

History of the Calcutta School of Physical Sciences. Purabi Mukherji and Atri Mukhopadhyay. Springer Nature Singapore Pte Ltd, 152 Beach Road, #21-01/04 Gateway East, Singapore 189721. 2018. xix + 170 pages. Price: 103,99€.

George Gamow's famous book on the developments of physics in the first three decades of the twentieth century was titled *Thirty Years that Shook Physics*. While historians of science often debate whether a certain development in science qualifies to be called a 'scientific revolution' or not, one fact remains undisputed. If any scientific development after the European Renaissance can legitimately be called a scientific revolution, then the developments of physics around quantum theory and relativity in the early decades of the twentieth century constituted one such revolution. It is often not realized that this revolution took place in a very small region of Western Europe. Almost all the important physics discoveries of that era came from a handful of individuals working in a few research groups in close proximity – Cambridge, London, Paris, Copenhagen, Berlin, Göttingen, Munich, Bern, Vienna. Then, all of a sudden, the Saha ionization equation (in 1920), the Bose statistics (in 1924) and the Raman effect (in 1928) came from a distant impoverished land under the colonial rule without any previous tradition of research in modern science. This was a development totally unique and almost unprecedented in the annals of the history of science. Perhaps the Compton effect discovered in the USA in 1923 was the only other physics discovery of that class made outside Europe during this momentous era.

While a few scholars – notably S. N. Sen, G. Venkataraman, Santimay Chatterjee, Rajinder Singh – have docu-

mented certain aspects of this unusual era of Indian physics, there still remain big gaps in our knowledge of what transpired in that era. There is no doubt that such an extraordinary era of scientific development should be documented more fully and a new study is certainly welcome. According to the blurb given on the back cover of the book by Purabi Mukherji and Atri Mukhopadhyay, this 'book presents the golden age of the physical sciences in India in compact form'. In view of the paucity of comprehensive books on such an important subject, many reviewers may feel inclined to praise any effort in this direction – even if it does not meet the international standard of scholarship and professionalism. However, the present reviewer begs to differ. There is no reason why we shall not demand the highest professional standards in a new scholarly work – especially when some of the earlier scholarly works met such standards.

One expectation in a professional scholarly work in any field is that there should be a complete bibliography of past works. Although Santimay Chatterjee did more work than anybody else in preserving the legacies of M. N. Saha and S. N. Bose, his contribution is not acknowledged except for a quotation of D. S. Kothari from one of his books. Rajinder Singh has carried on extensive recent studies of many topics discussed in the book under review. Not a single work of Singh is cited anywhere. Another professional expectation in a scholarly work of this kind is that the authors should give full references to the sources from which they extract important data. Again, there are repeated lapses. To give an example, on p. 34 the authors give a list of the subjects taught by various faculty members of Calcutta University, without telling the readers where they got this list from. Such lapses definitely limit the usefulness of the book for serious historians of science who may want to learn the subject from this book. Curiously, one of the authors (Atri Mukhopadhyay) is the writer of a remarkable biography of Meghnad Saha written in Bengali, which is free from such lapses. While I do not agree with certain interpretations given in that book (mainly regarding Saha's problematic relationships with Raman, Bhabha and Bhatnagar), I am an admirer of that book as a work of meticulous scholarship. That is why I approached the present book with very

high expectations. I have to confess that I am somewhat disappointed.

In spite of what the title of the book and its blurb may suggest, this book is not a comprehensive unified history of what the authors call the Calcutta School of Physical Sciences. Rather, the book is a collection of almost disjoint chapters devoted to the major personalities involved in that extraordinary era of Indian physics. It was Sir Asutosh Mookerjee, a brilliant mathematician with a deep interest in physics, who served as the Vice-Chancellor of Calcutta University for several years and transformed that University from a merely degree-granting university without core faculties to a university with postgraduate departments in different disciplines. Mookerjee virtually handpicked the faculty of the new Physics Department which started functioning during the difficult years of the First World War. This book is basically an account of the extraordinarily gifted individuals who gathered in this newly established Physics Department. Jagadis Chandra Bose, arguably the first Indian to make important contributions to physics, is not included in this book because he was never associated with this Physics Department. On the other hand, a chapter is devoted to Asutosh Mookerjee as the founder of this school of physics, although he was not a physicist in the usual sense of the word. Three chapters are naturally devoted to C. V. Raman, S. N. Bose and M. N. Saha, the three stars of this new Department. The most famous works of M. N. Saha and C. V. Raman were done while they were at Calcutta University, although Saha left for Allahabad University soon after his



Sir Asutosh Mookerjee as Vice-Chancellor, 1914.

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famous work. However, S. N. Bose had already shifted to Dacca University at the time of his famous work, which was done from Dacca. Two chapters are devoted to two other outstanding faculty members of this Physics Department – D. M. Bose and S. K. Mitra – who should be known to the present-day physics community of India much more than they are. The youngest person covered in the book is K. S. Krishnan, who was never a faculty member of this Physics Department, but was a student of Raman involved in the discovery of the Raman effect. Scholars keep arguing whether Krishnan should have been given more credit for this discovery.

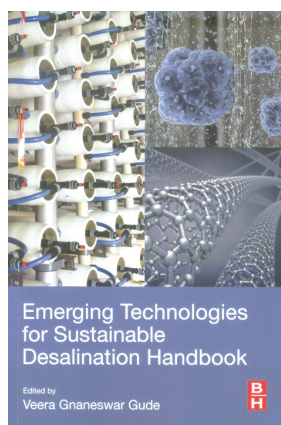
Each chapter gives a biographical outline of the man to whom the chapter is devoted and presents a summary of his scientific contributions. Apart from a short Epilogue in which the authors make some general remarks, the book is primarily descriptive – with very little attempt at analysing the significance of the historical events covered in the book. The different chapters are rather uneven in the style of presentation. For example, the chapter on D. M. Bose gives a complete list of his papers, which is not the case in other chapters. There are no references in the chapters devoted to M. N. Saha and S. N. Bose, though some references are given in other chapters (although the bibliography is highly incomplete in most cases, as I already pointed out). The depth to which the authors delve also varies from chapter to chapter. The chapter on Raman runs to 56 pages. On the other hand, each of the chapters on M. N. Saha and S. N. Bose is of only 16 pages, including several photographs. Readers with some knowledge about the history of Indian physics of that era will probably find nothing new in this book about M. N. Saha and S. N. Bose which they already do not know. However, I liked the chapters on S. K. Mitra and K. S. Krishnan, which are excellently written and are relatively free of the professional lapses I complained above. The chapter on Mitra gives an attractive account of his pioneering work on the upper atmosphere and its impact on his contemporary peers, including an account of how his classic monograph got written. Although the chapter on Krishnan is largely based on his outstanding biography by D. C. V. Mallik and S. Chatterjee, the authors have done an admirable job of summarizing the

main events of his life and his scientific achievements.

The authors do not present much original research in the form of new findings which previous scholars had not noted. Rather, the aim of the book is to provide short accounts of the lives and works of the physicists covered in the book – based primarily on the previous historical accounts of these physicists. As I have already pointed out, the book would have been much more valuable if it were prepared with more proper professional care. Still, scholars as well as general readers will find this book useful as a source of basic information about the important Indian physicists of that era between the two covers of one single book. Each chapter ends with ‘Milestones in the Life of ...’, giving a valuable chronology of the important events in the life of the man covered in the chapter. The book also has a collection of several fascinating photographs. A little more care and thoroughness on the part of the authors could make it a much better book. Still, readers interested in this most extraordinary era of Indian physics will surely benefit from consulting this book.

ARNAB RAI CHOUDHURI

*Department of Physics,
Indian Institute of Science,
Bengaluru 560 012, India
e-mail: arnab@iisc.ac.in*



Emerging Technologies for Sustainable Desalination Handbook. Veera Ganeswar Gude (ed.). Butterworth-Heinemann, An Imprint of Elsevier, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, United Kingdom. 2018. xxvii + 529 pages. Price: US\$ 250.

The book under review attempts to address the important topic of new and

emerging technologies for sustainable desalination. The water stress around the world with reasons like huge population growth, climate change and improper water management has led to the idea of augmenting water using desalination. Today several technologies have become proven and some are at proof of concept stage. Thermal systems like multi stage flash (MSF), multi effect distillation (MED) are well known and membrane systems like reverse osmosis (RO) are being used. These systems have known advantages and disadvantages and energy requirement continues to be an area of concern. However it is imperative to keep trying out new technologies because desalination is dependent on various factors like whether steam is available, whether water is brackish or seawater. The other concerns should be the operation and maintenance and sustainable utilization of the by products. Some of these issues are supposedly addressed in some of the chapters.

The chapter on Adsorption Desalination gives an overview of what the technology involves. More details could have been provided for the adsorption desalination process itself. Costing section is superficial. The chapter on Forward Osmosis (FO) is interesting and clearly brings out that FO is not viable as a desalination methodology, but more as a pre-treatment for RO for low quality high salinity water. Various piecemeal information regarding membrane distillation (MD) have been put together in the next chapter. Various phenomena and formulations regarding MD have been discussed. But overall a reader cannot finally understand the relevant processes that go into designing a MD system.

Properties of membranes and their surface modification for MD are discussed in the next chapter. The next chapter deals with permeate gap membrane distillation (PGMD). Efficacy of PGMD could not be established. But good literature on MD has been presented. RO energy consumption is given as 6–12 kW/m³, but this information is not up-to-date. The next chapter discusses desalination by pervaporation for which details are provided well. Conclusion and techno-economic analysis are very superficial. The chapter on Humidification De Humidification is crisp and covers required information.

The chapter on spray assisted low temperature desalination technology is