

## BOOK REVIEWS

Radha Charan Gupta, *Prācīna Bhāratīya Gaṇita kī ātīhāsika va sāmṣkṛtika Jhalakīyān* [Historical and Cultural Glimpses of Ancient Indian Mathematics], xiii + 149 pp., Rs. 42; *Madhyakālīna Bhāratīya Gaṇita Kī ātīhāsika va sāmṣkṛtika Jhalankīyān* [Historical and Cultural Glimpses of Medieval Indian Mathematics], xi + 95pp., Rs. 26. National Council of Educational Research and Training, New Delhi 1997.

Despite her long tradition of scientific writings and despite her significant contributions to the world heritage of mathematics, India possesses today hardly any books on history of mathematics that appeal to the general reader, let alone school pupils. Therefore, it was a happy idea that the NCERT decided to bring out these two volumes in Hindi as additional reading material for school children. The NCERT could not have found a better author for writing these books than Professor R. C. Gupta, whose deep scholarship and pedagogical engagement in the history of mathematics are well known.

The first volume on ancient India contains ten chapters in the form of ten independent episodes. The book opens with the well-known story of the failed wedding of Bhāskara's daughter Līlāvātī. Through this poignant story, the author introduces Bhāskara's famous arithmetical treatise *Līlāvātī* and elucidates its style of discourse. In this connection he describes the types of problems taught in the *Līlāvātī* and the way numbers are represented by symbolic words. The second episode deals with the invention of the game of chess by a mathematician and the ingenious reward he wanted from the king, viz. to fill the chess board with grains of wheat in a geometrical progression. This story forms the starting point for the discussion of series of numbers and their summation. In a like manner, other stories from mythology and folklore are employed for elucidating complex mathematical ideas and their diffusion across cultural and geographical boundaries. There are several stories that lucidly explain India's contributions to

the world heritage like the decimal system, rule of three and sine tables. Egyptian mythology of solar god Horus introduces the problems of converting one unit fractions (Horus eye problems) into sums of several unit fractions. The Greek legend about doubling a cube for the pacification of gods leads the pupils to similar requirements in the construction of the Vedic fire altars and to the origins of geometry.

The second volume, though ostensibly devoted to mathematics in medieval India, transcends the boundaries of time and geography and dwells on the development of certain mathematical concepts through the centuries. The five chapters in this volume are addressed to more advanced pupils and are designed to sharpen their mathematical logic. The first chapter challenges them to locate the fallacies in certain computations. By means of the story of a village bridegroom who comes to an unfortunate end through his half-baked application of statistics, the second episode leads the pupils to the notion of the statistical average. The third chapter is devoted to the solution of problems related to cyclical quadrilaterals. The fourth chapter gives a clear overview of the development of mathematics in medieval Kerala. The final chapter tells about the life and work of Ramanujan.

Professor Gupta does not just narrate the developments of certain mathematical concepts within India, but endeavours to explain these developments against the broader canvas of the developments in the world, and thus lays stress on the exchanges between India and other culture areas. Such a give and take indicates a lively exchange of ideas between countries. Only a mature nation will know how to make meaningful use of borrowings from outside and only a mature historian can describe the outside influences without being afraid of diminishing the worth of his nation's achievements. The lively narration helps in arousing the curiosity of the pupils towards the development and spread of mathematical ideas. The author painstakingly elucidates the Sanskrit mathematical terminology; he also cites and explains several Sanskrit verses in such an engaging manner that pupils lose the fear of Sanskrit as an abstruse tongue.

In Sanskrit, *līlā* means "play", "sport," "ease" and the like. Bhāskara

had these meanings in mind when he called his book *Līlāvati*, namely that it teaches arithmetic playfully without effort. This is precisely what R. C. Gupta has achieved through these volumes, for bringing out which the NCERT deserves to be commended. It is hoped that these eminently readable books will be issued soon, with better illustrations, in all Indian languages including English.

S. R. Sarina

Howard R. Turner, *Science in Medieval Islam; An Illustrated Introduction*. Oxford University Press, Delhi, 1999, xviii + 262 pages; 107 illustrations. Rs. 525.

To celebrate the fourteenth centennial of Islam, a major exhibition on "The Heritage of Islam" was mounted in the United States during 1982-83. In this volume Howard Turner presents the material on science, which he collected for this exhibition as the curator of scientific objects. Originally published in 1997 by the University of Texas Press, this edition is brought out for South Asia.

In his foreword, the author states that this "book is intended as a detailed survey for general readers and as a corollary or background reading for college and high school students." The book is organised in sixteen chapters. Chapters 1 to 3 are introductory; the next nine chapters deal with Islamic contributions to different disciplines, viz. cosmology, mathematics, astrology ("scientific non-science"), geography, medicine, natural sciences, alchemy, and optics. The succeeding four chapters describe the transmission of this knowledge to Europe and how it helped in laying the foundations of modern science.

Each chapter on a scientific discipline begins with a succinct account of how this particular discipline was developed in the Islamic world, first by absorbing already existing scientific thought in other traditions—mainly Greek—, and then by systematizing and further refining this knowledge. Transmitted to Renaissance Europe, this knowledge became, in many cases, the starting point for modern scientific endeavours, especially in

mathematics, astronomy, optics and medicine. The introductory account is followed by a number of illustrations with brief commentaries. The illustrations are drawn mostly from manuscripts, but there are also reproductions of scientific instruments and architectural elements. The quality of reproduction, however, is not commensurate with the rich variety of the illustrations.

Today there exists a formidable corpus of scholarly writing on all branches of Islamic science. For the non-specialist, the present work provides a comprehensive and lucid introduction. In a general work of this nature, there are bound to be omissions. For example, in the particularly well-written section on medicine, the author could have added that this system of medicine survives today only in the Indian sub-continent. Or, take pages 84 and 85, which show respectively the Fakhri sextant built by Ulugh Beg at Samarqand in 1420 and the Samrāt-yantra erected by Sawai Jai Singh, some three hundred years later, in the 1720s at Jaipur. In the Fakhri sextant, the sun's ray (not the light from all the celestial bodies) passes through a small opening in the roof and falls on the subterranean graduated arc at midday. However, the instrument at Samarqand is in ruins and does not have the roof any more. Consequently, the arc is non-functional for measuring the sun's meridian altitude. On the other hand, the only functional specimen is on the facing page 85. Jai Singh incorporated the Fakhri sextant in both the eastern and western wings of the Samrāt-yantra shown on this page. These sextants are in a good state of preservation, and one can still see the fascinating celestial drama of the sun's ray entering the opening and touching the arc. Since the two pictures are on facing pages, their inter-relation should have been mentioned. Apropos Jai Singh, there are avoidable errors. Al-Berūnī did not translate Euclid's works into Sanskrit (as claimed on p. 48); this was done by Jai Singh's court astronomer Jagannātha Samrāt. Nor was Jai Singh "the Muslim, or Mughal, emperor" (p. 66). But these are minor matters of detail; they do not mar the otherwise admirable clarity of the narration.

Medieval India played a not insignificant role in the cultivation and preservation of the vibrant legacy of Islamic science; witness the wealth of

manuscript collections in India. But the modern sub-continental scholarship, with a few honourable exceptions, hardly explored this wealth. Therefore, it is a small recompense that this book should be published in India. Hopefully, many Indians would read this book, hopefully too, some would even venture to study the original scientific texts.

S.R. Sarma

Polavarapu Hymavathi, *History of Āyurvēda in Āndharadeśa (AD. 14th c - 17th c)*, Bhargava Publishers, Warangal 1993, pp. xii + 373, Rs. 195.

History of Medicine is a subject that is yet to get its proper place in India. Its recognition as an independent subject of study was, to a certain extent, the result of the report of Bhore Committee. In 1944 the Government of India appointed a Health Survey and Development Committee with Sir John Bhore as the chairman. Prof. H. E. Sigerist was one of the six overseas experts invited to assist the Committee. Prof. Sigerist, who was Director of John Hopkins Institute of History of Medicine, was impressed by the social, medical and cultural background of medical practice in India. He found that there was vast source material for history of medicine in India. He recommended the opening of an Institute or Department of History of Medicine. He gave a detailed report, which appeared as Appendix 47 to the Bhore Committee Report.

Prof. Sigerist commenced the report with the following statement: "It is no longer necessary to stress the value of studies and of academic instruction in the history of medicine. Since 1905, the year when the Leipzig Institute was founded by Karl Sudoff, one country after another has developed similar institutions." He also stated that "In India ancient and medieval medicines are still alive and practised on large scale" and "the overwhelming majority of the people received the medical care from indigenous practitioners." He gave many reasons for the survival of indigenous system against the competition from the modern medicine.

The book under review is a significant contribution to the history of Āyurveda (HOA) in Andhra for about four centuries. The book, which is the thesis for her PhD degree, is based on a wide range of sources. In the first introductory chapter the sources are mentioned: inscriptions, monuments, general literature in Telugu, Sanskrit, *Cātu* (stray) verses, *Kaifiyats* (administrative records), medical works in Sanskrit and Telugu, accounts of foreign travellers (Persian, Italian, Portuguese, Dutch, Spanish, French, Russian and the British).

The second chapter attempts to determine the chronology of the physicians who flourished in Andhra during the medieval period. Among them Vajravarma, Aggalayya, Guṇḍadeva and some others are known only from inscriptions. Some other scholar-physicians like Hejibu Rāmanna and Revaṇasiddha are known from the manuscripts in different libraries. Many others, however, are mentioned in medical books in Sanskrit and Telugu. A list of 54 physicians from the thirteenth to the seventeenth centuries with approximate dates is given, after giving brief notes on them. However this is not exhaustive. That there are certain authors and works not included here does not reflect on the author but only reveals the vast wealth of source material which still remains unexplored. Some of the great men of Āyurveda who were left out are the author of *Dravyaratnāvalī*, Sūraya of *Cūdāmaṇiṅghaṇṭu* Rāghāvacārya of *Camatkāranighaṇṭu* and Gelavaṅgala Maṅgalagirisūrin, the commentator of the *Aṣṭāṅgahṛdaya*.

Interestingly enough the present book asserts that well known medical writers like Bhāvamiśra, Narasiṅhapaṇḍita, Mādhva Upādhyāya, Lolimbarāja belonged to Andhra deśa. P. V. Sharma suggested that Bhāvamiśra belonged to Bihar while P. C. Ray relates him to Varanasi. HOA concludes that Bhāvamiśra belonged to South India on the basis of the description of seasons (*ṛtus*). Narasiṅhapaṇḍita, author of *Rājanighaṇṭu* is placed in the fourteenth century while P.V. Sharma places him in the seventeenth century based on internal evidence. Mādhava Upādhyāya of *Āyurvedaparakāśa*, according to P. V. Sharma, was a native of Saurashtra but lived in Varanasi not before the eighteenth century. HOA places him in the fourteenth century and states

that he was a *guru* in Srisailam in Andhra. Again Lolimbarāja is placed in the fourteenth century as a contemporary of Harihara I of Vijayanagara kingdom. P. V. Sharma places him in the first quarter of the seventeenth century and says he was a native of Pune district. In these cases, the author provides adequate reasons for thus deciding the place and time of the medical writers but she makes no efforts to refute the views of other scholars.

The third chapter discusses the status of the physician and his training. All the details like selection of students, initiation, training and apprenticeship, fees paid to the physicians, medical ethics and institutions are covered from the material collected from diverse sources. Tavernier, the French traveller, mentioned that there were no physicians for common people except royal physicians. The author refuted this, quoting from the accounts of the same traveller where he referred to priest physicians and other physicians in towns and cities. Four types of physicians were popularly known in medieval period, viz. *naravaidyas* (for human beings), *gajavaidyas* (for elephants), *Āśvavaidyas* (for horses) and *paśuvaidyas* (for cattle). Among the first group general physicians and *bhūtavaidyas* were also common.

The fourth chapter discusses drugs and covers also different economic aspects like their availability, exports, imports, taxes, trade etc. The fifth chapter is about the state of medicine and health care in the four centuries from the fourteenth to the seventeenth. Diseases and treatment, concepts of Āyurveda, place of pulse examination, prognosis, seasonal ailments, diseases of eye, ear, teeth, epidemics, surgery, hospitals, and other institutions are very elaborately and efficiently dealt with.

All these chapters deal with medicine and health care of the society unlike the earlier books that dealt mainly with medical authors and books and sometimes the sociological and other aspects based on a few individual treatises. The significance of the book under review is that all the topics are highly informative and based on sources of diverse nature, giving a comprehensive picture of the health and medical care in the period.

The author is a scholar of history without formal training in Ayurveda, yet the technical information culled by her is very much appreciable and deserves compliments.

In the end it is undoubtedly a contribution valuable for the history of Ayurveda and medical care of the society in the region. Such attempts should be made for all regions and periods, collecting evidences from all sources.

Though the printing and get up are satisfactory, the absence of an index is disappointing.

B. Rama Rao.

Stephan F. von Welck (ed.), *Crossing Borders, Stretching Boundaries*, Manohar Publishers, New Delhi 2000 ; pp. 237, illustrations; Rs.450, ISBN: 81-7304-349-3 Rs.450.

*Crossing Borders, Stretching Boundaries* is a collection of twelve Bose-Einstein Lectures on Science, Technology and Environment, organized in India under the auspices of the German Embassy and the Federation of Indo-German Societies during the years 1997-2000. The title expresses very well the kind of interaction which had been generated between the eminent Indian physicist Satyendra Nath Bose and Albert Einstein in the 1920s that led to the theory of Bose-Einstein Condensation, an important contribution to sub-atomic physics, which was nonetheless proven by experiments only 70 years later.

The seed of cooperation thus sown in that distant era between these two physicists from India and Germany developed into a full-fledged programme for Indo-German cooperation in education, science research and technology and covers today a large number of scientific disciplines. The Bose-Einstein Lectures complement this interactive transboundary cooperation at an intellectual level focusing on policy issues and the exchange of views on fundamental problems caused by the ever increasing importance of science, technology and the environment.



These lectures were delivered by scientists, and representatives of research institutions, companies engaged in R&D and administrators as well as politicians. They reflect recent development in Science and Technology from the point of view of those who are personally involved in these developments and cover the subjects from the interaction between Einstein and Bose to the globalization of R&D activities by multinationals, the internationalization of space science and the impact of science and technology upon political power, philosophy, ethics and religion.

Although all the lectures in this volume are highly interesting, two lectures are especially thought provoking. Stephen von Welck, the editor of the volume dwells on the fundamental question on ethics raised by the recent advances in genetic engineering. Murli Manohar Joshi, the Union Minister for Human Resource Development and Science & Technology, quoting copiously from ancient Sanskrit literature, discusses how modern science is converging at the same point where ancient thinkers of India had reached when they realized the Absolute Truth.

There are some vintage photographs which add to the charm of the volume.

A. N. Thakur