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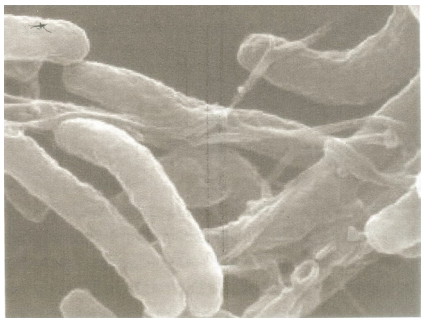
Sambhu Nath De: The Discovery of Cholera Toxin. M. S. S. Murthy. Vigyan Prasar, Department of Science and Technology, A-50, Industrial Area, Sector-62, Noida 201 309, UP. 2018. x + 70 pages. Price: Rs 80. ISBN: 978-81-7480-302-3.

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 natural 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*.

Vibrio cholerae, there are at least thirty other bacterial pathogens which cause various diseases in humans…'. This is an unrealistically low number. Another ambiguous statement in the chapter titled 'Endotoxin or Exotoxin?' is 'All pathogenic bacteria produce toxins through which they exert their effect'. All pathogenic bacteria produce toxic substances; these are known as toxins if they possess antigenic properties. Secondly, toxins are not the sole mechanism of pathogenicity. Finally, in the past two decades, cases of non-toxigenic *Corynebacterium diphtheriae* causing infections, have been reported.

S. N. De is an unsung hero, but M. S. S. Murthy's tune is off-key.

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PERSONAL NEWS

M. K. Bhan (1947–2020)

India lost a titan of Science and Medicine on 26 January 2020. Professor Maharaj Kishan Bhan, Former Secretary of the Department of Biotechnology (DBT), Government of India, was in the true sense, a born leader. A leader who led by example. Born in 1947, the year India attained Independence, the spark of life left him when the country was celebrating its 72nd Republic Day – he was destined to be part of the country's history, both in life and death.

A true leader, a visionary, a passionate scientist and doctor and above all a wonderful human being, full of joy and happiness, he has given love and affection to all around him.

Born and initially raised in Srinagar (Kashmir), Dr Bhan was raised in an environment of curiosity and exploration, right from childhood. Brought up in an environment that encouraged philosophical conversations and thoughts, he moved from Srinagar to Pune to complete his MBBS degree from the prestigious Armed Forces Medical College. He pursued an MD (Paediatrics) from Postgraduate Institute for Medical Education and Research in Chandigarh, to take on what became his lifelong passion-child health and nutrition. His faculty position at the All India Institute of Medical Sciences (AIIMS) and later post-doctoral research focused on diarrhoeal diseases and child nutrition.

Dr Bhan's career spanned a spectrum of different activities and roles that only a few people would have managed as successfully as he did. Beginning as a trained paediatrician, to becoming an academic clinician at AIIMS, to becoming a Science Administrator at the Department of Biotechnology, his adaptability and perseverance made him successful in each of his roles. He contributed to each of the fields that he was involved in. In recognition of his exemplary research, he was awarded the prestigious Shanti Swarup Bhatnagar Prize for Science & Technology in 1990 and the coveted Padma Bhushan in 2013, for outstanding contributions to governance and civil service which stand out from several other awards he has received from scientific institutions and agencies.

Dr Bhan's most well-known legacy is, of course, the discovery of the strain of the rotavirus vaccine in India. In 1985, when he began his endeavour towards developing the Rotavac, he found a weakened strain of rotavirus in new born babies admitted to AIIMS which was not causing any disease – isolated the strain and called it 116E. Around the same time, Roger Glass, from the US National Institute of Health (NIH) also began characterizing similar strains of rotaviruses that did not result in diseases. After exchanging notes and working tirelessly for decades, Dr Bhan brought together government, NGOs, international organizations and private players to develop the life-saving vaccine. The formulation of the Rotavac witnessed the unique amalgamation of multi-institutional and multi-agency collaboration which is seldom seen around the world and went on to become the first indigenously developed vaccine for the children in India and the globe. The vaccine today is credited with saving the lives of thousands of children around the globe.

However, Dr Bhan's legacy does not end there.

From having given the country its first indigenous Rotavirus vaccine to having created the most vibrant translational biotech ecosystem, he has been a driving force. A great institution builder, he transformed the landscape of biotechnology in our country – from bringing in the whole ecosystem for translational research to developing new institutional governance models and also new models of partnership and funding. Creation of autonomous institutes like InSTEM, NIBMG, THSTI, NABI, the NCR and Bangalore Biocluster and the Public Sector Company – BIRAC, we owe all our success in public–private partnership to his vision. He was a great mentor and our best critic. We built international partnerships and many capacity building initiatives with his vision which focused on empowerment.

Apart from a formidable intellect, for which he is well known, his ability to bring together people to collaborate and work across disciplines was phenomenal. Being a firm believer in collaborations