

BOOK REVIEWS

The author has studied the upcoming solar missions in great detail and presented the same in simple language.

The book concludes with a description of the forthcoming projects on solar observation and the search for other Suns (other planets, quite naturally). The chapter on the Sun and black hole does not fit into the flow of thoughts. It stands out isolated since there is no direct relevance to the Sun.

The book serves as a good resource material for students and teachers. The author needs to be congratulated for having put in efforts in visiting the establishments for understanding the details to present the best picture to the readers. The coverage on the Indian efforts, which generally is not available for an average reader, deserves special appreciation.

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A Brief History of Rocketry in ISRO.
P. V. Manoranjan Rao and P. Radhakrishnan. Universities Press (India) Private Limited, Hyderabad. 2012. 369 pp. Price not mentioned.

In the years since independence, the country has made significant achievements in many areas of technology. Generally speaking, technology procured under licence essentially ended up in assimilation and adaptation; it did not add much to innovation or improvement. However, key science and technology departments set up during this time, thanks to the vision and farsightedness of their leaders, chalked up significant achievements. Such achievements were a result of essentially the confidence in Indian capabilities – which could be brought to bear even under adverse conditions of tight budgets, import restrictions and technology denial regimes. The fact that India has notched up significant capability in the area of space – one in the building of application and scientific satellites and the other to launch them into the desired orbit – is due to a large measure to the inspirational leadership

the space programme benefitted from in its formative years. Within four years of the launch of *Sputnik* by the Soviet Union in 1957, the seeds for the Indian space effort were sown with the Department of Atomic Energy under Homi Bhabha's stewardship assuming the responsibility. Bhabha strongly believed that science and technology provided the very basis for the future of the country and space was a strong contender. In Vikram Sarabhai (who was asked by Bhabha to chair the newly formed Indian National Committee on Space Research to guide India's space effort), Bhabha found the ideal foil. Sarabhai generated a wide canvas for space research involving development, experimentation and facility generation. Satish Dhawan steered the space programme after Sarabhai's death and consolidated the space effort technologically and organizationally to what the Indian Space Research Organisation (ISRO) represents today – a technology development-oriented and goal-focused organization equipped with the necessary human and infrastructure resources.

In India, where written histories of departmental technological achievements are few and far between, the authors of this book, Manoranjan Rao and Radhakrishnan have done yeoman service in chronicling the development of rocketry in India. The book provides an anecdotal narrative starting from the Indian response to the International Geophysical Year and the birth of the Indian National Committee of Space Research, and takes one to the current status of the launch vehicles. The book is a veritable treatise on India's space odyssey and captures in fair detail not only the history and development but also the trials, tribulations and outstanding successes of ISRO, which had the good fortune of being fathered and fostered by some of the greatest scientists and human beings (a rare combination indeed) the country has produced.

The chapter giving the background reiterates the strong impetus Jawaharlal Nehru provided to science and technology. The space programme benefitted from his early encouragement; the programme has without exception been strongly supported by all Governments since independence; and the programme, as a rule has consistently enjoyed the backing and support of Indian parliamentarians of all political perceptions. The background chapter illustrates this by

quoting the questions asked in the Indian Parliament in January 1963 relating to the establishment of the rocket launching station in Kerala and the answer provided by Lakshmi Menon on behalf of the Prime Minister. The authors have neatly stitched the description of phenomenon of equatorial electrojet, the then prevailing interest of the international scientific community in investigating the electrojet and the consequent siting of the rocket launch facility at Thumba and its sponsorship by the United Nations. The two-stage rocket *Nike-Apache* took to the skies on the evening of 21 November 1963 with sodium vapour payload, heralding the first ever rocket launched from Indian soil for scientific purposes.

Sarabhai's thought processes were wide-ranging. Procurement of sounding rocket technology from abroad served the purpose of meeting the needs of the national and international scientific community for flying their experiments. Sarabhai simultaneously set up the mechanism for indigenous capability and capacity building, first towards sounding rockets and then towards the satellite launch vehicle. The authors have touched upon the rather chaotic working practices prevalent in the early years with more than one team involved in rocket development activities. Sarabhai's mind had already gauged the positive societal gains of satellite-based communication and resource management. It was therefore no surprise that while his scientists at Thumba were still experimenting with sounding rockets and associated technologies, he set in motion the development of the satellite launch vehicle, SLV-3.

Two consecutive failures of the Augmented Satellite Launch Vehicle (ASLV) called for serious introspection and failure analysis. The authors have stressed the transparency and rigour of the review systems that became established at ISRO; how the constitution of two independent failure analysis teams helped nail the problem; the recommendations which emerged for overcoming the design inadequacies, and the successful achievement of the mission with these modifications. The ASLV flight failures and their analysis had an overarching impact on the design practices, simulations and checks introduced for the subsequent launch vehicles. The successful operation of a score of PSLV launches bears testimony to the positive fallout.

Two major features of PSLV – the number of new technologies which were developed for the PSLV and the continuous improvement resulting in 50% improvement in the payload performance have been highlighted by the authors. The versatility of PSLV in doing geosynchronous and deep space missions finds appropriate mention. While discussing the peculiarity of the GSLV configuration and the range constraints, the authors could have also mentioned the alternate configurations studied and the perceived development difficulties. One alternate configuration had a liquid core of L-110 and employed solid strap-ons. This would have been an elegant configuration and incidentally L-110 was subsequently developed for the GSLV-Mk III. The authors have detailed in the endnote, the effort towards the indigenous cryogenic engine development. The development story could have included the efforts of a core group under Gowariker in the early 1970s, which started cryogenic engine technology development and one more pilot study done by Namboodiry on the liquid hydrogen availability for such development after the successful flight of SLV-3. All the earlier efforts were stalled for non-technical reasons and could have helped in maturing the technology faster.

The profiles in technology development of the various subsystems of the launch vehicle are included and give a glimpse of the diversity of processes and performance requirements. The authors have condensed and abridged the details without losing the essence of the development stream within the constraints of space. Averments like ‘grains for large motors are not made as a single piece (monolithic). It is both unsafe and difficult to do so’ (p. 196) are out of place and not correct. Some dates and the reasoning behind decisions like that concerning the RATO motor (p. 216) are not correctly reflected. These are minor and in no way reduce the importance or the essence of development being portrayed.

Women scientists have played important leadership and supportive roles and their contribution could have merited some mention. The lay person may have some difficulty in appreciating the book, especially the later sections. The authors in their attempt to maintain the ‘semi-popular’ style of the book have not been able to do complete justice to the profiles in technology development. A few draw-

ings and sketches would have rendered the material more understandable.

The chapter on ‘The quartet’ makes fascinating reading and the reader is provided with rare vignettes of the personalities of the great men behind the space programme. Bhabha, Sarabhai, Dhawan and Brahm Prakash stewarded the space programme with conviction and nobility of leadership – qualities which emboldened the ISRO community to delve into uncharted territory with confidence. The leadership was open to the fact, that while mastering technology mistakes will occur and the solution lay in understanding the issues, analysing them in depth and correcting them. These leaders were not risk-averse, but could take decisions based on reasoned thinking. In turn, they groomed good leaders.

The book is a useful contribution to the five decades of rocket development efforts at ISRO.

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Annual Review of Genetics, 2011.
Bonnie L. Bassler *et al.* (eds). Annual
Reviews, 4139 El Camino Way, Palo
Alto, CA 94303-0139, USA. Vol. 45.
ix + 469 pp. Price: US\$ 86.

It is difficult to sum up all the developments of a research area in a year in one book, especially when the task is to cover all the major developments in the area of genetics. However, the *Annual Review of Genetics (ARG)* 2011, as before, has attempted to cover the developments in the last few years in a wide range of topics in genetics from bacteria, fungi and nematodes to plants and animals.

The volume starts with a well-documented review by Sommer and Streit, on comparative genomics of nematode species. The comparison of genetic processes

between *Caenorhabditis elegans* and its close relatives *Caenorhabditis briggsae* and *Pristionchus pacificus* reveals a high number of diverse control mechanisms, and alerts the research community that sequence conservation and gene function(s) are totally unrelated issues. All the seven sequenced nematode genomes indicate a relatively high number of novel genes, which have no apparent orthologs in other organisms. The authors finally conclude that an emerging principle of comparative genomics of nematode parasites is the absence of a general mechanism of parasitism.

As in eukaryotes, the regulation of cell growth and cell death is also important for bacteria under various stress conditions. Almost all bacteria contain a gene that codes for toxins, which may inhibit cell growth. These toxins are co-expressed with their antitoxins from an operon called the toxin–antitoxin (TA) operon. The chapter on TA systems explains how, under stress conditions, stress-induced proteases digest less stable antitoxins to free the toxins in the cells, which interact with various cellular targets to cause cell death. The released toxins help in survival during adverse conditions, e.g. they cause cells to enter persistence or quasi-dormant state in which they are completely resistant to antibiotics and may also play a vital role in eliminating the damaged cells from their populations.

Two articles discuss about plant genetics. The first one by Klee and Giovannoni deals with genetics and control of tomato ripening. The tomato fruit development and ripening is considered as a classic model system to elucidate the important developmental processes in plants since it is being regulated by network of genes, especially different transcriptional factors. This review provides a detailed description of effects of ethylene as well as transcriptional factors in controlling the fruit ripening process. The legume and rhizobial symbiosis, a beneficial association of a plant and bacterium that results in conversion of atmospheric nitrogen into biologically active nitrate and ammonia forms, is one of the key issues to be elucidated in agriculture in view of rising fertilizer prices especially nitrogen. Comprising two key developmental processes, i.e. nodule organogenesis and bacterial infection, the association or the so called ‘symbiosis’ of legumes and rhizobium bacteria is