
Preface

Biophysics is a vast cross-disciplinary subject encompassing the fields of biology, physics and computational biology etc in microbes, plants, animals and human being. Wide array of subjects from molecular, physiological and structural are covered in this book. Most of these chapters are oriented toward new techniques or the application of techniques in the novel fields. The contributions from scientists and experts from different continents and countries focuss on major aspects of biophysics. The book covers a wide range of topics reflecting the complexity of the biological systems.

Although the field of biophysics is ever emerging and innovative, the recent topics covered in this book are contemporary and application-oriented in the field of biology, agriculture, and medicine. This book contains mainly reviews of photobiology, molecular motors, medical biophysics such as micotools and hoemodynamic theory.

Topics on Photobiology deal with Electromagnetic radiation and life: bioelementological point of view; Laser correlation spectroscopy approach to bioelementology problems: nutritional, ecological and toxic aspects; Chlorophyll fluorescence in plant biology, Thermoluminescence in chloroplast thylakoid. Topics on biotechnology and medical biophysics deal with molecular motors, micotools and application of hoemodynamic theory in mechanical cardiac assist devices.

Sun is the main source of electromagnetic radiation on earth that sustains life that has practical application in various fields: medicine, biology, agriculture and biotechnology.

The organization and structure/function relationships of biomembranes area represent substantial number of biochemical and biophysics probes. Fluorescence techniques are frequently used as a tools to characterize the structure and dynamics of biomembranes. However, a novel computer simulation method for the study of molecular dynamics (MD) of membranes for atomic-scale information using fluorescent membrane probes is described. The chapters on chlorophyll fluorescence

in plant biology and thermoluminescence in chloroplast thylakoid deal with the aspects of theory, technique and applications in biomembranes.

Bioelements are building blocks of life and physical-chemical principles regulate all the elemental behavior for the life processes to continue in the living system. Interesting introductory chapter describes how this phenomenon is regulated by light and explains the method of laser correlation spectroscopy that measures this phenomenon in a living system.

Polyhydroxyalkanoates (PHAs) is biopolymer produced by various microbes. In this book the authors have projected luminous bacteria as a novel potential PHA producer. That can be greatly used in biotechnology.

Energetics of biomolecular machines or molecular motors, is calculated in the chapter for Molecular Motors by calculating flux and free energy. This is used for predicting the conformational transitions and the extent to which the power stroke and the thermal ratchet mechanisms that take part in the molecular motor motion.

Nowdays microtools are used in microsurgery of single cells and microscopic things such as cells or organelles. Microsurgery of a single cell, replacing its elements, the introduction of foreign genetic material makes this area of medicine, agriculture, basic and experimental biology especially relevant. Appearance in the hands of microsurgeon of a single cell of the new microtools that have the ability of active interference in functioning of the cell without causing a significant damage to it have changed the experimental biology.

Cardiovascular diseases (CVD) still cause the highest mortality in developed countries. Recently, congestive heart failure (CHF) was defined by the NIH as the new epidemic in USA with 5 millions new cases per year. Mechanical cardiac assist devices (CAD) are currently indicated for CHF patients. "Flow and Rate": Concept and clinical applications of a new hemodynamic theory deals with transplantation problems and how to overcome them.

I would like to express my sincere thanks to the authors around the world for their excellent contributions to the book. I hope that the book will enhance the knowledge and give an insight into the present problems in biophysics. I express my appreciation to all the authors of this book.

Last but not the least, I express sincere thanks to my daughter Eva, son Rishi, son-in-law Divya and my granddaughter Diksha for their love, affection, encouragements and assistance during the preparation of this book which gave me immense inspiration for devoting my time and energy to this work. My parents, brothers and sisters and their family members have been a constant source of encouragement for my work and endeavours. I am indebted to them. There is none but my teachers at all levels who contributed to my knowledge and have been a

perpetual source of aspiration for all constructive academic work, that I have ever done in any sphere of my life. I owe them this piece of work and dedicate this book to them.

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1. Introduction

Changes in physiological status of the organism under the effect of environmental factors modulate metabolic processes, which in turn, affects the composition of biological fluids and possibly of bioelements – substances important for building and maintenance of the living matter. Bioelements are the elemental functioning units of living matter, which are biologically active complexes of chemical elements as atoms, ions and nanoparticles with organic compounds of exogenous (primarily of biogenic) origin (Galar, 2007, 2011). Evaluation of subtraction composition of samples provides information on percentage of biosubstrate constituents and yields internal characteristics of the function of systems and their readiness to adequate reaction of the body. In analytical biophysical method, named laser correlation spectroscopy (LCS) is used for screening of large groups of conventionally healthy individuals for diagnosis of body functional strain and detection of risk groups (Karganov et al., 2009). Optimized software takes into account individual peculiarities in internal sanogenetic systems of the organism when determining consequences for health in persons exposed to low doses of potentially harmful factors (Kryzhanovskiy, 2004). LCS allows measuring particle size in native biological fluids. It is successfully used in clinical practice for evaluation of the disease severity and treatment efficiency in patients with asthma, diabetes mellitus, infarction, some haematological diseases, and other pathologies (Kovalev et al., 2002; Kryzhan et al., 2004; Karganov et al., 2006).

2. Principles of laser correlation spectroscopy

Laser correlation spectroscopy (LCS) (laser spectroscopy of quasi-elastic light scatter, optical mixing spectroscopy, photon-correlation spectroscopy) consists in measurement of spectral characteristics of light scattered in quasi-elastic mode from the spectrum of incoherent fluctuations of the recorded light (Galar et al., 1973; Haur et al., 1981; Haur, Oulghuel, 1985; Howard, Curran, 1982; Chu, 1974). Two schemes of measurement can be used: homodyne (selective recording of the light scattered by the system) and heterodyne