

chapter suggest that topical interventions would hold promise with better understanding of role of lipids.

The steps of the host gene that impede retroviral infection and pathways that get turned on by viral gene products resulting in initial immune response to the infection have been described in detail in chapter 11. The viral proteins that subvert the innate immune response of the host have been described. By directly hampering the early infection steps, different signal transduction signals are relayed so that infection can be resisted but retroviruses have acquired different means to circumvent the factors, which restrict their multiplication. This chapter should inspire younger scientists to pursue retroviral research in future.

Chapter 12 deals with the roles of both viral and host non-coding RNAs in aiding replication of retroviruses in detail. RNA comprises at least 50% of retroviral mass and RNAs such as Transfer RNA, 7SL RNA, U snRNA, Y RNA and vault RNA have been described in this chapter. The mechanism of RNA interference through comparison with RNAi mechanism in plants, which plays roles in immune response has been described. Current treatments for RNA-based therapeutics for HIV-1 have been described. The authors of this chapter conclude that novel roles of ncRNA are being elucidated which would be important for future endeavours in therapy.

Transposable elements are a significant feature of eukaryotic genomes and among them are retroelements on whose roles chapter 13 focuses. The chapter further explains the structure–function of retroelements, how their expression is controlled through mechanisms of redundancy, PAMPs and among other factors, cytoplasmic DNA and also how innate immune system regulates these in detail. Perspectives in the chapter present interesting viewpoints with highlights on eight areas which would produce a high impact in retroviral research and lead the way for better therapies.

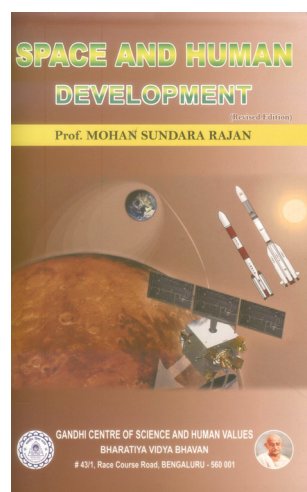
Various methods such as two hybrid screens, mass spectrometry, RNA interference and genome wide screens, RNA sequencing, and CRISPR technology to study retroviruses have been discussed in chapter 14. Various proteins such as gag and integrase to be used as bait to find host proteins have been described. Methods to find host factors that interact with viral proteins and nucleic acids to

restrict viral replication would be important so also to identify mechanisms by which retroviruses hijack host factors which are important for their replication cycle.

The book is an interesting read, is well documented, and caters to scholars intent on furthering their research in retroviral research.

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**Space and Human Development, Revised Edition.** Mohan Sundara Rajan. Bhavan's Gandhi Centre of Science and Human Values, Bharatiya Vidya Bhavan, No. 43/1, Race Course Road, Bengaluru 560 001. 2017. viii + 116 pages. Price: Rs 120.

India's space programme since its inception in the 1960s, has been driven by the desire to harness space technology for national development. Indigenous efforts to develop launch vehicles, spacecraft and their various sub-systems for communication, remote sensing and navigation purposes, spaceport to facilitate launches, and to build a network of mission centres for telemetry, tracking and command of satellites have been successfully undertaken over the last six decades. Important national programmes to use space infrastructure and data for developmental purposes in the field of natural resources survey/monitoring, improving weather forecasting, education,

telemedicine, social empowerment, disaster monitoring and mitigation have been conceptualized and executed with enthusiasm. In addition, a few missions to the moon and Mars and an Astrosat mission to study stars have been launched successfully, and significant results have been obtained. The Indian space programme is held in high esteem internationally and India is one of the six countries/agencies in the world to have mastered different aspects of space technology and applications. Such an effort needs to be told to a larger audience through publications.

This book discusses the progress made in space technology and applications in India. It is a small book divided into 19 sections corresponding to various sub-themes. It is written in a simple, non-technical language to address the general readers. Initial efforts to begin space activities in India by Vikram Sarabhai, and how he was influenced by his role at the United Nations in the Committee on Peaceful Uses of Outer Space have been described in the inaugural chapter. Establishing the Thumba Equatorial Rocket Launching Station (TERLS) at the fishing hamlet Thumba near Thiruvananthapuram, Kerala, has been enumerated. How Satish Dhawan, who took over the reins of space activities in India, after the untimely death of Vikram Sarabhai in 1971, steered the programme are described in the subsequent chapter. Indigenous efforts in building satellite launch vehicles comprising solid propulsion, some of the failures, and the important role played by Abdul Kalam are also illustrated. The Satellite Instructional Television Experiment using a borrowed satellite from the United States for beaming socially relevant TV programmes to 2400 villages in India and its social impact have been discussed. Systematic indigenous efforts to build launch vehicles using not only the solid propulsion but also the earth-storable liquid fuels with higher payload-carrying capacities have been well described. How the four-stage Polar Satellite Launch Vehicle (PSLV), with more than 40 successful launches has become the work-horse rocket for many of India's missions, as well as for launching some satellites of other countries has been discussed. Parallely, efforts made to build cryogenic engines and to have higher capacity launch vehicles to put much higher weight payloads into geosynchronous transfer orbit

## BOOK REVIEWS

(viz. GSLVs) have been enumerated. Various nuances involved in the development of cryogenics are also explained in simple language. The book also talks about the development of various communication satellites operating in different frequency bands like C, Ku, Ka, etc. It mentions about the availability of a large number of transponders, how they have revolutionized the abundance of TV channels in the country, VSAT connectivity, disaster warning, communication and transfer of data from one place to the other, etc. Use of satellite communication for telemedicine and tele-education are two successful socially relevant applications in the country, according to the author.

Starting from the experimental Bhaskara satellites in 1979–81, how spaceborne remote sensing has progressed in the country by leaps and bounds has been well described in some of the subsequent chapters. Various Indian Remote Sensing satellites starting from IRS 1A in 1988, operating with better and advanced sensors have catered to the needs of different applications in the field of agriculture, forestry, coastal zone, water resources, etc. Data from these satellites have also been utilized by other countries in the world. Cartographic satellites providing higher spatial resolution and stereo data have been launched. RiSAT 1 carrying a synthetic aperture radar operating in microwave frequency to observe the Earth through cloud cover has also been launched. Meteorological satellites carrying sensors to observe clouds, cloud-top temperatures and to measure humidity and temperature profiles of the atmosphere have also been part of this endeavour. Many satellites specific to measurements of ocean parameters have been also part of this effort. Several application programmes related to forecasting crop production in the country before harvest, forest extent, groundwater exploration, snow cover, glaciers, salt-affected soils, waste lands, desertification, etc. have been described. How satellite data are used to locate probable areas of schools of fish in the seas and how this helps the fishermen are also described. How satellites are found extremely useful in disaster monitoring, in particular, cyclone tracking and land-fall, drought condition, flood inundation, etc. is highlighted. Mention of entry of private entrepreneurs in space activities in India augurs well for the country.

The book is an easy read and is comprehensive. Readers will get an overview of the entire gamut of space activities in the country. There are a few typographical and some inadvertent errors (p. 41, INSAT 4CR, 264kg?). Timeline of launches and events and Glossary provided add value to this book. There have been a few publications of similar kind, e.g. *Touching Lives* by S. K. Das (Penguin Books, 2007), and *From the Fishing Hamlet to the Red Planet*, edited by P. V. Manoranjan Rao (Harper Collins Publishers, 2015); these could have been referred to here. Over all, it is an excellent book for the general readers that it intends to address.

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**Sambhu Nath De: The Discovery of Cholera Toxin.** M. S. S. Murthy. Vigyan Prasar, Department of Science and Technology, A-50, Industrial Area, Sector-62, Noida 201 309, UP. 2018. x + 70 pages. Price: Rs 80. ISBN: 978-81-7480-302-3.

Cholera, an ancient scourge, has claimed several million lives. This highly infectious and virulent diarrhoeal disease persists as a global health threat, estimated to cause 1.3 to 4.0 million cases, and 21,000 to 143,000 deaths annually. Cholera poses a problem not only in developing countries but also follows natu-

ral disasters. Epidemics in areas with poor sanitation and overcrowding, with limited access to clean water, highlight the need for better prevention and control measures. An outbreak of cholera was declared in Yemen, as recently as 2016 and is ongoing in 2019. Public awareness and research are imperative for the eradication of this dreaded disease.

The work of Sambhu Nath De on cholera spearheaded the understanding of the pathogenesis of the disease, facilitating the development of effective treatment and vaccines. He also paved the way for the understanding of other diarrhoeal diseases with his rabbit loop model. Despite this, he received no acclaim for his ground-breaking work, either in India or by the Nobel committee.

In his book, M. S. S. Murthy aims to highlight the innovative prowess of S. N. De in the hope of igniting 'even one Indian mind'. The cause is noble, but the execution is weak. The errors in spelling and grammar, and abrupt chapter endings could be overlooked. However, the book chapters bear glaring similarities to the articles published in *Current Science* (Special issue: S. N. De and Cholera Enterotoxin, 1990, **59**, 623–716) and *Resonance* (Life and Work of S. N. De by A. Sen and J. K. Sarkar, 2012) as well as Wikipedia! Not all these sources are mentioned as references. The same lack of referencing holds true for some of the illustrations.

Factual errors are scattered throughout the book. Robert Koch described *Vibrio cholerae* in the stools of cholera patients in 1883 not in 1853 as mentioned in Annexure 1. Professor C. V. Raman received a Nobel prize for physics in 1930, not in 1933. The data in Table 1 is clearly erroneous. In addition, the author makes some statements which are factually correct, but are misleading. For example, the author states 'In addition to



A comma shaped *Vibrio cholerae*.