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As computational hardware continues to develop at a rapid pace, quantitative computations are playing an increasingly essential role in the study of biomolecular systems. One of the most important challenges that the field faces is to develop the next generation of computational models that strike the proper balance of computational efficiency and accuracy, so that the problems of increasing complexity can be tackled in a systematic and physically robust manner. In particular, properly treating intermolecular interactions is fundamentally important for the reliability of all computational models. In this book, contributions by leading experts in the area of biomolecular simulations discuss cutting-edge ideas regarding effective strategies to describe many-body effects and electrostatics at quantum, classical, and coarse--grained levels. The goal of the book is to not only provide an up--to-date snapshot of the current simulation field but also stimulate exchange of ideas across different sub-fields of modern computational (bio)chemistry. The text will be a useful reference for the biomolecular simulation community and help attract talented young students into this exciting frontier of research.

The Advances in Chemical Physics series provides the chemical physics and physical chemistry fields with a forum for critical, authoritative evaluations of advances in every area of the discipline. Filled with cutting-edge research reported in a cohesive manner not found elsewhere in the literature, each volume of the Advances in Chemical Physics series serves as the perfect supplement to any advanced graduate class devoted to the study of chemical physics.

Diagnostic Molecular Biology describes the fundamentals of molecular biology in a clear, concise manner to aid in the comprehension of this complex subject. Each technique described in this book is explained within its conceptual framework to enhance understanding. The targeted approach covers the principles of molecular biology including the basic knowledge of nucleic acids, proteins, and genomes as well as the basic techniques and instrumentations that are often used in the field of molecular biology with detailed procedures and explanations. This book also covers the applications of the principles and techniques currently employed in the clinical laboratory. • Provides an understanding of which techniques are used in diagnosis at the molecular level • Explains the basic principles of molecular biology and their application in the clinical diagnosis of diseases • Places protocols in context with practical applications

In the last few years, hopes have emerged that simple concepts could perhaps explain the extremely complicated biomolecular processes which are known to a greater and greater accuracy thanks to the extraordinary progress of biology. In parallel, powerful methods in physics, especially nonlinearity and cooperative effects, have been developed. They apply especially to biological phenomena and can explain coherent excitations with remarkable properties. This book provides a pedagogical introduction to the theory of nonlinear excitations and solitons in a biological environment, and also to the structure and function of biomolecules as well as energy and charge transport in biophysics.

This handbook is a guide to current methods of computational chemistry, explaining their limitations and advantages and providing examples of their applications. The first part outlines methods, the balance of volumes present numerous important applications.

This volume represents a collection of lectures delivered by outstanding specialists in the fields of biophysics and of related scientific disciplines th during the 7 International Summer School on Biophysics held in Rovinj, Croatia from 14 to 25 September 2000 under the title "Super molecular Structure and Function ". This scientific-educational event was organized by the Ruder Boskovic Institute ofZagreb, Croatia with substantial material and intellectual support of a number of national and international institutions including the Croatian Biophysical Society (CBS), the International Union of Pure and Applied Biophysics (IUPAB), the International Centre for Genetic Engineering and Biotechnology (ICGEB) and the UNESCO Venice Office - Regional Office for Science and Technology for Europe (UVO-ROSTE). The seventh edition of the series of International Summer Schools on Biophysics, which was started in 198I, attracted more than 120 young researchers and post--graduate students coming from 27 countries of Europe, Asia, Africa and Latin America. Twenty-five outstanding experts in pure and applied biophysics presented the most advanced knowledge ofthis very interdisciplinary area of science during their lectures and round tables. It was commonly acknowledge that the Summer School achieved great success and fully reached its objectives. The success of the Rovinj Summer School was also due to the constantly growing attention being paid by scientific communities to younger generations of scientists, thanks also to the major outcomes of the World Conference on Science "Science for the Twenty-first Century: A New Commitment" held by UNESCO and ICSU in Budapest, Hungary in June 1999.

Contents: Biomolecules, Atoms and Molecules, Water, The Magic of Carbon, The Cell, The Catalysts of Life, Bionergetics, Carbohydrates, Protein Structure and Function, Amino Acid, Individual Amino Acid Metabolism, Lipids.

Biology has entered an era in which interdisciplinary cooperation is at an all-time high, practical applications follow basic discoveries more quickly than ever before, and new technologies--recombinant DNA, scanning tunneling microscopes, and more--are revolutionizing the way science is conducted. The potential for scientific breakthroughs with significant implications for society has never been greater. Opportunities in Biology reports on the state of the new biology, taking a detailed look at the disciplines of biology; examining the advances made in medicine, agriculture, and other fields; and pointing out promising research opportunities. Authored by an expert panel representing a variety of viewpoints, this volume also offers recommendations on how to meet the infrastructure needs--for funding, effective information systems, and other support--of future biology research. Exploring what has

been accomplished and what is on the horizon, Opportunities in Biology is an indispensable resource for students, teachers, and researchers in all subdisciplines of biology as well as for research administrators and those in funding agencies.

Concepts of Biology is designed for the single-semester introduction to biology course for non-science majors, which for many students is their only college-level science course. As such, this course represents an important opportunity for students to develop the necessary knowledge, tools, and skills to make informed decisions as they continue with their lives. Rather than being mired down with facts and vocabulary, the typical non-science major student needs information presented in a way that is easy to read and understand. Even more importantly, the content should be meaningful. Students do much better when they understand why biology is relevant to their everyday lives. For these reasons, Concepts of Biology is grounded on an evolutionary basis and includes exciting features that highlight careers in the biological sciences and everyday applications of the concepts at hand.We also strive to show the interconnectedness of topics within this extremely broad discipline. In order to meet the needs of today's instructors and students, we maintain the overall organization and coverage found in most syllabi for this course. A strength of Concepts of Biology is that instructors can customize the book, adapting it to the approach that works best in their classroom. Concepts of Biology also includes an innovative art program that incorporates critical thinking and clicker questions to help students understand--and apply--key concepts.

A representative cross-section of elastic biomolecules is covered in this volume, which combines seventeen contributions from leading research groups. State-of-the-art molecular mechanics experiments are described dealing with the elasticity of DNA and nucleoprotein complexes, titin and titin-like proteins in muscle, as well as proteins of the cytoskeleton and the extracellular matrix. The book speaks particularly to cell biologists, biophysicists, or bioengineers, and to senior researchers and graduate students alike, who are interested in recent advances in single-molecule technology (optical tweezers technique, atomic force microscopy), EM imaging, and computer simulation approaches to study nanobiomechanics. The findings discussed here have redefined our view of the role mechanical signals play in cellular functions and have greatly helped improve our understanding of biological elasticity in general.

How the amino acid sequence of a protein determines its three-dimensional structure is a major problem in biology and chemistry. Leading experts in the fields of NMR spectroscopy, X-ray crystallography, protein engineering and molecular modeling offer provocative insights into current views on the protein folding problem and various aspects for future progress.

This book is a guide for advanced undergraduates, post-graduates and researchers to the fundamental principles in studying kinetics and mechanism of processes concerning proteins. It provides a rare broad overview that concentrates on fundamental principles and understanding underlying the physics and chemistry. It is a single author text by someone who has direct experience in all of the areas covered.

This book provides a comprehensive overview of modern computer-based techniques for analyzing the structure, properties and dynamics of biomolecules and biomolecular processes. It is organized in four main parts; the first one deals with methodology of molecular simulations; the second one with applications of molecular simulations; the third one introduces bioinformatics methods and the use of experimental information in molecular simulations; the last part reports on selected applications of molecular quantum mechanics. This second edition has been thoroughly revised and updated to include the latest progresses made in the respective field of research.

This is a collection of papers presented and discussed at the first EBSA workshop held at Saltsj6baden outside stockholm in Sweden, July 6-10, 1986. The common theme of these papers is dynamics of biomolecules, and how the dynamics depends on the molecular structure and organi zation, and connects to and determines the biological function. This is a rapidly expanding field of research which combines many different aspects of molecular bio physics. Much material is new and presented for the first time. Even if the work so far has been of the kind that is usually called basic research, practical applications are clearly indicated in some articles, and are waiting around the corner in several other cases. At the workshop only one third of the time was used for the formal presentations and two thirds for discussion. To this should also be added discussions during the poster sessions. During these lively and unrecorded discussions fresh viewpoints emerged and new ideas were created. Ad mittedly, our knowledge at present is only fragmentary but when pieces of the puzzle are brought together at a workshop or in a publication of this kind more extended and sometimes unexpected contours and shapes become vi sible. It is our hope that this rapid publication of camera-ready manuscripts will transfer some of the spi rit at the workshop to the reader, and in his or her institute or laboratory initiate further discussions, bring forward more ideas and start new experimental ap roaches.

This book covers applications of computational techniques to biological problems. These techniques are based by an ever-growing number of researchers with different scientific backgrounds - biologists, chemists, and physicists. The rapid development of molecular biology in recent years has been mirrored by the rapid development of computer hardware and software. This has resulted in the development of sophisticated computational techniques and a wide range of computer simulations involving such methods. Among the areas where progress has been profound is in the modeling of DNA structure and function, the understanding at a molecular level of the role of solvents in biological phenomena, the calculation of the properties of molecular associations in aqueous solutions, computationally assisted drug design, the prediction of protein structure, and protein - DNA recognition, to mention just a few examples. This volume comprises a balanced blend of contributions covering such topics. They reveal the details of computational approaches designed for biomoleucles and provide extensive illustrations of current applications of modern techniques. A broad group of readers ranging from beginning graduate students to molecular biology professions should be able to find useful contributions in this selection of reviews.

Authors Dave Nelson and Mike Cox combine the best of the laboratory and best of the classroom, introducing exciting new developments while communicating basic principles of biochemistry.

First multi-year cumulation covers six years: 1965-70.

This book covers the recent innovations relating to various bioactive natural products (such as alkaloids, glycosides, flavonoids, anthraquinones, steroids, polysaccharides, tannins and polyphenolic compounds, volatile oils, fixed oils, fats and waxes, proteins and peptides, vitamins, marine products, camptothecin, piperines, carvacrol, gedunin, GABA, ginsenosides) and their applications in the pharmaceutical fields related to academic, research and industry.

The Principles of Biology sequence (BI 211, 212 and 213) introduces biology as a scientific discipline for students planning to major in biology and other science disciplines. Laboratories and classroom activities introduce techniques used to study biological processes and provide opportunities for students to develop their ability to conduct research.

Herbal Biomolecules in Healthcare Applications presents extensive detailed information on all the vital principles, basics and fundamental aspects of multiple herbal biomolecules in the healthcare industry. This book examines important herbal biomolecules including alkaloids, glycosides, flavonoids, anthraquinones, steroids, polysaccharides, tannins and polyphenolic compounds, terpenes, fats and waxes, proteins and peptides, and vitamins. These herbal biomacromolecules are responsible for different bioactivities as well as pharmacological potentials. A systematic understanding of the extraction, purification, characterization, applications of these herbal biomolecules and their derivatives in healthcare fields is developed in this comprehensive book. Chapters explore the key topics along with an emphasis on recent research and developments in healthcare fields by leading experts. They include updated literature review of the relevant key topics, good quality illustrations, chemical structures, flow charts, well-organized tables and case studies. Herbal Biomolecules in Healthcare Applications will be useful for researchers working on natural products and biomolecules with bioactivity and nutraceutical properties. Professionals specializing in scientific areas such as biochemistry, pharmacology, analytical chemistry, organic chemistry, clinics, or engineering focused on bioactive natural products will find this book useful. Provides a study of different type of biomolecules from herbal extracts and their bioactivities as well as their application in the healthcare industry Contributions by global leaders and experts from academia, industry and regulatory agencies, who have been considered as pioneers in the application of herbal biomolecules in the diverse healthcare fields Includes updated literature review along with practical examples and research case studies

Over the last three decades a lot of research on the role of metals in biochemistry and medicine has been done. As a result many structures of biomolecules with metals have been characterized and medicinal chemistry studied the effects of metal containing drugs. This new book (from the EIBC Book Series) covers recent advances made by top researchers in the field of metals in cells [the “metallome”] and include: regulated metal ion uptake and trafficking, sensing of metals within cells and across tissues, and identification of the vast cellular factors designed to orchestrate assembly of metal cofactor sites while minimizing toxic side reactions of metals. In addition, it features aspects of metals in disease, including the role of metals in neuro-degeneration, liver disease, and inflammation, as a way to highlight the detrimental effects of mishandling of metal trafficking and response to "foreign" metals. With the breadth of our recently acquired understanding of metals in cells, a book that features key aspects of cellular handling of inorganic elements is both timely and important. At this point in our understanding, it is worthwhile to step back and take an expansive view of how far our understanding has come, while also highlighting how much we still do not know. The content from this book will publish online, as part of EIBC in December 2013, find out more about the Encyclopedia of Inorganic and Bioinorganic Chemistry, the essential online resource for researchers and students working in all areas of inorganic and bioinorganic chemistry.

Fundamentals of Molecular Structural Biology reviews the mathematical and physical foundations of molecular structural biology. Based on these fundamental concepts, it then describes molecular structure and explains basic genetic mechanisms. Given the increasingly interdisciplinary nature of research, early career researchers and those shifting into an adjacent field often require a "fundamentals" book to get them up-to-speed on the foundations of a particular field. This book fills that niche. Provides a current and easily digestible resource on molecular structural biology, discussing both foundations and the latest advances Addresses critical issues surrounding macromolecular structures, such as structure-based drug discovery, single-particle analysis, computational molecular biology/molecular dynamic simulation, cell signaling and immune response, macromolecular assemblies, and systems biology Presents discussions that ultimately lead the reader toward a more detailed understanding of the basis and origin of disease

By providing expositions to modeling principles, theories, computational solutions, and open problems, this reference presents a full scope on relevant biological phenomena, modeling frameworks, technical challenges, and algorithms. Up-to-date developments of structures of biomolecules, systems biology, advanced models, and algorithms Sampling techniques for estimating evolutionary rates and generating molecular structures Accurate computation of probability landscape of stochastic networks, solving discrete chemical master equations End-of-chapter exercises

Molecular biophysics is a rapidly growing field of research that plays an important role in elucidating the mysteries of life's molecules and their assemblies, as well as the relationship between their structure and function. Introduction to Molecular Biophysics fills an existing gap in the literature on this subject by providing the reader with th

Biomolecules and the cell Biomolecules and the cell

an integrated approach to electron transfer phenomena This two--part stand-alone volume in the prestigious Advances in Chemical Physics series provides the most comprehensive overview of electron transfer science today. It draws on cutting-edge research from diverse areas of chemistry, physics, and biology-covering the most recent developments in the field, and pointing to important future trends. This initial volume includes: * A historical perspective spanning five decades * A review of concepts, problems, and ideas in current research * Electron transfer in isolated molecules and in clusters * General theory, including useful algorithms * Spectra and electron transfer kinetics in bridged compounds The second volume covers solvent control, ultrafast electron transfer and coherence effects, molecular electronics, electron transfer and chemistry, and biomolecules. Electron transfer science has seen tremendous progress in recent years. Technological innovations, most notably the advent of femtosecond lasers, now permit the real-time investigation of intramolecular and intermolecular electron transfer processes on a time scale of nuclear motion. New scientific information abounds, illuminating the processes of energy acquisition, storage, and disposal in large molecules, clusters, condensed phase, and biophysical systems. Electron Transfer: From Isolated Molecules to Biomolecules is the first book devoted to the exciting work being done in nonradiative electron transfer dynamics today. This two-part edited volume emphasizes the interdisciplinary nature of the field, bringing together the contributions of pioneers in chemistry, physics, and biology. Both theoretical and experimental topics are featured. The authors describe modern approaches to the exploration of different systems, including supersonic beam techniques, femtosecond laser spectroscopy, chemical syntheses, and methods in genetic and chemical engineering. They examine applications in such areas as supersonic jets, solvents, electrodes, semi- conductors, respiratory and enzymatic protein systems, photosynthesis, and more. They also relate electron transfer and radiationless transitions theory to pertinent physical phenomena, and provide a conceptual framework for the different processes. Complete with over two hundred illustrations, Part One reviews developments in the field since its inception fifty years ago, and discusses electron transfer phenomena in both isolated molecules and in clusters. It outlines the general theory, exploring areas of the con-

trol of kinetics, structure-function relationships, fluctuations, coherence, and coupling to solvents with complex spectral density in different types of electron transfer processes. Timely, comprehensive, and authoritative, Electron Transfer: From Isolated Molecules to Biomolecules is an essential resource for physical chemists, molecular physicists, and researchers working in nonradiative dynamics today.
CD-ROM includes animations, living graphs, biochemistry in 3D structure tutorials.
Pedagogically enriched, the book provides engaging chpter-end assessment exercises to enhance and strengthen learning of the readers

The nitrogen-containing ring structures are at the hub of metabolism and include ATP, nucleic acids, many coenzymes, metabolic regulators and integrators such as adenosine and GTP, signalling compounds such as cyclic nucleotides and plant cytokinins and biochemically functional pigmets of which haemoglobin, the cytochromes and chlorophyll are examples. This important book collates and integrates current knowledge of all the biologically important N-heterocyclic compounds, covering the relationship between their chemical structures and physiological functions within this key group of compounds. Few biochemical reaction sequences do not involve one of these compounds as a substrate, product or coenzyme and a full understanding of the interrelationship between their structure and function is vital for all those woorking in the field of biochemistry. Professor Eric Brown who has a huge wealth of experience in teaching and research on these compounds has written a very comprehensible and thorough book which will be of great value for advanced students and researchers in biochemistry and those at the interfacing subject areas of chemistry, biology and pharmacology including all those employed in researching biological function within pharmaceutical companies.
Biomolecular self-assembly provides a green, facile, and highly effective method to synthesize various functional nanomaterials that have exhibited considerable potential in the fields of nanotechnology, materials science, biomedicine, tissue engineering, food science, energy storage, and environmental science. In this collection of articles, we presented recent advance in the synthesis, characterization, and applications of self-assembled bio-nanomaterials. In a comprehensive review article, the controlled self--assembly of biomolecules including DNA, protein, peptide, enzymes, virus, and biopolymers via internal interactions and external simulations is introduced and discussed in detail. In other research articles, the self-assembly of DNA, protein, peptide, bio--drugs, liquid crystal polycarbonates, and diblock copolymers to various biomimetic/bioinspired nanomaterials and their potential applications in nanopatterning, sensors/biosensors, drug delivery, anti-parasite, and water purification are demonstrated.
Guide to Biochemistry provides a comprehensive account of the essential aspects of biochemistry. This book discusses a variety of topics, including biological molecules, enzymes, amino acids, nucleic acids, and eukaryotic cellular organizations. Organized into 19 chapters, this book begins with an overview of the construction of macromolecules from building-block molecules. This text then discusses the strengths of some weak acids and bases and explains the interaction of acids and bases involving the transfer of a proton from an acid to a base. Other chapters consider the effectiveness of enzymes, which can be appreciated through the comparison of spontaneous chemical reactions and enzyme-catalyzed reactions. This book discusses as well structure and function of lipids. The final chapter deals with the importance and applications of gene cloning in the fundamental biological research, which lies in the preparation of DNA fragments containing a specific gene. This book is a valuable resource for biochemists and students.
"The common etiological feature among the majority, if not all, of human diseases, is the impairment of crucial cellular events stemming from complex reactions at the molecular level. Precise understanding of these processes, such as structure-function relationships between biomolecules, could help guide the design of successful clinical interventions to prevent or halt diseases. Consequently, it is important to measure and characterize biomolecules at the finest possible granularity. Glycolipids, biomolecules comprised of a sugar (glycan) head and a lipid tail, serve as one of the key components of the cell membrane. Aberrant glycolipid metabolism is a hallmark of many pathologies, which accentuates their importance in disease pathogenesis. Despite their vital role, our present understanding of glycolipid biology remains incomplete, partly because of the dearth of technologies available to study them. Mass spectrometry (MS) has inarguably fueled much of our current knowledge on glycolipids. But, contemporary methods using this platform are not powerful enough to either detect low abundant glycolipids or elucidate subtle structural details that could facilitate uncovering of their precise biological functions. Often, the glycan and lipid components are analyzed separately, making correlation between structure and biological function impossible. Recent evidences have showcased that both glycan and lipid moieties dictate the overall function of glycolipids, which underlines the importance of structural analysis at the intact molecule level. In this respect, this dissertation was conceived to address the following aims, 1) To develop innovative MS methodologies to measure and characterize glycolipids in its intact, native form; and 2) To apply the developed methods in reasonably complex biological mixtures. Each method developed here is in-line with the following objectives: 1) to enhance detectability of glycolipids by increasing ionization efficiency, 2) to facilitate structural analysis, and 3) to improve quantification of glycolipids with potential for high-throughput applications. Both aims were addressed in four standalone projects that employed both commercially available standard glycolipids and complex biological samples. The first two projects sought to establish a method to determine double bond locations in unsaturated glycolipids. We exploited ozone-induced dissociation MS (OzID-MS), a relatively new fragmentation technique that uses ozone gas inside the collision cell of MS in lieu of conventional inert gas. Ozone reacts selectively to carbon-carbon double bonds, as such, the products of the ozonolysis in situ could be detected by MS and being used to locate the double bonds. Using complex bovine brain sample, this method revealed low abundant glycolipids, mostly isomers and isobars, that are otherwise non-detectable and non-distinguishable when conventional methods are used. We also discovered that the use of different adducts, such as [M+-Na]+, [M+Li]+, and [M+H]+, could provide distinct OzID-MS patterns. Thus, to rationalize the observed OzID-MS data, theoretical calculations were performed to establish the structures of ionized glycolipids in the gas-phase. The in silico generated models were consistent with the experimentally observed fragmentation patterns. Overall, these projects emphasized that innovative approaches like OzID-MS could uncover previously unknown molecular species in a complex sample and the use of different adducts could provide distinct levels of structural detail. The third project aimed to establish a method that exploits a relatively new approach to quantitation called isobaric labeling, a technique that has been extensively used in proteomics and glycomics fields as a multiplexed analytical tool. It involves the covalent attachment of a molecular tag to an analyte that generates reporter ions when fragmented in MS. The intensities of the reporter ions serve as surrogate measures of their relative concentration in the sam-

ple. Because this tag only reacts with a reactive aldehyde or ketone, which is absent in native glycolipids structures, we first employed a chemoselective oxidation approach to introduce a reactive site in the intact glycolipids, using sialic acid-containing glycolipids called gangliosides as a model. When applied to complex porcine brain total lipids extract, this method not only enabled multiplexed analysis of up to six independent samples and improved sensitivity of gangliosides by two orders, but also provided rich spectra that facilitated the structural analysis of both the sugar head group and lipid backbone. The fourth project addressed the increasing demand for heavy isotope labeled internal standards, which are currently limited and costly, while improving the detectability, facilitating structural characterization, and enabling multiplexed analysis. In this project, we employed permethylation, a reaction that converts active protons in the molecule to a methyl group using methyl iodide. In this so-called differential isotope labeling approach, using methyl iodide with either light (12C) or heavy (13C) carbon isotopes, two different samples were separately labeled, one of which is a pooled aliquot of individual samples, then mixed and analyzed by LC-MS. The pooled sample, labeled with heavy carbon isotope served as a universal internal standard which was spiked to individual samples at constant amount. Samples were analyzed using reversed-phase liquid chromatography mass spectrometry (RPLC-MS), and the resulting peak areas were used to calculate the 12C/13C ratio as a surrogate measure of the relative concentration of analytes in each sample. Using an in vitro model of Gaucher's disease, characterized by accumulation of neutral glycolipids, temporal changes in glycolipid profile were measured and each glycolipid was annotated using retention time and MS/MS fragmentation."--Abstract from author supplied metadata. [This abstract has been edited to remove characters that will not display in this system. Please see the PDF for the full abstract.]

Among the major challenges facing society today, seeking renewable alternatives to petroleum-based fuels and manufactured goods is critically important to reducing society’s dependency on petroleum and tackling environmental issues associated with petroleum use. In recent years there has been considerable research targeted toward the development of plant-derived bioproducts to replace petrochemical feedstocks for both fuel and manufacturing. Plants not only provide a large amount of renewable biomass, but their biochemical diversity also offers many chemical and molecular tools for the production of new products through biotechnology. Plant Bioproducts is an introduction to the production and application of plant bioproducts, including biofuels, bioplastics, and biochemicals for the manufacturing sector. Contributing authors examine various bioproducts with respect to their basic chemistry, relationship to current petrochemical-based products, and strategies for their production in plants. Chapters cover the integrated roles of agronomy, plant breeding, biotechnology, and biorefining in the context of bioproduct development. Environmental, economic, ethical, and social issues surrounding bioproducts, including the use of genetically modified crops, challenges to food security, and consumer acceptance, are also covered.

Medical Biochemistry, Second Edition covers the structure and physical and chemical properties of hydrocarbons, lipids, proteins and nucleotides in a straightforward and easy to comprehend language. The book develops these concepts into the more complex aspects of biochemistry using a systems approach, dedicating chapters to the integral study of biological phenomena, including particular aspects of metabolism in some organs and tissues, the biochemical bases of endocrinology, immunity, vitamins, hemostasis, autophagy and apoptosis. Additionally, the book has been updated with full-color figures, chapter summaries, and further medical examples to improve learning and illustrate the concepts described in the book. Sections cover bioenergetics and metabolic syndromes, antioxidants to treat disease, plasma membranes, ATPases and monocarboxylate transporters, the human microbiome, carbohydrate and lipid metabolism, autophagy, virology and epigenetics, non-coding, small and long RNAs, protein misfolding, signal transduction pathways, vitamin D, cellular immunity and apoptosis. Integrates basic biochemistry principles with molecular biology and molecular physiology Illustrates basic biochemical concepts through medical and physiological examples Utilizes a systems approach to understanding biological phenomena Fully updated for recent studies and expanded to include clinically relevant examples and succinct chapter summaries

"The chapters in this book survey the progress in simulating biomolecular dynamics.... The images conjured up by this work are not yet universally loved, but are beginning to bring new insights into the study of biological structure and function. The future will decide whether this scientific movement can bring forth its Picasso or Modigliani." –from the Foreword by Peter G. Wolynes, Bullard-Welch Foundation Professor of Science, Rice University This book highlights the state-of-art in coarse-grained modeling of biomolecules, covering both fundamentals as well as various cutting edge applications. Coarse-graining of biomolecules is an area of rapid advances, with numerous new force fields having appeared recently and significant progress made in developing a systematic theory of coarse-graining. The contents start with first fundamental principles based on physics, then survey specific state-of-art coarse-grained force fields of proteins and nucleic acids, and provide examples of exciting biological problems that are at large scale, and hence, only amenable to coarse-grained modeling. Introduces coarse-grained models of proteins and nucleic acids. Showcases applications such as genome packaging in nuclei and understanding ribosome dynamics Gives the physical foundations of coarse-graining Demonstrates use of models for large-scale assemblies in modern studies Garegin A. Papoian is the first Monroe Martin Associate Professor with appointments in the Department of Chemistry and Biochemistry and the Institute for Physical Science and Technology at the University of Maryland.