

C. V. Raman's work on scientific journals: Legacy and lessons for Indian science

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'Do not allow the journals of the Academy to die, as such journals are the only indicators as to whether science is taking root in our country or not.'

C. V. Raman
the day before his death.

Today, C. V. Raman (1888–1970) is a household name, mostly remembered for two things: his Nobel Prize and that he was a nationalist who chose to stay in India. Many believe that his era was so different to the present that all we can learn from his philosophy is a commitment to quality. To scientists today, Raman may appear irrelevant. Even in his time, he could seem old-fashioned. He was inspired by and aimed to answer the questions posed by nineteenth-century physicists, such as Helmholtz. He did not, like most pre-eminent physicists of the period, embrace the new sciences of the early twentieth century. While theoretical physics was taking-off, he was investigating the acoustics of Indian instruments, optics, the colours of flowers and crystals: not usually headline-grabbing fields. Even the literary style of his papers harked back to an earlier age.

When looking for a figure to inspire science in India, he is not an obvious choice. During my visit to the Raman Research Institute (RRI) and Indian Institute of Science in Bangalore, however, I explored Raman's contribution to India's scientific journals. I examined his legacy – the journals of the Indian Academy of Sciences (IASc), Bangalore, and over-viewed the evolution of the publishing climate and its impact upon these journals. These studies have convinced me of the necessity of 'Indian science' and Indian journals. In this note, I will suggest what lessons must be taken from Raman's work on journals if science in India is to flourish.

Raman's personal contribution to the development of scientific journals in India is astounding. When Raman entered science, there was no scientific journal of international repute in India. He was not only founding editor of the *Proceedings of the Indian Academy of Sciences* (hence-

forth *Proceedings*) in 1932, but continued to edit this monthly journal until his death. Under his direction, publication of the *Proceedings* was the utmost priority of the Academy. Raman was on the editorial board of the fortnightly *Current Science* from its inception. Holding positions of power does not in itself indicate strong support for Indian journals; as demonstrated by the many Indian scientists today who are associated with the editorial boards of Indian journals, yet publish abroad. Raman, however, was not in this category, writing 133 articles, 15 major book reviews and hundreds of short notices for *Current Science* alone. He saw India's scientific achievements as national assets that ought to be showcased worldwide. It is easy to underestimate the difficulties he would have faced. The Indian print industry was not set up for technical publication; there was little precedence of journals regularly appearing on time and the IASc, neither seeking nor receiving government subsidies, had limited finances. Raman was truly the father of scientific publishing in India and Indian scientific publishing was undoubtedly most successful in the years when *Current Science* and the *Proceedings* were under his direction.

Scientific publishing has evolved since Raman's days. Journals around the world have had to respond to rapid changes in the publishing environment, such as increased commercialization and specialization of the industry and the advent of e-publishing. Since World War II, the USA has become the centre of gravity for scientific research and American journals have become the clear frontrunners, leaving many historically high-quality journals struggling to survive.

Indian journals seem to have responded well to these pressures. The IASc journals were split into multiple specialized journals; the layout of the journals has been overhauled several times and six years ago, electronic versions of the journals were put on an open-access server. In 2007, the Academy brokered a deal with Springer, which will guarantee electronic delivery of all ten IASc journals to over 10,000 institutions worldwide.

The various Indian journals have risen and declined, and despite the positive steps described above, they have never enjoyed the success they did under Raman in India's scientific 'glory years'. It seems that the IASc has consistently responded well to the changing publishing climate. Why then do the journals still have such limited impact? To answer this question, we must look to Indian scientists.

Most Indian scientists are highly reluctant to publish in Indian journals. They prefer to publish in high-impact journals, putting letters or less important papers into an Indian journal. Even those speaking at national conferences, who vociferously advocate publishing in India, often go on to publish their important papers abroad. This tendency is, as N. Kumar (RRI) puts it, a 'Darwinian adaptive response to selective pressures'. First, if a paper is published in an Indian journal, it will receive fewer citations and be less favourably received than if published abroad. Secondly, there is selective pressure from within the community itself. When councils consider scientists for promotion, they self-confessedly set much less academic value on papers published in Indian journals. When the senior members of the Indian scientific community itself show so little support for the national journals, how can the younger generation, striving for recognition, be expected to make the apparent sacrifice of publishing in an Indian journal? The pressure from within India is to publish elsewhere.

I maintain that it is crucial that the Indian scientific community is supported and that journals play an important role in this support. Some insist that the decline of Indian journals since Raman's time is inevitable and there are those who do not see it as a tragedy. Many scientists do not adhere to the notion of 'Indian science' at all. They claim that 'science is international' and that its future lies in international collaborations. If this were true, encouraging scientists to publish in Indian journals would hamper their careers and encourage a destructive Indian isolationism: scientists should be encour-

aged to publish where their papers will have the greatest impact, i.e. elsewhere.

Unfortunately, this is not the case. Science is not international in many respects. First, communication may be instant, but scientific communities and groups remain confined to physical loci. Scientists from different regions are less interdependent than many would like to think and the extent to which an 'on-line community' exists is easily exaggerated. The physical locus of research and the impact of where a paper is published cannot be ignored. Secondly, scientists cannot exist in isolation. Studies in the sociology of scientific knowledge have demonstrated that science is a social activity. Scientists need to be in a thriving community to survive and must be concerned with the health of their neighbouring institutions. Thirdly, in the age of 'big science,' the necessity for highly specialized equipment means that countries can choose only a few foci of research. No country but the US can afford cutting-edge telescopes, nanoscience laboratories and particle accelerators. Countries must choose to pursue specific fields of research at the exclusion of others, and these decisions must be taken as a community, rather than not really taken at all, as in India. And finally, another aspect which indicates that science is not international is in its accessibility. Indian institutions cannot always afford foreign journals; so publishing abroad affects the availability of Indian research to Indian scientists. Journals such as *Physical Review Letters* are simply too expensive for most institutions.

In India, there is not a critical mass of researchers in any area of science. Too few people are doing too many things. Science in India does not lack imagination, but does lack the schools of mutually supporting scientists who can fill out the details of each other's work. Indian scientists have much to gain through working within their own community to build it up. G. Srinivasan (RRI) recalled the link between termite hills and scientific projects, pointing out to me a 7 foot termite hill which stands tall in RRI, unknowingly imparting its lesson. Termites will gradually abandon their own hill for a bigger hill until they are all building the same hill. To succeed in the big science environment, scientists must act like this, but they must choose hills being built in their own country if they wish to stay there. One need only look at the

successes of the Cavendish Laboratory in Cambridge under Bragg, to see the importance of a strong, localized and independent community. When Bragg realized that Cambridge would not have the resources to keep pace with the US groups working on nuclear physics, he chose not to continue the work of his predecessor, Rutherford, and instead applied his knowledge of crystallography to molecular biology, with resounding success.

Some reservations about the relevance of journals to this problem must be sustained. Their role has certainly changed. It can be argued that in the period when Raman was at his best, it was reasonable from the point of view of individual scientists to publish their best work in Indian journals, as there was less competition internationally between journals. There are now so many journals that one must strive to publish in high-impact journals. I maintain, however, that the rise of a scientific community still depends on its journals, even if the nature of that dependency has changed.

If scientists publish in a home journal, it gives identity to a scientific community. For a community to exist, its members must be both contributors and beneficiaries. Home journals facilitate this. If scientists publish abroad, this consolidates the community's lack of self-confidence. Indian journals also allow scientists to measure the pulse of the scientific community and inspire confidence by showcasing success. Furthermore, journals allow India to retain a peer-review system, essential to the health of a scientific community. Moreover, Indian scientists are naturally given priority in their own journals: it will always be harder to publish abroad. The advantage that Indian scientists have when making submissions to their own journals will only benefit their careers when the journals' reputations increase. As S. Ramaseshan had asked, 'Should we not attempt to bring the playing field to India?'. Finally, the excuse that one could not publish in Indian journals due to poor circulation is less applicable now as the journals are published online.

The building of a scientific community makes demands on both the Indian scientists and their institutions. Both can learn much from Raman. Raman's support for 'Indian science' could and has been misconstrued as nationalistic. He did not, however, suggest that national success

should be pursued at the expense of bi- or multilateral collaborative efforts, recognizing that therein lies and should lie the future of science. He merely realized that if India wished to be a significant contributor to these future efforts, scientists must show national self-interest. All countries which enjoy a high scientific profile today have either shown historically, or are now showing, an interest in the success of the national scientific community. For scientists who wish to work in India, my appeal to Indian scientists to publish in their own journals is more than emotional or nostalgic.

Long-term vested interests aside, it is true that for Indian science to flourish, Indian scientists must make the short-term sacrifices necessary to build up a community. Senior scientists must publish in their own journals. Raman had incredible ambition for India as well as personal ambition. His Nobel Prize made him a household name, but his patriotism is what made him a national hero. He thought that Indians should elevate themselves to the highest level. He stood, above all, for Indian self-respect.

If Indian science fails to learn these lessons, the consequences will be suffered. Unless India develops a strong community with strategic research efforts, there will always be better facilities and funding available elsewhere. The trend of Indian scientists jocularly accused of being 'half in the air, half in the chair', will be exacerbated. In looking at science during Raman's period, we catch a glimpse of what Indian science can and still could be.

In conclusion, Indian national scientific journals are vital for science in India. Raman's wisdom on scientific communities needs to be reinterpreted in a contemporary context. By examining Raman's work on scientific journals, we are able to distil the essence of what science in India needs today: individual courage, a scientific community with strong institutions and a commitment by scientists to 'Indian science'. What Raman advocated 70 years ago still holds great relevance today.

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