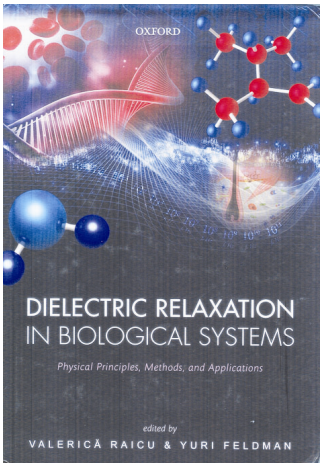

Dielectric Relaxation in Biological Systems: Physical Principles, Methods and Applications. Valerica Raicu and Yuri Feldman (eds). Oxford University Press, 198 Madison Avenue, New York 10016, USA. 2015. xix + 429 pages. Price: £ 65.00

This book is based on the new theories and technologies developed recently. It covers the theoretical background, experimental techniques and a few biomedical applications. The historical overview provided in the beginning gives a feel for the advancement of the new technologies. It is rare that one can get all the information in a single book. A reader with any background can easily understand the dielectric behaviour of the living system and can find ways to develop real-life applications. The theories in the text are explained well with the help of schematics, plots and illustrations to make them vivid and easy to understand. Nowadays, not only biologists, but engineers, biophysicists, mathematicians, electrochemists and computer scientists are engaged in understanding the human system and in the development of new methods to improve the quality of human life. It would be difficult for a biologist to understand the physics of the cells without knowing the background. Indeed, this book achieves the goal to explain the physics of the biological entity in an impressive manner. It justifies the importance of gaining knowledge in the field of dielectric behaviour of biological systems before thinking about developing a biomedical device. I think many interdisciplinary studies could not achieve any fruitful conclusions, because of the lack of proper justification of the work.

The first part of the book begins with theoretical background of dielectrics and different models to understand the dielectric behaviour of various systems. It starts with the basic definition of the dielectrics and then explains the complex systems. The book provides an overview of suspension models of single/multishell particles and their implementation in the real cell models. Various references and equations are provided to compute the dielectric behaviour of the cell organelles, e.g. mitochondria, cytoplasm and nucleus. Also, this section provides various models to analyse the dielectric behaviour of the cells in different stages; for instance, during cell division, dilute individual cell suspension, cell pair suspension, cell agglomeration, concentrated cell suspension systems, etc. It explains all the possible changes in cell polarization during cell–cell interactions in various stages of cell life.

After giving full theoretical background and different modelling approaches in the first part of the book, the second part focuses on the experimental techniques to analyse the dielectric behaviour of the biological systems. It addresses type of electrodes, frequency ranges to measure the dielectric properties of the biological cells and the issues related to designing and selection of the electrodes. The authors emphasize on the selection and design of the electrodes, which can affect the biological tissue during measurement, i.e. electrode stability in the physiological environment, roughness, corrosion, polarization and toxicity for biological systems. This section also provides an understanding of the complexities related to the measurement of dielectric properties of the biological systems and gives some directions to overcome the difficulties during measurements and analysis of the data.

The third section of the book, 'Applications', begins with dielectric behaviour of smaller water molecules and end ups with proteins in the cell membranes. The reader will get information about several analysing tools, parameters and problems associated with measurements in this section of the book. The dielectric properties of blood and its components are discussed in detail. The behaviour of normal and malignant cells is presented, because they are the cause of various blood-related diseases. In this section of the book, one can get an answer to the question: why do we need to understand the dielectric behaviour of the biological systems? A few examples are cited at the end of the book, like measuring changes in the blood glucose level in diabetic patients. Detailed literature, and possible reasons for the controversial results obtained by different methods are also provided.

In the case of devices related to measuring glucose level in diabetic patients, the authors first briefly discuss diabetes and then the physiological difference in the deceased and normal human body tissue. In this way the reader will get a complete understanding of the cause and solution to the problems. Also, the authors discuss the parameters which can affect the measurements in detail. This part of the book introduces various facts, for example, change in the skin thickness with change in temperature, and compares the difference among normal, healthy skin and diseased skin.

Overall, the book provides guidance to researchers who want to develop a biomedical device. The authors clearly explain the use of dielectric measurement in the practical use and discuss the available biomedical devices based on dielectric behaviour of the cells for various applications. While reading the book, one can feel the lack of explanations for results obtained in various studies presented in the text. However, the reader can find them in the later sections of the book. The book thus summarizes properties of the devices which are essential to know before fabrication of a biomedical device.

Till date, in the field of interdisciplinary biomedical work, there is a gap in the understanding of living systems between physicists and engineers on one side, and doctors and biologists on the other. This book attempts to bridge this gap, and in future such books will be beneficial for further advancement in the biomedical field. The editors have attempted to integrate all such knowledge that highlights the emerging issues and to suggest actions to tackle them through advanced methods and techniques.

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