neither was true! In his capacity as the Director, Raman forwarded the Council resolution to the Viceroy and along with it sent a letter of his own. This infuriated the Council which then summoned Raman and revoked its earlier offer. It declared that Raman was unfit to continue any longer as Director and offered him two choices: Either to continue as Professor of Physics or resign with effect from April 1, 1938 on such allowances as he might be entitled to according to standard rules. Raman was also warned that if he declined both options, he would be suspended! There was practically no support from any quarter.

Soon after Raman stepped down, it was widely remarked, including by people well disposed, that while Raman was a brilliant scientist he was a poor administrator. Similar statements were aired in the press during the earlier showdown in Calcutta. These comments do not make any sense when one considers the rich encomiums paid to Raman for his administrative ability while he was in government service. No less a person than the Member for Finance in the Viceroy's Council had written:

We find Venkataraman is most useful for the Finance Department being, in fact, one of our best men.

The truth is not that Raman was a bad administrator but that he was a strong one, a fact not liked by his opponents.

From a historical perspective, I see Raman's struggle as a battle between excellence and mediocrity. Raman championed the cause of excellence but, unlike in fairy tales, he lost. The Council he faced no doubt had men of eminence but alas, they were the legal types who understood little about academic matters or scientific creativity. The handful of people that did, were mostly opposed to Raman on personal grounds.

It is sometimes said that the battle of Kurukshetra is a symbolic representation of the inner conflict we often face. In a similar vein I venture to suggest that Raman's struggle is the paradigm of the battle between excellence and mediocrity which is still going on in most of our laboratories and academic campuses. And alas, as before, excellence is generally continuing to lose.

One of the charges levelled against Raman was that he was antagonistic to applied science. In fact, the Irvine Committee went to town on this subject claiming that while Jamshedji Tata wanted a close association of scientific research with industry, Raman came in the way. In his defence, Raman drew attention to the consultancy he had been offering to the Railways, to his role as an adviser to many princely states concerning their industrialisation programmes, etc. At the same time, he firmly declared that as far as the Institute itself was concerned, it should not become the front-end for industry solving its day-to-day problems like: how to extract more oil, how to make better soap or how to make a particular industrial process more efficient. The Institute was an academic centre aiming to become world-renowned and as such should engage only in those problems which would stimulate the keenest minds. Superior skills are developed only by facing basic challenges. However, the exercise would not be in vain, for such abilities are always useful and available on tap when applications are demanded. Back in 1924, Raman had spent a semester at Caltech as the guest of Robert Millikan and it would seem that he was trying to model the Institute along those lines whereas the Irvine Committee and the Council both wanted it to go in exactly the opposite direction. The crying irony is that after Raman was removed, the Institute did not really do much to promote the industrialisation of the country. As Homi Bhabha pointed out years later, when after Independence we started setting up steel plants, we went abroad shopping for technology although steel plants had been established decades earlier by Tata and by Visweswarayya. Even today we are importing technology left and right. All that has happened is that we have established a string of premier institutes which process our human resources into a commodity called NRIs.

Let me now turn to the scientific contributions which Raman made during his Bangalore period. After he ceased to be the Director, Raman focussed all his attention on research and on building up his Department. Not surprisingly, the prophecy about Bangalore becoming a centre for scientific excellence soon became true. If today Bangalore has emerged as the Science City of the Nation, it is in no small measure due to the seeds sown by Raman half a century ago. Since subsequent speakers are likely to discuss Raman's work in detail, I shall restrict myself to calling attention to a few hardly noticed facts.

One observes that in the Bangalore period, Raman has become more preoccupied than before with natural phenomena. No longer does he seem to set up controlled experiments to test specific principles or theories of physics. Instead aesthetics dominates his attention, and he explores things such as the colour of plumage, the iridescence of shells and of ancient glass, and so on. Even his style seems different. Consider, for example, how he opens his very first paper from Bangalore. He starts:

Great interest naturally attaches to the investigation of the colours that form a striking feature of the plumage of the numerous species of birds. Even a cursory examination, as for instance the observation of the feathers under microscope, shows that the distribution of colour in the material and its optical characters are very different in different cases, indicating that no single explanation will suffice to cover the variety of phenomena met with in practice.

After discussing whether the problem of the origin of colours belongs to the realm of chemistry or physics, Raman directs his attention to the feathers of one particular bird namely, *Coracias indica*. About this bird he says:

This is a species of jay, very common in Southern India, which furnishes readily accessible material for the investigation of this type of colouration of birds. Seen sitting with its wing folded up, *Coracias indica* is not a particularly striking bird, though even in this posture its head, sides and tail show vivid colouration. It is when in flight that the gorgeous plumage of this bird is more strikingly seen and museum specimens of the bird are therefore best mounted with the wings outstretched. The wings then exhibit a succession of bands of colour alternately a deep indigo-blue and light greenish-blue; the tips of the wings show a delicate mixture of both colours.

Raman wrote two papers on shells, the first of which is largely descriptive, being in the style of a naturalist. The papers abound in Latin names seldom seen in a physics journal, and there are delightful descriptions of the shells.

Most people today would tend to conclude that such work is not physics and that Raman had started rambling. My own view is quite different, being based on a detailed study not only of Raman's papers but those of his students as well. If one reads Raman's papers carefully, one will observe a connecting link which is that all these studies relate to the optics of heterogeneous media. While Raman focussed on the natural manifestations of such media, his students explored the more technical aspects. The study of the optical properties of heterogeneous media is highly developed at the present time, and has many practical applications. Unfortunately, the pioneering contributions made by the Bangalore school to the development of this subject are hardly known. It has also escaped notice that these studies are a vindication of Raman's point of view that good applied science is born out of high-class basic research.

During the final phase, Raman spent a good deal of time studying gems and minerals. I have read many of Raman's papers on this subject, and I must confess they left me a bit disappointed on first reading. Some might even wonder whether such papers would get past a referee. Perhaps they might not but that would be too clinical an analysis of the matter. Viewed in a larger perspective, it would appear that during this phase Raman was no longer interested in explaining to others. He had seen, he had understood and he had enjoyed — that was all that mattered. As the poet Keats wrote:

To understand and so become aware,
And, thus, mine beauty from the crystallised air.

It would be too hasty to dismiss these papers as lacking physics. On the contrary, these investigations raised several important questions which were left for Raman's protege Pancharatnam to answer. Crystal optics might have not been fashionable in an age when parity non-conservation was the in thing. But there were certain subtle questions relating to coherence which Pancharatnam exposed and succinctly answered, almost at the same time when others came to similar conclusions *via* the newly emerging topic of quantum optics. Here in Bangalore, Raman and Pancharatnam did not need the maser; good old crystal optics was just as effective. I should also call attention to several papers Raman wrote on internal conical refraction. If that sounds like a topic belonging to the 19th century, then let me mention that Bloembergen investigated precisely this phenomenon in the late seventies, several years after Raman had passed away. Of course, Bloembergen, was interested in the nonlinear aspects.

I do not want you to carry the impression that it was all feathers, shells and gems. The Raman-Nath theory and the soft mode about which you will undoubtedly hear later offer adequate proof that at least till the forties, Raman did contribute directly to mainstream physics. It is, however, unfortunate that even these contributions did not always receive the recognition they deserved. I have, for example, seen books on acousto-optics which make no mention of the Raman-Nath papers, although the theory due to them is discussed! There are others who make it appear as if the last word on the subject was said by Brillouin, which is not true.

Why did Raman continue with optics after leaving Calcutta, especially when nuclear physics was the new rage? This is an interesting question. Actually Raman was greatly excited by what was going on at Cavendish and very much wanted to pursue nuclear physics. But alas, he had no money. When Bhabha joined the Institute Raman hoped that the Tatas would make a small grant. The Tatas eventually did, not to Raman but to Bhabha so that he could found the TIFR! However, that is another story. Nevertheless, for a moment one does wonder what might have happened if nuclear physics had struck roots in Bangalore instead of in Bombay. It is said that later in his life Raman often lamented that he should have spent his Nobel Prize money buying a gram of radium instead of investing it on diamonds.

During the last decade, Raman spent much time studying the physiology of vision, a topic to which his boyhood hero Helmholtz had contributed very much. It is an accepted fact that from a scientific point of view, this work of Raman is of no consequence. Raman is often summarily dismissed for having produced theories of dubious value like this one. I do not wish to defend the indefensible but would at the same time like to ask whether it is not conceivable for a person to lose his creativity when repeatedly trampled upon? If this seems far fetched, consider what Abraham Pais says about Einstein:

After that, the creative period ceases abruptly, though scientific efforts continue unremittingly for another thirty years. Who can gauge the extent to which the restlessness of Einstein's life in the 1920's was the cause or the effect of a lessening of creative powers?

The reference is to the violent attacks made on Einstein as a part of Hitler's anti-Semitic campaign. Thus we have here one more famous example of the loss of creativity caused by intemperate personal vilification.

The Raman Institute phase should have been a happy one for Raman as he was now in his own laboratory with independent means and totally free from outside control. Besides, there were interesting problems to study, there were the affairs of the Academy to manage, and last but not the least, there was the wonderful garden to tend to. And yet these were some of the most painful years that Raman spent. Prof. Ramaseshan has given us a poignant description of Raman's agony, comparing his emotions to those of Mahatma Gandhi during the Noakhali disturbances. Why was this so?

In the years immediately after Independence, one witnessed a remarkable scene. We had at the helm of our affairs a great visionary whose centenary we shall be celebrating next year. Unlike the run-of-the-mill leader of the Third World, Jawaharlal Nehru was a profound thinker and held the view that India must emulate the Soviet Union in adopting science and technology as the means of solving her numerous problems. Such a dream had been forming in his mind since the thirties, and now was the time to give shape to those dreams. Thus, science became the magic wand and everybody rallied to Nehru's clarion call. Those were exciting times, thrilling beyond words. Laboratories were established, buildings built, equipment bought, and people hired in large numbers. In no other country was so much sought to be accomplished so rapidly. I vividly recall the magic spell cast on us by Bhabha.

Wasn't this a great experiment and wasn't it to be supported? Yes, thought the whole country, swept as it was by a sense of euphoria. But Raman was troubled. He too wanted poverty banished, he also was in favour of technology and industrialisation, and he was behind no one in his desire to see his country emerge as a powerful nation. However, good science was not created merely by spending money, starting laboratories and by passing orders. More important was the human element, and if in the name of hurry quantity replaces quality then disaster would inevitably follow. To him it seemed that the policies pursued by the government were fraught with danger, however good intentioned they might be. Besides, they appeared to be a negation of all that he had stood and worked for. And so in a characteristic manner he made his objections be known. He was brief, blunt and brusque. As was to be expected, especially in the mood that prevailed, Raman was ignored in official quarters, although his comments made good copy. I myself used to wonder in those days why Raman was objecting to something that appeared to be good. After all he himself had worked for the development of science. So why was he now vigorously protesting? Three-and-a-half decades of service in government have made me wiser and I am now able to see clearly the logic behind Raman's arguments, although he himself chose not to elaborate on it.

As in all countries, funding for science and technology in India has necessarily to come from the government but that does not mean it should come with strings attached. It is a widely accepted fact that the existing governmental framework is not conducive to creativity. Science is a creative endeavour and yet for four decades we have been compelled to work with a totally incompatible system. Government control not only

inhibits creativity, but more disastrously, it encourages sloth and intrigue, besides rewarding non-performance. It is not as if the government and the bureaucracy is composed of ignorant or stupid people. On the contrary, there are many many clever and talented persons in government. And yet we see this amazing contradiction of the government spending a sizeable amount of money in the name of science, etc., on the one hand and preventing achievement by slapping an outmoded system on the other. I have come to the conclusion that barring isolated individuals, the governmental machinery as a whole is indifferent and insensitive to whether our science achieves excellence or not. If specific individuals achieve excellence by overcoming obstacles like Ramanujan and Raman did, for example, they are applauded by the society and the government alike; otherwise scientists as a community are either criticised or ignored. This is a great tragedy, considering the high place given to talent and creativity in our society in earlier eras. Richard Feynman has pointed out in his celebrated report on the Challenger enquiry, that if there is a loss of common interest between the scientists and the management, then calamities are possible. Calamities do not always have to be in the form of a crash: being saddled with a millstone is an equal disaster.

Raman was one of the first to raise his voice against the bureaucratic approach in the post-Independence era, and he did this even though he himself was not subject to the pinch. It is curious that no less a person than Nehru complained about bureaucracy in several of his addresses to the Science Congress. Homi Bhabha did the same in his last public lecture. But bureaucracy has survived, thrived and grown to even more ominous proportions. And there is nobody left now to raise a word of public protest.

I belong to the generation which saw Raman as a fading giant. And our impressions were based on the misconceptions and the biased folklore we were fed with. Having carefully researched his life, I now see how misguided I was. I am sure there must be many other misguided persons like me. Raman was and still is often portrayed as one who did not understand physics. It beats one's imagination how then he could have commanded the respect of giants like Rutherford and Bragg, long before he discovered the Raman Effect. Again, how was he elected a Fellow of the Royal Society as early as 1924 although he did his work in a place so far away from London? How was it that he was asked to open a discussion meeting in Toronto in the early twenties and how come Millikan invited him as a Visiting Professor at Caltech, a post earlier adorned by Lorentz, Sommerfeld and Einstein? When he was appointed to the Palit Chair, it was suggested that Raman should first visit England to receive training. He indignantly refused to visit England for that purpose, although he had not gone abroad even once at that time. How many would pass up a foreign trip today? When he had to step down from the Directorship of this Institute, the press was full of rumours that Raman was planning to settle abroad. With a Nobel Prize in his pocket that should have been quite easy and yet Raman chose to stay behind in his darkest hour. Today, on the other hand, people are dreaming of a green card even while entering college! After retirement, the government offered funds but Raman rejected it even if it meant hardship, so that he could preserve his independence. Can we find such a spirit today? And finally, when he was sounded out for the high office of the Vice-Presidentship, he declined. How many would turn down power and position?

It seems to me that this country has been most fortunate in producing such a spirited scientist who, by his shining example, showed that given courage and tenacity one can achieve against the greatest odds. On the occasion of the Silver Jubilee of the Raman effect, Homi Bhabha wrote that the only purpose of celebrating the anniversary of a great event is to derive inspiration from it. Today we are celebrating another anniversary and I submit that we should derive inspiration from all that this Noble Son of India stood and worked for. Raman made Mahendralal Sircar's dreams come true but unfortunately his own dreams did not. Should we not on this occasion dedicate ourselves to the realisation of that ideal?