

Indian Journal of Physics – Special Issue: Landmark Papers (1926–2001). Indian Association for the Cultivation of Science, Jadavpur, Kolkata. 2003. 289 pp. Price: Rs 500/US\$ 50.

There seem to be at least three types of collections, of important publications in journals and other resources, generally referred to as ‘Landmark Papers’: (i) publications of individuals, (ii) publications pertaining to thematic topics and (iii) from publications in a specific journal. For example, references are made to three ‘Landmark Papers of Einstein’ made in 1905, ‘Landmark Papers on Photorefractive Nonlinear Optics’ edited by Pochi Yeh and Claire Gu, and ‘Landmark Papers from *Science* and *Nature*: Completion of the Human Genome Project’ *Science* and *Nature*, April 2003.

One of the famous publications in the context of ‘Landmark Papers’ is ‘*On the Shoulders of Giants: the Great Works of Physics and Astronomy*’ by Stephen Hawking. ‘He shows how seven intellectual pioneers, including Einstein and Newton, contributed to the evolution of modern science by collecting their landmark papers in one volume . . . This magnificent selection represents the most influential books in the history of science; and each book is introduced with a potted biography of the scientist, which examines their discoveries within the context of the work and beliefs of their contemporaries, as well as notes on how Hawking has expanded on their theories in his own research.’ *Quantum Theory and Measurement* edited by John A. Wheeler and Wojciech H. Zurek contains reprints of landmark papers, including a translation of Erwin Schrödinger’s 1935 ‘cat paradox’ paper. Another notable publication is *Evolutionary Computation: The Fossil Record* edited by David B. Fogel, a ‘collection of 30 landmark papers spanning the entire history of evolutionary computation – from today’s investigations back to its very origins more than 40 years ago¹. Chapter by chapter, Fogel highlights how early ideas have developed into current thinking and how others have been lost and await rediscovery. Such compendiums are useful in many ways: they help a researcher beginning his career to get acquainted with *classic* papers in a chosen field or by *icons* of science; one also gets to know the history of growth of a subject.

Some 29 papers published (since its inception in 1926) in *Indian Journal of Physics (IJP)*, a journal being published by the Indian Association for the Cultivation of Science, Jadavpur, Kolkata have been collected together in this special issue of *IJP* to coincide with the 75th year of publication of the journal. C. V. Raman was the founder and first editor of *IJP*; the journal is the oldest among Indian journals in physics.

Although the subtitle refers to the publication as ‘Landmark Papers (1926–2001)’, the editors have terminated scrutiny of papers in the *IJP* collection during the early eighties as they ‘felt the importance and impact of a scientific paper can only be judged roughly a quarter century later after its publication’. The year-wise distribution of the landmark papers is as follows: 1926(1), 1928(6), 1930(2), 1931(1), 1935(1), 1936(1), 1937(1), 1938(2), 1939(1), 1941(1), 1944(1), 1943(1), 1952(1), 1954(1), 1965(1), 1969(1), 1970(1), 1976(1), 1977(1), 1978(1), and 1983(1), the numbers in parentheses giving the number of publications chosen from that year for the compendium. This translates to the fact that 16 papers appeared during the twenties and thirties, and a lesser number of 13 appeared during the next five decades, more or less uniformly. Thanks to the publication of physics journals by other academies, associations and by CSIR, *IJP* ceased to have monopoly for publication of papers in physics in India. In addition, publication of papers in Western journals continued to be promoted directly or indirectly due to various reasons.

It is not clear how the landmark papers were selected from the other ‘average’ papers. Generally, one relies on citation analysis. The selection could have been based on ‘subjective analysis’ or by *somehow* identifying the impact of each paper or by the icon related to the paper. A set of landmark papers is expected to seminally point the way to researchers. If this were the criterion, only a handful of papers seem seminal.

The editorial notes preceding each paper have tried to highlight the importance of the paper contextually, but they are not uniform. For example, the first landmark paper (‘Are gaseous molecules oriented in a magnetic field?’) by K. S. Krishnan is preceded by a technical note relating the paper to Glaser’s work. But the next two papers by C. V. Raman (‘A new radiation’ and ‘A new class of spectra

due to secondary radiation-part II’) are preceded by a general comment that merely relates them to ‘the vision of Mahendra Lal Sircar’. The paper ‘A new radiation’ is the Address delivered by Raman to the South Indian Science Association on 16 March 1928 at Bangalore, whereas the publication by Raman and Krishnan related to this appeared in *Nature* (121, 501) only on 31 March 1928. By any standard, this is a landmark paper setting afloat Raman spectroscopy. The vision of Raman is amply clear from the conclusion that he came to: ‘We are obviously only at the fringe of a new region of experimental research which promises to throw light on diverse problems relating to radiation and wave-theory, X-ray optics, atomic and molecular spectra, fluorescence and scattering, thermodynamics and chemistry. It remains to be worked out’. His vision has been borne out extensively and intensively, especially with the advent of laser and synchrotron sources. To be fair to the editors, one may also note that they have indeed drawn attention of the readers to the paper (‘Thermodynamics of the Compton effect with reference to the interior of the stars’) by S. Chandrasekhar and to the fact that it was this paper that ‘made use of quantum statistics, which was three years old at the time of the work and the author was an undergraduate!’.

Among the papers in the collection, the other notable ones from a general point of view are:

- (a) ‘Studies in X-ray diffraction – Part I; The structure of amorphous carbon’ by P. Krishnamurti, who comes up with an entirely new phenomenon – a very strong low angle scattering. As the editors point out ‘the next low angle X-ray scattering from an amorphous material was done more than two decades later’.
- (b) The paper (‘The origin of mass in neutrons and protons’) by M. N. Saha. As recently as the beginning of the 21 Century, one of the unsolved problems in nuclear and particle physics relates to the origin of mass. ‘It is known that over 99% mass of the matter is carried by atomic nuclei. A nucleus is an assembly of protons and neutrons. Each proton or neutron is made of three quarks. One puzzle which has not been solved quantitatively until now is that the mass of proton (or neutron) is $\sim 1 \text{ GeV}/c^2$, whereas the constituent quark mass is less than 1/100 of the proton mass’. Of course, Saha examined

the problem by 'a set of interesting speculations'.

(c) The paper ('On the total reflection of electromagnetic waves in the ionosphere') by S. N. Bose. It is well known that Bose did pioneering work on Planck's blackbody radiation law, which removed a major objection against light quanta. Subsequently, he worked on total reflection by the ionosphere, experimental crystallography, fluorescence, thermoluminescence, theoretical general relativity, etc.

The papers are interleaved with writings that are related to the Indian Association for the Cultivation of Science (the home for *IJP*), founded by Mahendra Lal Sircar in 1876, 'with the sole function of science learning and science teaching'.

The compendium deserves to be added to libraries, because it gives at one place some of the important papers published by the pioneering and well-known scientists of India, of the pre-independence era.

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Random Harvest – An Anthology of Editorials. Memoir 51. B. P. Radhakrishna. Geological Society of India, Bangalore. 2003. 444 pp. Price: Rs 250/US\$ 25.

The book under review is an anthology of editorials written by B. P. Radhakrishna, a doyen among Indian geologists. The author, affectionately known as BPR, is synonymous with the Geological Society of India and its journal, of which he was the editor for about 18 years. The selected articles spanning a period from 1984 to 2002, which appeared in the various issues of the *Journal of the Geological Society of India*, deal with the development of geological sciences, management of mineral and water resources, sustainable development, state of the environment and the Indian antiquity, in addition

to a few other general topics and some personal reminiscences. Encompassing a wide range of topics, this anthology allows the readers to fathom the views of a great living visionary of Indian geology and to share his concerns on the deteriorating levels of science, social values and environment. BPR does not stop with listing the maladies, but goes further than that and he provides us with a road map for recovery, healing and sustainable development. Each page of the book is a call for action and it reveals BPR's humanistic world-view, which rests on the solid pillars of the age-old Indian value system and is profoundly influenced by a Gandhian social outlook.

The book, most appropriately, starts with an article on the twenty-five years of the Geological Society of India (GSI) – a premier association of Indian geologists. The author, who is intimately involved with its origin and development, traces the history of this organization and projects what its role should be in future, a theme that is touched upon in several articles in the book. This organization, initially a handiwork of a few enthusiasts has been nourished and nurtured and brought to an independent status by the toil of a handful of committed individuals, of whom BPR was a key player. He remembers the services of many and mentions especially about the BBD Press, which had stood behind him like a bastion. Among the most visible activities of the Society, the publication of the journal has been justifiably cited as a significant achievement, and is a major medium for publishing peer-reviewed papers of geological studies in the country. Started in 1959, this monthly journal is a landmark event in Indian geology and continues to work diligently to enhance the quality of earth science research.

Having served as the editor of the journal, BPR occupied a vantage position to monitor the quality of earth science research. It is, therefore, no wonder that a recurrent theme of his articles is about the means of raising the standard of geological education, the quality of research and the means of effective dissemination of knowledge thus accrued. To make geological studies regain their lost sheen, the author stresses on the importance of geological mapping and fieldwork, among other measures – the areas that are largely relegated to the background by many present-day practitioners. His call for the primacy of field mapping resonates in

many parts of this book. In one eloquent article on William Lambton and George Everest – who led a mission to measure the Great Indian Arc – a 2500-long-segment of India, which took about nearly fifty years ('The Great Indian Arc – Longest Measurement of Earth'), BPR concludes with this observation: 'The spirit, which animated the early pioneers who endured innumerable hardships in providing accurate topographic maps on a variety of scales, is sadly missing today. What is more regrettable is that topographic maps so badly needed for planning development are denied to user agencies, raising the bogey of defense of India . . .'

Another equally valid point that BPR raises in this book is the lack of interest in interdisciplinary studies among earth scientists. A strange lack of bonhomie between geologists and geophysicists in India appears to be a major stumbling block to greater understanding of the geological problems. He is also critical about the attitudes of many national organizations in their refusal to part with basic data. He stresses the importance of cultivating the reading habit and cautions against 'lateritization of brain', which will eventually result in drying up of wells of creativity. In the article, 'Whither earth science research in India' he opines, 'the quality of earth science research in our country should greatly improve. It should cease to be merely repetitive and descriptive . . . The field of earth sciences . . . should be in the forefront instead of waiting in the corridors, unheard and unrecognized'.

BPR goes on to dissect the current state of geology in several other articles. He worries that the geologists are going through an identity crisis and have developed a sense of inferiority in relation to other disciplines (article on 'Declining interest in geology'). 'How could this happen in a period when geology and its unique interpretative methodology are becoming central to finding lasting solutions to many complex problems that confront the earth system?', he asks. Another theme repeated in the book is about ethics in science and scientific fraud per se. The author draws attention to the infamous case of 'Himalayan fraud' perpetrated by an Indian professor of palaeontology. The *Journal of the Geological Society of India* had been in the forefront in upholding the ethics in science. BPR's suggestion is to create a national apex body for looking into such cases and to