

BOOK REVIEWS

Albert Einstein, who recommended his case for grants to set up his laboratory in India. He was offered professorship in Allahabad University, where he started his own School of Astrophysics and Spectroscopy.

Mitra started as a research student of Raman and wrote a thesis: 'Investigation of interference and diffraction of light' to earn a D.Sc. degree. In 1920, he went to France and earned his second D.Sc. degree in the area of microwaves. On returning to India, he started teaching wireless technology after setting up a radio transmitting station in 1925. In 1935, he carried out studies on the properties of ionosphere at the Institute of Radio Physics and Electronics, Calcutta, now a Department of CU.

Chapter 8 describes the pioneering work of B. B. Ray in X-ray spectroscopy. Ray was also a student of Raman and did work on 'Optical analogue of whispering gallery effect'. Later on, he changed from acoustics to optics as Raman did. Ray went to Sweden under a travelling fellowship and started working under M. Siegbahn on X-ray spectroscopy. He spent two years in Copenhagen working with Bohr. In 1926, he returned to India and made strenuous efforts to set up the X-ray crystallographic laboratory in CU. He published 25 papers of high quality in this area.

Chapter 9 gives an overview of the activities of other teachers of the Physics department, namely J. C. Mukherjee, P. N. Ghosh, S. K. Acharya, B. N. Chakrabarty, D. Banerjee, H. Rakshit and S. C. Sirkar. The authors have given a brief resume of all these teachers who served the Physics Department in its formative years. Mukherjee was a topper of the Presidency College in 1907 and a classmate of Rajendra Prasad, the first President of India. He did not join research, but was among the first two lecturers of physics in 1916. He was rated among the best teachers of the Physics Department.

Ghosh was also a topper of MA in physics from Presidency College in 1908. He started research under Raman and got his Ph.D. after writing his thesis entitled 'The colours of the striae in mica and other optical investigations'. He joined as Ghose Professor of Applied Physics in 1920. Not much is known about the research career of Acharya, but he was associated with the Heat and Thermodynamics Laboratory of the Physics Department and teaching of theoretical courses. Chakrabarty joined Raman's group and got a D.Sc. degree for his thesis, 'On the colours of tempered steel and other tarnished surfaces'. He was ap-

pointed Assistant Professor on the recommendation of Raman.

Banerjee started his career as a laboratory Assistant in Physics Department in 1917, then promoted as a Demonstrator, and finally as a lecturer in 1922. He submitted his D.Sc. thesis under Raman in 1923 on the basis of four papers published in the proceedings of the IACS. Rakshit did his D.Sc. working under the supervision of Mitra. He played an important role in radiophysics and ionospheric research. He is well known for the first radio map of Calcutta. Sirkar joined Raman's group in 1926 and his investigations led to the discovery of resonance Raman scattering, which played an important role in conformational analysis of biomolecules in later years.

Chapter 10 gives a brief introduction to the contributions of A. C. Saha, K. Banerjee, S. K. Banerjee, L. A. Ramdas, N. K. Sethi and S. N. Ghosh to the Department of Physics at CU. A. C. Saha taught electricity and magnetism. K. Banerjee got his D.Sc. in 1930 and is known as the founder of crystallographic studies in India. S. K. Banerjee got his D.Sc. under Raman and became Ghose Professor in the Department of Applied Mathematics. Ramdas got his Ph.D. under Raman and became a pioneer in agricultural meteorology in India. Sethi joined Raman's group in IACS and got his D.Sc. from CU for his work on 'Optics and relativity'. He was associated with Raman for testing the predictions of the special theory of relativity. S. N. Ghose was neither a teacher nor a researcher, but was hand-picked by the Vice-Chancellor Mukherjee to develop laboratories of the Physics Department. He was a freedom fighter who went to USA to wage struggle for the freedom of India.

Chapter 11 is of special interest as it justifies the title of this book. The authors have provided glimpses how the 'dazzling dawn' occurred. There are three main reasons. First, CU had a visionary Vice-Chancellor, who recruited the best available faculty for the Physics Department. Second, he motivated rich nationalists of Bengal to create endowments for Science Chairs. As a result of his efforts, three Chairs, namely Palit, Ghose and Khaira Professorships were established in physics. These Chairs became the fulcrum for promoting teaching and research in physics. During this early phase, Indian scientists established close contacts with their counterparts in Europe. This provided a great fillip to their research. The third reason is more of a societal nature. Indian scientists wanted to prove to

the British that they are not inferior in the field of science.

The authors attribute the eclipse of the 'dazzling dawn' again to three reasons as follows: (i) After independence, India followed a model where research was shifted from universities to central institutions set up for this purpose. As a consequence, talented faculty of universities moved to these institutions. (ii) Universities suffered due to lack of funds and loss of talent. Bureaucratic control and lack of vision continues to plague university education. (iii) Raman guided 80 students for research and attracted talent from all over India. We lack role-models like Raman, J. C. Bose, P. C. Ray, S. N. Bose and M. N. Saha to motivate students in scientific research.

The authors must be appreciated for bringing out this book with a focus on the golden era of Indian physics. We need more such books motivate Indian students of science and to inculcate a spirit of excellence and pride in the Indian heritage of science.

HARDEV SINGH VIRK

*SGGS World University,
Fatehgarh Sahib 140 406, India
e-mail: hardevsingh.virk@gmail.com*

Techniques in Molecular Biology and Plant Biotechnology: A Compendium on Laboratory Experiments in Molecular Biology, Immuno-Diagnostics, Tissue Culture and Genetic Engineering in Plants. M. R. Shylaja, Deepu Mathew and K. V. Peter (eds). NIPA, a division of NIPA Genx Electronic Resources & Solutions P. Ltd., 101, 103, Vikas Surya Plaza, CU Block, L.S.C. Market, Pitam Pura, New Delhi 110 034. xxiv + 191 pages. Price: Rs 2995. ISBN: 9789390591022.

Biotechnology has emerged as a promising career option demanding skilled biotechnologists in various fields of agriculture, horticulture, animal sciences, fisheries science, natural resource management, medicine, pharmaceutical and food-processing industries. For addressing the challenges of climate change and outbreaks of global epidemics and pandemics, biotechnology offers effective and efficient tools and techniques. Thorough hands-on knowledge of biotechnological tools is essential to develop protocols and procedures in the field.

The present-day education system also focuses on skill and capacity-building, development of entrepreneurial human resources and academia–industry linkages. A laboratory handbook covering step-by-step procedures on various techniques in molecular biology and plant biotechnology is very much required in the present-day education, research and entrepreneurship development scenario.

This book covers a total of 90 experiments in molecular biology, plant tissue culture, genetic engineering and immuno-diagnostics. The chapters also consist of validated protocols/procedures.

Chapter 1 deals with techniques in molecular biology covering genomics, transcriptomics, proteomics and metabolomics along with 35 experiments. It details genomic DNA isolation, assessment of quality and quantity of isolated DNA, the principle and procedure for thermal cycling/polymerase chain reaction (PCR), electrophoretic separation of PCR products and documentation, bacterial and plasmid DNA isolation, restriction digestion, ligation, competent cell preparation, transformation and screening of recombinants by α -complementation, Southern hybridization, molecular marker analysis and interpretation of data. RNA isolation, assessment of quality and quantity of the isolated RNA, cDNA synthesis by reverse transcription, analysis of gene expression using real-time PCR and Northern hybridization are dealt with in detail. The extraction, precipitation and quantification of protein, protein electrophoresis using SDS-PAGE, silver staining to visualize proteins and 2D electrophoresis to identify the differentially expressed proteins for a specific situation, Western blot and yeast two-hybrid assaying are also presented. Separation and quantification of small-molecule metabolites, different chromatographic separation techniques like thin layer, affinity, ion exchange and high-performa-

nce liquid chromatography are detailed. Synthesis and characterization of nanoparticles, bioinformatics tools essential for plant biotechnology like designing primers and BLAST are also discussed in the chapter.

Chapter 2 deals with techniques in immunology and molecular diagnostics. It covers 19 experiments. Besides the basic immunology experiments, techniques like immune electrophoresis, rocket electrophoresis, quantitative precipitin assay, immunoprecipitation, ELISA, dot blot, Western blot, production of polyclonal antibodies and purification are presented. Further, the protocol for bacterial species identification by PCR amplification and sequencing of candidate gene 16S rDNA and identification of plant pathogens using PCR and real-time PCR are described.

Chapter 3 deals with plant tissue culture and its various applications like micropropagation, crop improvement, conservation of germplasm and secondary metabolite production. Starting from media preparation, the chapter covers different routes of micropropagation, commercial micropropagation and cost-reduction protocols, tissue-culture techniques for crop improvement like the creation of variability, haploid and triploid production, embryo rescue, protoplast culture, *in vitro* conservation of germplasm, and secondary metabolite production and scaling up of the metabolite.

Chapter 4 covers experiments in plant genetic engineering. Direct and indirect gene transfer methods are dealt with step by step up to confirmation of transgene insertion through PCR and GUS assay. Gene silencing using RNAi is discussed elaborately, including construct design, genetic transformation and phenotyping of mutants. The latest genome editing platform CRISPR/Cas9 is also mentioned – the CRISPR guide RNA design, construct development, ligation and transformation are

covered. In addition, good laboratory practices, preparation of solutions and reagents, glossary and references are included in the appendix.

The book has the following salient points:

- It covers various biotechnology techniques in molecular biology, plant tissue culture, genetic engineering and immuno-diagnostics.
- The step-by-step procedure on various biotechnology techniques will be a ready reckoner for students, research scholars, teachers and scientists.
- The protocols/procedures presented have been tested validated by a team of teachers/scientists.
- Practical hands-on information on various plant biotechnology techniques will be useful for skill and capacity-building and entrepreneurship development in biotechnology.

In summary, this is a reference book which comprehensively examines different experiments of biotechnology. I congratulate the authors and editors for bringing out an important and informative book. I recommend it as a valid and updated reference to the teaching/scientific community. It is hoped that the step-by-step procedure on different techniques in plant biotechnology presented in this book will be an authentic knowledge source and a ready reckoner for skill and capability development in biotechnology for graduate and postgraduate students, research scholars, teachers and scientists.

G. R. ROUT

*Department of Agricultural Biotechnology,
College of Agriculture,
Odisha University of Agriculture and
Technology,
Bhubaneswar 751 003, India
e-mail: grrout@rediffmail.com,
rout07@rediffmail.com*