

C. V. RAMAN THE UNIQUE MENTOR

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IN the realm of Indian Science, Professor Raman was the most outstanding figure for the last forty years. In making an assessment of his contributions to Indian Science, I have certain limitations. First of all, I was not privileged to have been his pupil. Secondly, the field of scientific research in which I have taken interest was far removed from the very many fields in which Raman was concerned. Nevertheless, it is not out of place to mention that I was privileged to know him for the past thirty years and during the last ten years or so, it was again my cherished experience to know him closely and to gain an insight into his attitude to science and problems facing India through intimate discussions during the several annual sessions of the Indian Academy of Sciences.

The first occasion I had of meeting Raman was during my research student days soon after the founding of the Indian Academy of Sciences in the year 1935. It was through the late Professor Gopala Aiyar that I had the occasion to meet him and the recollection of that meeting which I have to this day was the strong desire on his part to see that the best work done in India at that time by the young scientists was published in the *Proceedings of the Indian Academy of Sciences*. It is a matter of pride to me that some of my very early contributions were, in fact, published in the *Proceedings of the Academy* and this became a good tradition for many scientific papers which came from the Zoology Department of the University of Madras. When, even now, many scientists in India crave to have their papers published abroad, the keenness with which Raman was encouraging the publication of the work of Indian scientists within the country is well worthy of emulation at the present time. In spite of the fact that there were many difficulties in securing adequate circulation by publishing material in a then not very well-known journal, the support which he gave to the journal and the regularity with which it appeared, secured admiration from all scientific circles and there was a time when in many foreign libraries, the *Proceedings of the Indian Academy of Sciences* was the only Indian scientific journal known.

The next series of contacts I have had with him was after my return to India in 1942, after some years of work abroad. This was the time when he was vigorously pursuing problems of optical physics at the Indian Institute of Science, Bangalore, after he had relinquished the Directorship to take independent charge of the Department of Physics. I still remember the long discussion I had with him one afternoon on the role of physical and biological research in Indian science.

For many years, Raman's attitude towards biological sciences was that they did not belong to the forefront of scientific research. He was inclined to consider that biologists in general lost sight of the main problems through too much attention to descriptive aspects and too little attention to original thinking. He felt strongly that the fundamental discoveries in the field of science have to emanate from the physical sciences. This somewhat rigid earlier approach had mellowed in later years and he openly admitted that there was a growing realization on his part that biological sciences and the contributions therefrom are equally of the highest value in the advancement of science. As a corrective to his earlier attitude he used to allude to his earlier interests in biological topics such as iridescence of shells, the colour of birds and butterflies, and lastly, to the colour patterns in flowers. The latter subject led him to the studies on the physiology of colour vision on which he spent much time during his last years and controversial although some of his concepts, he brought to bear on these studies a refreshing originality and attempted at finding solutions to the basic problems.

Great as his achievements were, he was humble about what has already been accomplished by him and he openly admitted at a gathering of Fellows of the Academy assembled to celebrate his eightieth birthday that he considered his life as a failure. This was because of the high standards he had set for himself and he explained that his assessment was based on the achievements of eminent scientists of the calibre of Helmholtz and Rutherford.

His earlier consideration that biological sciences do not rank as high as physical sciences did not at any time prevent his intense enthu-

siatism to promote work in biological fields. Even in subjects which he himself considered as not of high importance, it was his endeavour to do his best to see that the results of studies undertaken are quickly published in India, so that the younger generation of scientists will have the fullest opportunity to have their papers seen by their compeers in all countries. In this respect, he abhorred the approach of certain perfectionists who would never like to see material published unless it had reached a form in which all work was completed. But in his own field of research he applied the test of perfectionism rather rigidly; to many of his later students, his standards were high and exacting.

Looking at the background in which Raman worked, and the milieu of Indian science during the past several years, the most outstanding contribution he made has been the building up of the Indian Academy of Sciences and the Raman Research Institute. His contributions in the field of physics have, no doubt, been of outstanding significance and are dealt with by many other contributors in this volume, who are most competent to assess them; but to one who is not a physical scientist, the assessment of his towering personality in Indian Science has been one of giving new inspiration and confidence to the large body of scientists who were associated with him, irrespective of their disciplines. The Annual Sessions of the Academy witnessed small gatherings of persons deeply interested in science, who met to discuss problems with which they were concerned, and in which they were contributors and which they wanted to foster by mutual exchange of ideas and criticism. These annual gatherings drew perpetual inspiration from him and as one who belonged to the many group discussions which he organized under the aegis of the Academy, I feel that his impact on this body of workers has been profound.

As an exponent of science to the public and the layman, there were very few in the world of science to match Raman. In the popular lectures he delivered during the Academy meetings and which he arranged during the sessions, attempts were made to cover various growing points of Indian Science. This by itself has been a great education to the Indian scientific community. He took great care to select University centres for holding the Annual Sessions of the Academy and arranged programmes in a very compact and effective man-

ner, with a good admixture of original contributions, reviews and popular lectures. The size of the meetings was always kept small except for popular lectures. It was the generally accepted rule that scientists from all disciplines attend the whole series of meetings and lectures. Many of us remember the great care with which he selected topics for group discussions, arranged the speakers, allotted time to them and provided opportunities for general discussions in which he himself took part. To many of us with heavy administrative and organizational duties, the Academy Sessions provided a much-needed intellectual enchantment which kept us as scientists. In this manner, in addition to his great drive and enthusiasm as leader of Indian Science, he acted as a great dispenser of the highest scientific traditions, giving lustre to the group of dedicated workers he fostered and the institutions where these meetings were held.

Raman held the English language in the highest esteem as the most effective vehicle for the propagation of scientific ideas and was firmly of the view that the growth and achievements of Indian science was inextricably connected with the continued usage of this world-medium of communication.

The blue colour of the oceans was one of the subjects which attracted him early in life and came for study at the hands of Raman and K. R. Ramanathan many years ago. He was deeply interested in the growth of oceanographic studies in India and felt happy that schools on certain aspects of ocean research were coming up in India. "The country must have several ships for these studies," he used to say, "and not rely on the one you borrow from the Navy." Speaking after my account of Indian ocean researches on one occasion at Poona, he unhesitatingly attributed the loss of Indian independence in the days of colonial expansion to the neglect of the seas and called for renewed scientific effort in this field. "The colour of the sea interests me more than its fishes," he used to tell me; he had desired some new and original approach to optical problems in oceanography to be taken up by Indian physicists.

At the Raman Research Institute which he founded, it was his ambition that all branches of work should develop and flourish, physical, chemical, biological and geological. The full fruition of his ideas in this direction had not taken place owing to the enormity of the financial resources required and the exacting

standards of scholarship which he demanded from the younger generation of scientists who joined him. Perhaps the environment in which such all-round development could have taken place had not progressed to that desired level to give effect to the lofty ideals which Raman

held. Let us hope that many of us who have gained from his inspiring leadership and association with him will live to see his noble ideals kept alive and the high aspirations which he had held out for the Institute, achieved.

RAMAN AND ASTRONOMY

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MANY a great man-of science, whose personal contributions have led to the unravelling of some of Nature's secrets, has been an ardent admirer of Nature's handiwork and its beauty. Raman belonged to this restricted fold, whose members gained inspiration from the beauty of their surroundings. The blue of the ocean, the plumage of birds, floral colours and the symmetry of crystals gave him a feeling of intense rapture, and the inspiration to ponder over their origins and characteristics. Likewise, the canopy of stars as seen on a clear moonless night must have stirred the imagination of one who was so much impressed by natural splendour. Indeed, in one of his writings he has described astronomy as "a heaven-born river of knowledge which flows to the earth and fertilizes the fields of learning and culture".

For one who had such an intense feeling towards the splendours of the science of astronomy, Raman's personal involvement in its development has been only from the side lines. One may consider this surprising. An explanation would be the limitation imposed on an individual's selection of a sphere of effort, by the brevity of the human life-span. Raman has often said that should he be given the opportunity of living his life all over again, he would choose to be an astronomer. This statement is expressive of his interest and the fascination that the subject had for him.

As one whose principal researches lay in the science of optics, Raman admired the contributions of the large aperture telescope to astronomical progress. He believed that "progress in astronomical science in a country depends on the existence in it of skilled opticians who can grind, polish and figure great lenses and mirrors up to the most exacting requirements". These words appraise the situation with as much correctness today, as

they did three decades ago when he expressed them. A great admirer of John Brashear, the famous American telescope builder, he felt that the immense support which American men of wealth gave astronomy in their country, was to a large extent the offshoot of Brashear's telescope building capabilities and his love of the stars. Like the connoisseur of art, he delighted in the sheer artistry and precision of a well-figured mirror. He was happy to possess a few of the mirrors made by one of his contemporaries, H. P. Waran. And he derived the satisfaction of a dream-come-true as it were, when he learnt that Jayarajan at Kodaikanal had been successful in figuring larger mirrors for astronomical use, and that we had embarked on a large scale telescope-building programme.

Raman was a Visiting Professor at the California Institute of Technology in Pasadena, for a few months in 1924. These were stirring times in astronomical history and must have left a lasting impression in his mind. The Hale era at Mount Wilson was at its peak where the great 100-inch telescope had just gone into operation, and in the hands of Hubble had almost as a first result yielded the spectacular transformation of our concepts of distances in the Universe. Raman recounted these momentous days often; the sights of the gaseous nebulosities that he viewed through the 100-inch had etched in his memory a picture of inspiration and beauty. Years later, I had an account of his first visit to Mount Wilson from J. A. Anderson of diffraction grating fame, who had given Raman his guided tour. Raman spent a couple of nights on the mountain taking in the heavenly sights at night and exploring the mountain side during the daytime. Anderson also recalled how Raman took his companions by surprise, walking barefoot over the various trails on the mountain, in preference to the foot-gear his