had to travel to Pune to access these journals at the National Chemical Laboratory. His colleagues thought of the book idea as 'a joke'. His stint as head of the chemistry department at IIT Kanpur eased the matters as he had necessary equipment and chemicals brought there as part of the Kanpur Indo-American Programme (KIAP). Only in 1977, Rao says he had reasonable facilities for research at IISc – 18 years after beginning independent career in research. Rao's experience in his early career may well resonate with many young researchers even today though our research institutes are much better funded.

The work of Indian scientists interested in new areas of science often gets hampered due to lack of equipment and other facilities. This is what happened with Rao who had been working on lanthanum copper oxide since the 1970s and had shown that it was anti-ferromagnetic. This material came into prominence with the sensational discovery of high temperature superconductivity in 1986. Rao says that he had not measured properties of lanthanum copper oxide compositions at liquid helium temperatures due to paucity of facilities. Undeterred by this, Rao continued vigorously in this area, resulting in his group making first liquid nitrogen superconductor independently in 1987. Bell Labs in the US and Peking University in China had prepared this compound at the same time. The book describes the dramatic way Rao first came to know about the superconductivity discovery in the middle of a conference from a visiting scientist. Those days scientists still depended on printed journals and the postal system to learn about latest developments in science. Another new area of research pursued by Rao by the turn of the century is carbon nanotubes and graphene which the book describes in some detail.

Given wide ranging activities Rao has been engaged since the mid-1980s when he became director of IISc, people have often wondered how he managed to handle multiple tasks in science administration and planning as well as research. Rao has answered this question in the book. He says he had consciously decided to continue laboratory work despite any other responsibility he would hold by dividing time between his office and laboratory work. He continued to balance research and his other responsibilities while he was director of IISc, founder-director of the Jawaharlal Nehru Centre for Advanced Scientific Research, President of science academies and other professional bodies, and scientific advisor to successive prime ministers. This should serve as an example to our science-administrators and academic leaders who often give up research while shouldering other responsibilities like directorship of institutes. Rao particularly enjoys working with young students. He says that his research showed a marked improvement after 60 and flourished further after the age of 70. Even crossing the 80-mark, Rao is not tired. He says 'I would love to be a Ph D student in the US, and perhaps start publishing again'. Such zest for science is indeed rare and praiseworthy.

The book is important not only as personal reminiscences of a leading figure of Indian science, but adds an important chapter to rather small body of literature on history of science in the post-independent era. Hopefully Rao's book would not only be inspirational for young researchers, scientists and science administrators, but would also prod other senior scientists to pen their experiences for the benefit of present and future generations interested in science in some way.

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Biomedical engineering (also called bioengineering) generally refers to the utilization of engineering concepts to study biology and develop new technologies for use in medical practice. Based on this definition, research in biomedical engineering tends to be extremely diverse and providing an overview of all the major developments in a single volume is next to impossible. The editors of this volume of Annual Reviews have done a remarkable job in understanding this problem and concentrate on providing an in-depth overview of a few emerging areas in biomedical engineering. The 16 review articles broadly focus on 7 topics: drug development and delivery; imaging; immuno-engineering; systems and computational methods in medicine; mechanics of tissues; micro-scale technologies for biological and medical application; and tissue engineering.

Therapeutic formulations (drugs) are one of the pillars of today's healthcare systems. Developing new drug entities and devising methods to deliver them effectively to the site of disease are significant areas of research in their own right, but they also form an important component of biomedical engineering. Biomedical engineering tools and approaches such as computational techniques, reverse-engineering and rational-design have significantly aided in drug discovery. Two articles comprehensively review these approaches for the development of new molecular entities, with one focusing on drugs that bind to atypical regions of membrane proteins and another on creating polypeptides and peptide-assemblies with catalytic function. Another review provides a realistic perspective on drug delivery and targeting. Although the importance of drug-targeting in diseases ranging from infections to cancer cannot be denied, the practical aspects of delivering drugs to diseased cells in the body have been challenging. A majority of drug targeting strategies, at least the ones that have been successful in laboratory experiments, employ the use of small molecules or peptides or antibodies that target specific cell surface proteins (receptors). However, these receptors may not be expressed only on diseased cells. Basic biological studies to identify receptors or other molecular entities that are specifically present only in diseased cells would be of tremendous help in developing new targeting strategies.

The old adage 'seeing is believing' applies to biology and medicine too. Numerous advances in biology have been the result of new and improved visualization tools. Further progress in these fields requires the enhancement of imaging modalities. A fundamental research area in biomedical engineering has been the development of new imaging technologies. Deservedly, a significant portion of this volume (three articles) focus on imaging. Tunnell and colleagues provide an extensive synopsis of contemporary imaging techniques, and one of the delights of reading this article is their summarization of the advantages and disadvantages of each technique using a radar chart that is easy to comprehend. The other two articles offer insight into emerging imaging technologies that offer the advantages of decreased cost, enhanced portability, high-throughput capabilities and amenability for easy digitization. Even though the articles are written to present a broad perspective, grasping the material presented in these articles requires a fundamental understanding of advanced optics and image processing algorithms.

A rapidly advancing area of research in medicine is the modulation of the immune system for the treatment of a variety of disorders ranging from cancer to autoimmune diseases. Arising from these advances is a new field termed 'immunoengineering', which involves the application of engineering tools such as drug delivery systems and biomaterials to modify immune cell behaviour. In order to engineer immune responses, a basic understanding of immuno-biology is essential. Three articles in this volume provide a comprehensive summary of some of the fundamental concepts in immunology and discuss a few technologies which have been developed to modulate immune cells. Two of these articles focus on an understudied but vital field of study in immunology, which is transport in the lymphatic system. A majority of immune reactions are primed in the lymph nodes and understanding lymphatic physiology is essential for designing interventions to modulate immune activity. A separate article brings attention to different aspects of regulating immune responses. When one thinks of dysfunctional immunity, the general impression is that the system is not sufficiently active. However, an important aspect of immune dysfunction is over-activity of inflammatory cells and reduced activity of the regulatory arm of the immune system. Increasing the activity of regulatory immune cells – termed as inducing immunotolerance – is essential for the treatment of autoimmune diseases, and the article by Shea and colleagues introduces the concept of engineering tolerance.

The use of mathematical and computational approaches to study biology is quite common today, but the adoption of these methods in medicine has been slow. Numerous barriers have prevented the wide-scale utilization of *in silico* approaches in medicine, which include the difficulty in linking molecular level data obtained from biological studies to systems level physiology and the relative paucity of multi-scale modelling approaches that are appropriate for medicine. In one of the reviews in this volume, Viceconti and Hunter provide a comprehensive overview of a large-scale initiative to overcome these barriers. This initiative, entitled virtual physiological human, has focused on the development of tools and technologies that would enable the use of systems level computational predictions in treating patients and in testing new therapeutics. Several similar efforts are required to translate the numerous biological and biomedical engineering discoveries from the laboratory to the clinic.

Study of the mechanics of cells and tissues, biomechanics, has been considered a key part of biomedical engineering research. While a number of studies on the mechanics of joints (made up of the connective tissue – cartilage) have previously been performed, a lot more needs to be done to understand and potentially build *de novo* synthetic joints. An overview of recent advances in this area of research is provided in an article, with emphasis on the interactions between biological molecules present in cartilage that enable efficient joint movement. A noteworthy point is the ease with which the authors are able to present fundamental concepts from both view points of mechanics and physiology in the same article.

Micro- and nano-technologies have not only provided tools to study biological systems, but have also revolutionized the idea of hand-held portable biomedical devices that ably perform the functions of traditional brick-and-mortar diagnostic laboratories. Three articles are devoted to such technologies, with the first two providing a basic review of the techniques to fabricate the micro-devices followed by an in-depth analysis of the types of biological studies that have been performed in the past. The third article draws attention to the development and use of portable devices for use in biological sensing (bio-sensors). This article in particular, primarily discusses the use of electrical technologies in biosensors for detection. While colorimetric detection techniques that rely on labels, chemicals and antibodies are most common, charge, potential and impedance-based detection offer several advantages especially for use in point-of-care testing in a local clinic or at home. Additionally, the use of electrical technologies for sensing enable the development of biosensors that perform better in and on humans.

Tissue engineering has long been considered an area of research with far-reaching implications for human health, however, numerous challenges have hindered clinical translation of this technology. Tissues are identified as a collection of cells that perform a common function, but this definition is often regarded as too simple. Tissues contain different types of cells that are arranged in a specific pattern, communicate with each other using precise interactions and form defined boundaries that prevent cellular movement and loss of patterns. Developing engineered systems that mimic this complexity accurately has been a major challenge. One article in this volume discusses these problems and provides a comprehensive summary of how tissue organization occurs in nature, especially during embryo development. Learning from these natural mechanisms and potentially replicating them in engineered systems may be the way forward for engineering tissues with clinical translatability.

In summary, this volume presents some of the most exciting developments in the area of biomedical engineering. An important feature of each article is that there is an attempt to cover in detail the basics of the topic of interest before delving into the recent advances. This feature coupled with a comprehensive list of references and the numerous artistic schematics summarizing textual material, make many of the articles in this volume a must-read for beginners and experts alike.

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