

Vedic Mathematics and Science in Vedas. S. Balachandra Rao. Navakarnataka Publications Private Limited, Embassy Centre, Crescent Road, Bengaluru 560 001. 2019. 172 pages. Price: Rs 200.

The attractive title *Vedic Mathematics and Science in Vedas* is catchy enough to raise the eyebrows; however after a glimpse at the name of the author, the reader is assured of a unbiased rationalistic discussion. That is how Prof. Balachandra Rao is known. For this reason, his earlier books *Tradition, Science and Society* and *Astrology – Believe it or not?* have seen multiple editions. Among his other books, *Indian Astronomy – Concepts and Procedures* has received very good reviews.

The book under review may be broadly discussed in two sections. The first part covers a variety of topics from decimal system to astronomical computations. The second part deals with ‘Science – that was not’, which demands a greater attention in today’s world.

The book begins with a clarification on the word *Jyotiṣa*, it means planetary astronomy involving phenomenon like eclipses and not predictive astrology as is popular today. Every mathematician of yesteryears was an astronomer too. Thus we see books by the same author on mathematics and astronomy, although there are texts devoted to pure mathematics.

The evolution of the decimal system is discussed in a great detail. It is this contribution from India that is hailed everywhere. (Discovery of ‘zero’ is more of a witty comment.) When the other civilizations were still struggling to write down the numbers larger than 100, here already there was a perfect system in vogue. The

place value was already in practice. Inscriptions from several centuries BCE have written the numbers with this method. A number written down as 300 20 3 was to be understood as 323. However, within a century, better methods had evolved – the *bhūta sankhyā* system rendering it easy and fool proof for oral transmission (the numbers are represented by objects – earth for 1, eye for 2, guṇa for 3, veda for 4 and śara for 5, rasa for 6, muni for 7 and so on). The mathematics texts were written down this way and the operations like additions, subtractions, etc. were described by verbs. It may be recalled that the symbols plus, minus, etc. entered into western mathematics books only about 500 years ago.

The making of calendars was an important task of the astronomer/mathematician. The essence of this is written down in the monumental work *Vedāṅga Jyotiṣa*. The author is Lagadha and his time is inferred from the astronomical details he provides. That takes it to 1370 BCE. Rao argues that the book currently available may be a copy written down much later. The length of the sidereal day derived from this part differs from the modern value by 0.03 seconds. The book covers basic concepts of time measurements from a second to a *yuga*. Here *yuga* stand for 5 years only. The discussion by *Jaina* mathematicians also concur with the *Vedāṅga Jyotiṣa*.

Another set of treatises highlighting the proficiency in mathematics are the *sulva sūtrās*. These are dated from 700 BCE to 1300 BCE. The discussion on the construction of altars for rituals involves a thorough knowledge of geometry, arithmetic and algebra. The so called Pythagoras theorem is utilized in these texts extensively (Pythagoras lived during 5th century BCE). Many of the geometrical constructions are within the reach of high school students.

Astronomy goes hand in hand with mathematics – the calculation of the phase of the moon – *tithi* – is quite a complicated process and the details of the calculation vary from astronomer to astronomer. The definitions of the lunar and solar years, solstices and equinoxes are needed to fix the intercalary month – *adhika māsa* and sometimes a *kṣhya māsa* also. Shorter divisions of the day such as *ghaṭika*, *muhūrta* are all discussed in detail. Quite interestingly, the twelve zodiacal constellations and the

concept of seven day week do not find a place here.

The 27 stars along the zodiacal belt are used to specify the positions of the planets, the sun and the moon. Many allegories depicting the need to shift the reference points are given in chapter 7. However it is very difficult to extract meaning from stories of *Prajāpati* and *Rohiṇi*. On the other hand, statements about the heliacal rising and setting can be used to date the events. The removal of the star *Abhijit* from the zodiacal belt also has a story associated with it.

The second section on the *science in vedās* begins with the controversial subject of *Vimāna Śāstram*. It may be recalled that a few years ago there was a great debate on this book supposedly composed by Maharṣi Bhāradwaja. Here Rao starts the discussion with the citation from *Yajurveda* and interpretations by people of the past and by those who had seen an aircraft. Unfortunately, (for the interpreters) the word *Vimāna* in ancient texts referred to ‘anything’ moving in the sky and that included the sun. In the following chapter the contents of the book are explained in detail along with the findings of the experts from the Aerospace Department of Indian Institute of Science.

Likewise claims on knowledge of electricity and telegraphy are debunked in the following chapter. It is well known that centuries of effort were required to extract electricity from a simple experiment by Gilbert (on static charge) to the 220 V plug points. Rao ridicules many attempts by neo-revolutionists who try to attribute quantum mechanics, principles



Saptarṣi maṇḍala (The Great Bear).

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of relativity and uncertainty and even physiology to the *Vedas*.

Another popular claim is on the speed of light as mentioned in the *Rg Veda*. This is based on a verse which states ‘Salutations to the Sun God who traverses 2202 *yojanās* in half a *nimiṣa*’; this is the motion of the sun and not light. The trick is to conveniently modify the value for *yojanā* as 9 miles and 110 feet (instead of 5 miles) and 1/8.75 second for *nimiṣa* (instead of 90 ms).

Seven chapters are devoted to *Vedic mathematics*, a book authored by Sri Bhārathi Kṛṣṇa Tirthaji Māhāraj (1884–1960) who was the Śankarācārya of Govardhana Maṭha, Puri. He had a great fascination for mathematics and used to deliver lectures on rapid calculations. He devised 16 formulae or *sutrās*. Techniques for arithmetical operations, finding squares, square roots, cubes, solving algebraic equations are all explained in a great detail along with the *sutrās*.

Then follows a chapter on Trachtenberg’s speed mathematics. His methods of solving arithmetical operations also are described in great detail. This is followed by a life sketch of this genius whose struggle during the war touches one’s heart. Even though one finds this out of context, its similarity with Vedic mathematics needs to be understood. A good teacher of maths should get inspired by these methods which look like magic, to lead a child to enjoy solving mathematical problems.

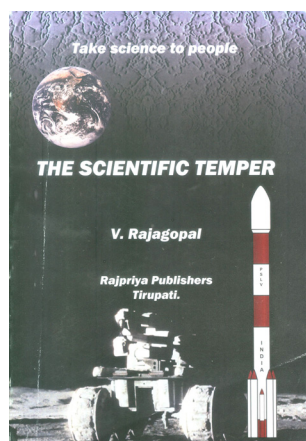
The book, *Vedic Mathematics*, when published in 1965, created a new wave of admirers, who were stung by the words *vedic* and *sutrās* to the extent that a re-discovery claim got attached to the Swāmiji of the Puri Maṭha. Rao cites many great scholars who admired the content but were quick to add that there is nothing ‘Vedic’ about the book. The last part of the book carries discussion on this false claim on a *vedic* source and the concern of great mathematicians of our time. They are directly aimed at a resolution adopted by the Government to act on this ‘important “*vedic*” source with a view to promote a particular band of religious majoritarianism’. The methods can be introduced in text books without the tag *vedic*, they say with a suggestion that they can be called ‘Śankarācārya’s mathematics by high speed computation’.

Thus the book is an eye opener on the real contribution to mathematics and the

false claims. It serves as an important resource in a field where Rao is a lone traveller. The younger generation, irrespective of their exposure to mathematics, should read this book carefully and appreciate the role of honesty in doing science and be watchful on the false claims. We also need to congratulate Navakarnataka Publishers along with Prof. Balachandra Rao for having brought out this book.

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The Scientific Temper. V. Rajagopal. Rajpriya Publishers, Tirupati. 2018. 184 pages. Price: Rs 400.

The Scientific Temper is non-fiction, popular science book. It delivers an interesting account of the crucial issues confronting the current scientific scenario in India. The author V. Rajagopal is a research scientist of international repute with over four decades of experience as an agricultural scientist and is the visionary behind the social movement ‘Hunger Elimination and You’ (HEY).

The book is a compilation of an in-depth analysis of various aspects of science. In the course of just over 180 pages and 40 chapters, the author has shed light on a range of topics stretching from scientific research, science journals, scientists, India’s potential to win Nobel prize, science academies to biodiversity loss, women health security, agrarian crisis, science journalism, the need for

holistic approach and conducive environment for advancement of science, etc. This book offers an informative read for students, research scholars and science enthusiasts and helps them to develop a scientific temper.

From the first to the last page the book promotes critical thinking and focuses on the scientific topics of prime concern and converses diverse viewpoints on the topic but with a human touch to it. The essays are written in a non-technical language with the essence of modesty. Most of the projections and facts presented by the author are based on the previously published scientific data. Virtually most of the essays are compilation of earlier published articles either in scientific journals or in newspapers. A few of them are updated versions of the global and national reports on nutrition, hunger, farmer’s suicide, and various other themes.

In the introduction, the book inspires the youngsters with the scientific principles and quotes from the people’s President Kalam and who prepares the ground for the development of scientific temper with a strong conviction.

In the next section, the author has set forth adequate background information on various issues hindering the growth of science and then has offered specific solutions to it. The incisive SWOT analysis, non-recognition of Indian scientific research for Nobel prize, suggestions to improve the ranking of Indian journals, and emphasis on quality, citation and impact of research over the quantity of research publication as a criteria for recognition of applicants for the scientific post serves as an eye-opener in the pursuit of achieving research excellence. The author’s effort and infectious enthusiasm to take science to the public is evident throughout the book. Rajagopal’s first-hand experience and substantial illustration of depletion of the forests, biodiversity loss and environmental pollution due to human activities generate concern in the reader’s mind and calls for inspired action. This book also takes the reader on a journey through the previously untold circumstances that lead to the development of science and some of the remarkable achievements of Indian scientists over several decades. The book is fascinating in its depiction of the importance of the green revolution, the value of *Annadhata* in combating the food crisis which will