

Biotechnology – Expanding Horizons.

B. D. Singh. Kalyani Publishers, 4779/23 Ansari Road, Daryaganj, New Delhi 110 002. 2004. 844 pp. Price: Rs 290.

This is a book intended for postgraduate students. It has been organized into twenty-one chapters dealing with different aspects of biotechnology. Biotechnology is a vast subject and for any book on general biotechnology, it becomes essential to weave in the principles and techniques involved in areas such as molecular biology, immunology, enzymology, tissue culture, etc. The author successfully deals with such topics. A special feature of this book lies in the effort of the author to cover a wide variety of topics of relevance to biotechnology. The book makes a beginning with an introductory chapter about the definition, scope and importance of biotechnology. While the 2nd and 3rd chapters deal with recombinant DNA technology, the 4th chapter deals with genome mapping and 5th chapter is devoted to animal tissue culture. Basics of immunology are brought out in the 6th chapter followed by a chapter on transgenic animals. The 8th chapter is devoted to plant tissue culture, wherein plant tissue culture techniques and their applications are described in detail. The 9th chapter describes the principles and techniques involved in plant biotechnology and this chapter prepares a background for the following three chapters on transgenic plants. The 13th chapter deals with vaccine production, drug designing and drug delivery. Industrial microbiological aspects have been brought out in chapter 14. One complete chapter has been devoted to enzyme technology and industrial applications of enzymes. Considering the importance of enzymes in biotech industries, this is apt. This chapter provides information about the applications of a variety of enzymes in several industries at one glance. An attempt has been made to briefly introduce the basics of enzymology such as classification, nomenclature and kinetics. Considering the fact that postgraduate students of biotechnology come with some training in biochemistry wherein they learn these aspects in greater detail, these topics could have been skipped. The 16th chapter is devoted to food technology, while the 17th and 18th chapters focus on fuel biotechnology and environmental biotechnology respectively. The author introduces bioinformatics in chapter 19 and biosafety and IPR issues in the last two

chapters. As is clear from the above, the author has tried to bring in a wide variety of topics of relevance to biotechnology. The book is a good source for understanding fundamental issues and principles involved in different areas of biotechnology. The advantage of covering a wide range of topics is that a student can always refer to various chapters in the same book in order to gain a clear understanding of any given topic. But the disadvantage is that it becomes difficult to provide a detailed account of our current understanding in any given area, for example, drug designing, drug delivery or bioremediation, etc. which a postgraduate student is expected to learn. However, the 'suggested further reading' at the end of each chapter is helpful. These references and other books in the market on the respective topics would help one gain a thorough understanding of each of the topics. The book prepares the reader to have the necessary knowledge and understanding of the fundamentals in order to dwell deeper into the subject. It is written with clarity and in simple English, making it easily understandable by an average student. Figures, flow charts and tables are provided wherever necessary, making it explicate. For a student bombarded with diverse information on diverse aspects of biotechnology, this book would serve as a 'dictionary'.

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A Primer of Special Relativity. P. L. Sardesai. New Age International (P) Ltd, 4835/24 Ansari Road, Daryaganj, New Delhi 110 002. 2004. 177 pp. Price: Rs 75.

The International Union of Pure and Applied Physics (IUPAP) has declared the year 2005, as the 'Year of Physics', and celebrations are afoot all over the world to spread awareness amongst communities, schools, colleges and other educational institutions about the importance and relevance of physics as a fundamental discipline. This special year for physics marks hundred years since Einstein offered

to science, all in the same year, three works of outstanding creativity: the theories of Brownian motion, photoelectric effect and special relativity (SR). Each of these theories has influenced the development of modern physics in profound ways. But it is SR that has had the most far-reaching impact, making it a requirement that any theory in modern physics dealing with space, time, mass and energy, and it is hard to think of one that does not, passes its 'scrutiny'.

When Thomas Kuhn wrote in *The Structure of Scientific Revolutions*, now a classic in the history of science, about paradigms in physics and the manner in which a paradigm shift leads to an entire change in the meanings of physical concepts, Einstein's SR was a prime example on hand. The concept of ether in the 19th century providing an absolute frame of reference and its interesting consequences on the speed of light had led to many important experiments, including the famous experiment of Michelson and Morley. Others which used Galilean relativity to analyse the path of light in fluid media travelling in different directions, such as Fizeau's experiments in interferometry using glass tubes with water, failed to obtain results in accordance with the Galilean principle. Fizeau himself found that the so-called drag coefficient due to the fluid media in analysing the light propagation, had to be proposed empirically. The ether itself was taking quite a beating. After Michelson and Morley's result on the constancy of the speed of light no matter how the apparatus of their experiment was arranged, many hypotheses were proposed, in the Ether Drag, or in the Elastic Corpuscles, to rescue this concept from becoming superfluous. The gestalt switch away from this mode of thinking came about when Einstein proposed in his Principle of Relativity that with respect to all observers in inertial frames the speed of light should be a constant. Apart from this principle which provided the right explanation for Michelson and Morley's results, his use of the Lorentz transformations (LT) in relating the coordinates of inertial frames in relative motion with respect to each other, of which the velocity addition theorem is a consequence, provided the framework for analysing optics experiments such as that performed earlier by Fizeau. Now there was no longer a need for invoking any of the ad hoc hypotheses and the ether and its concomitant absolute frame of reference was simply abandoned.

BOOK REVIEWS

The book by P. L. Sardesai makes one appreciate the processes that led to these changes in conceptualization in an elegant manner, while strictly adhering to the pedagogical order that is necessary in introducing the challenging concepts of special relativity to the undergraduate student. Therefore, while one has to arrange concepts in a textbook in a manner which may not necessarily reflect their chronological development, Sardesai does take care to reveal the interesting twists and turns in the history of science in the 19th and early 20th centuries which provided the context for SR.

Written, as he says in the preface, for an Indian student who may find many other excellent texts on the subject by foreign authors too highbrow, and who may be in the end at a loss when it comes to developing problem-solving skills, the author has provided an ample number of illustrative examples and problems. One gets a feeling while going through the chapters, that the author's endeavour to enable the average student to master the elements of SR, makes him take great care in imparting lucidity to the concepts he explains. After introducing LT, the author moves on to explaining coincidence, colocality and simultaneity, as they are defined in SR. While coincidence implies that two events happen at the same place and at the same time, colocal events are those that happen at the same place, but not necessarily at the same time. Simultane-

ous events are those that happen at the same time, but not necessarily at the same place. What happens to these notions when we re-examine them from the point of view of an observer in another inertial frame related through a LT? While coincidence remains valid for all inertial frames, colocality and simultaneity lose their meaning when going from one frame to another! That is, events that are measured to determine that they happen either at the same place or at the same time, are found to happen at different places (in case of colocal events) or at different times (in case of simultaneous events). While colocality is not obeyed even in the Galilean transformations, violation of simultaneity is unique to SR. These notions that seem to defy the intuition of a student uninitiated in SR, are clearly presented here and as this reviewer found, not as explicitly treated in many other texts on SR. This sets the stage for introducing the concepts of world line of a particle through space-time diagrams and from a use of the space-time diagram, the important principle of causality.

The treatment of mass-energy relationship and relativistic mechanics follows a chapter on the consequences of SR in optical effects in which, apart from examining Fizeau's experiment in detail, the chapter offers a complete derivation of the relativistic Doppler effect. This brings out clearly that in relativistic Doppler effect, there is a shift observed in the wave-

length even when the observer is stationed orthogonal to the moving emitter, unlike in the non-relativistic case. This is an aspect glossed over in many classroom situations where the Doppler effect is being explained, and keeping relativistic aspects in mind is necessary for the teacher to present a complete picture. The concepts of Minkowski space and the four-vector, which help to present SR in a unified manner are introduced only after the basics are well entrenched. Relativistic mechanics is revisited here through the concepts of four-momentum and four-force (Minkowski force). The final chapter establishes the Lorentz invariance of the Maxwell's equations.

Perhaps an addition in the earlier chapters of the book that would have enriched the content is the introduction of the γ factor in the LT through Bondi's k -calculus, which is appealing in its treatment that makes use of simple space-time diagrams. However, this omission causes no serious loss to the excellent manner in which the subject is developed. At its price, this book is bound to be well received as a user-friendly and economic buy that provides an accurate and elegant treatment of this important theory.

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Science wallpaper for high school and undergraduate students



The National Council for Science and Technology Communication (Department of Science and Technology, Technology Bhavan, New Mehrauli Road, New Delhi 110 016) brings out a fortnightly science wallpaper for high school and undergraduate students called *Kyon aur Kaise* (Why and How). There are 18 issues annually to coincide with the school academic year from July to April and at present there are editions in English and Hindi. The annual subscription is Rs 120 (single copy Rs 10). The contents are chosen and structured to stimulate students, emphasizing the

scientific methodology of raising questions and seeking answers. Some of the highlights are: This Fortnight in Science, Experiments that Changed the World, Nature Watch, etc. It provides a forum for students to air their views and opinions on a wide range of scientific and social issues that they confront in everyday life. Eklavya, an Institute for Educational Research and Innovative Action, has taken up the editorial design and production responsibility. The email address is eklavyamp@vsnl.com and postal address is E-7, HIG-453, Arera Colony, Bhopal 462 016.