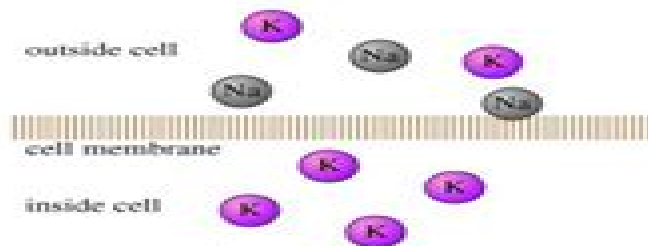


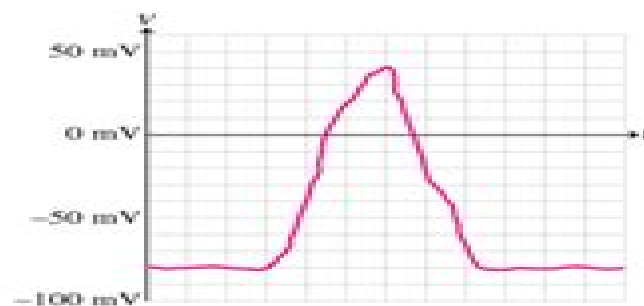
PHY2400: Advanced Physics For biologists

Lecture 2 tutorial

1. In its resting state, the membrane surrounding a neuron is permeable to potassium ions but only slightly permeable to sodium ions. Thus, positive K ions can flow through the membrane in an attempt to equalize K concentration, but Na ions cannot as quickly. This leads to an excess of Na ions outside of the cell. If the space outside the cell is defined as zero electric potential, then the electric potential of the interior of the cell is negative. This resting potential is typically about -80mV . A schematic of this situation is shown in the figure.



In response to an electrical stimulus, certain channels in the membrane can become permeable to Na ions. Due to the concentration gradient, Na ions rush into the cell and the interior of the cell reaches an electric potential of about 40mV . This process is termed depolarization. In response to depolarization, the membrane again becomes less permeable to Na ions, and the K ions flow out of the interior of the cell through channels established by the positive electric potential inside of the cell. This then reestablishes the resting potential. This is termed repolarization. Only a small percentage of the available Na and K ions participate in each depolarization/repolarization cycle, so the cell can respond to many stimuli in succession without depleting its "stock" of available Na and K ions. A graph of an electric potential inside a cell vs. time is shown in the next figure for a single depolarization/repolarization cycle.



(a) During the resting phase, what is the electric potential energy of a typical Na ion outside of the cell?

Physics For Biologists

Paul Davidovits



Physics For Biologists:

Physics for Biologists George Duncan, 1975-01-01 **Physics in Biology and Medicine** Paul Davidovits, 2008 This third edition covers topics in physics as they apply to the life sciences specifically medicine physiology nursing and other applied health fields It includes many figures examples and illustrative problems and appendices which provide convenient access to the most important concepts of mechanics electricity and optics **Introductory Physics for Biological Scientists** Christof M. Aegerter, 2018-11-08 Why do elephants have sturdier thigh bones than humans Why can't ostriches fly How do bacteria swim through fluids With each chapter structured around relevant biological case studies and examples this engaging full colour book introduces fundamental physical concepts essential in the study of biological phenomena Optics is introduced within the context of butterfly wing colouration electricity is explained through the propagation of nerve signals and accelerated motion is conveniently illustrated using the example of the jumping armadillo Other key physical concepts covered include waves mechanical forces thermodynamics and magnetism and important biological techniques are also discussed within this context such as gel electrophoresis and fluorescence microscopy A detailed appendix provides further discussion of the mathematical concepts utilised within the book and numerous exercises and quizzes allow readers to test their understanding of key concepts This book is invaluable to students aiming to improve their quantitative and analytical skills and understand the deeper nature of biological phenomena **A Question of Physics** Paul Buckley, F. David Peat, 1979-12-15 This book contains interviews with physicists biologists and chemists who have been involved in some of the most exciting discoveries in modern scientific thought The conversations with Bohm Pattee Penrose Rosen Rosenfeld Somorjai Weizsacker Wheeler and Nobel prizewinners Heisenberg Dirac and Prigogine explore issues which have shaped modern physics and those which hint at what may form the next scientific revolution The discussions range over a set of basic problems in physical theory and their possible solutions the understanding of space and time quantum and relativity theories and recent attempts to unite them and deal with related questions in theoretical biology The approach is non technical with an emphasis on the assumptions of modern science and their implications for understanding the world we live in The book which originated in a highly successful radio series provides a vivid first hand account of some of the astounding and perplexing developments in modern science a rare overview that will intrigue the informed non scientist and the scientist alike **Physics for biology and pre-medical students** Desmond M. Burns, 1973 Physics And Biology: From Molecules To Life Jean-francois Allemand, Pierre Desbiolles, 2014-10-15 Do you often lose your keys You will find in this book the best strategy to find them or at least the one deduced from statistical physics What is the link with biology Some proteins use the same strategy to find their target inside a living cell This example illustrates one of the many links between physics and biology These links result from an intense research activity in the past years at the interface between those two disciplines This book describes some of the most recent progresses at this interface from instrumental progresses used in

biology to the mechanical description of a cell to molecular motors from brain activity mechanisms to auditory or sensory perception Many fields are covered from the molecular to the scale at the organ level A few biological notions are presented in the first chapter that may help to access the biological aspects of the others In the end this book may interest people passionate in science from the simple amateur to the advanced researcher level

Basic Biophysics for Biology Edward K. Ph.D Yeagers, 2018-01-18 Basic Biophysics for Biology presents the fundamental physical and chemical principles required to understand much of modern biology The author has made extensive use of illustrations rather than a mathematical approach to establish connections between macroscopic world models and submicroscopic phenomena Topics covered include the nucleus atomic and molecular structure the principles of thermodynamics free energy catalysis diffusion and heat flow Students and professionals in general biology physiology genetics and radiation biology will appreciate this carefully prepared non mathematical volume

Physics for Biology and Medicine Irvin Whaley Richardson, Ejler Baastrup Neergaard, Beverley Boydston Richardson, 1974-01 Textbook

Physics With Illustrative Examples From Medicine and Biology George B. Benedek, Felix M.H. Villars, 2013-09-14 A reissue of a classic book intended for undergraduate courses in biophysics biological physics physiology medical physics and biomedical engineering This is an introduction to mechanics with examples and problems from the medical and biological sciences covering standard topics of kinematics dynamics statics momentum and feedback control and stability but with the emphasis on physical and biological systems The book can be used as a supplement to standard introductory physics courses as well as for medical schools medical physics courses and biology departments The three volumes combined present all the major topics in physics Originally published in 1974 from the authors typescript this reissue will be edited corrected typeset the art redrawn and an index added plus a solutions manual will also be available

Physics for Biology and Medicine I. W. Richardson, Ejler B. Neergaard, Ejler D. Neergaard, B.B. Richardson, 1972

Glimpsing Reality Paul Buckley, F. David Peat, 1996 A collection of interviews and conversations with physicists biologists and chemists involved in this century's most exciting discoveries in modern scientific thought originating in a Canadian Broadcasting Corp radio series Scientists including Werner Heisenberg and David Joseph Bohm discuss the origins and recent developments of quantum and relativity theories and theoretical biology Includes a glossary Accessible to students and general readers Previously published in 1979 under the title A Question of Physics this edition adds an overview of advances in the field plus a new conversation and two new essays No index Annotation copyright by Book News Inc Portland OR

Physics With Illustrative Examples From Medicine and Biology George B. Benedek, Felix M.H. Villars, 2000-09-08 A reissue of this 3 volume set of classic books newly edited and typeset as part of the Biological Physics Series in response to numerous requests Intended for undergraduate courses in biophysics biological physics physiology medical physics and biomedical engineering they offer an introduction to mechanics statistical physics and electricity and magnetism with examples and problems from the medical and biological sciences They can thus be used as

supplements to standard introductory physics courses and as texts for medical schools medical physics courses and biology departments and solutions manuals will be available The authors are recognised experts in the field and will also publish an upper level graduate text in biological physics at a later date Problems of Biological Physics Lev A. Blumenfeld,1981 This book was written to a not inconsiderable degree on the basis of the course The Problems of Modern Biophysics which the author gives to the students and postgraduates of the Biophysical Department at Moscow University School of Physics It is meant for those who have a sufficiently good background in physics as well as in biology I have tried to make this book intelligible to a broader circle of readers i e to physicists not competent enough in biology and to biologists not competent enough in physics I hope that I have succeeded This book is neither a textbook nor a systematic account of a field of science I think that in modern biological physics i e in the branch of biology where people having fundamental physical or physico chemical education are working so many specific answers have been recently obtained that it is now just the right time to ask at least several questions of a general nature The aim of this book is to formulate such questions though their choice is to a considerable degree determined by the authors preferences and interests **Intermediate Physics for Medicine and Biology** Russell K. Hobbie,Bradley J. Roth,2007-09-09 This text bridges the gap between introductory physics and its application to the life sciences It is intended for advanced undergraduates and beginning graduate students The Fourth Edition is updated to include new findings discussion of stochastic processes and expanded coverage of anatomy and biology The text includes many problems to test the student s understanding and chapters include useful bibliographies for further reading Its minimal prerequisites and wide coverage make it ideal for self study The fourth edition is updated throughout to reflect new developments **Physics and Biology** ,1994 Newton Rules Biology Colin J. Pennycuick,1992 This book invites biologists to look at their science from the point of view of Newtonian physics Because biology occupies that range of scale over which Newton s mechanics can account for physical processes to a level of precision appreciably higher than that to which biologists are accustomed this is an exercise that can yield new insights and a fuller understanding of biological processes Writing in a clear accessible style the author demonstrates the operation of physical laws at all levels from cellular structures to entire ecosystems In fact although ecology might seem an unpromising field for a mechanical approach it is here that considerations of such Newtonian concepts as mass and rates of flow are most valuable yielding new information on the constraints to the dynamics and development of integrated systems including those that contain human populations

Biology in Physics Konstantin Yu. Bogdanov,1999-10-21 *Biology in Physics* is a radical new book which bridges the gap between biology and physics The aim is to promote an interdisciplinary exchange of scientific information and ideas in order to stimulate cooperation in research The scope of this volume explores both the concepts and techniques of biophysics and illustrates the latest advances in our understanding of many of the specific mechanisms that are used by living organisms This volume represents a special effort to bring together the information that would allow a nonbiologically oriented physicist

to appreciate the important role that physics plays in life sciences An introduction to biophysics for non specialist Covers all the important topics in modern biophysics Takes account of the latest information emerging from biophysical projects Reports on novel therapeutic strategies Presents an advanced level overview of mechanisms that regulate a variety of processes in organisms ranging from bacterial to whales Basic Physics for Biologists, Medical Scientists and Biochemists Hector L Mancini, 2018-03-15 This book explains the principles of physics in the context of applications to biology medicine and biochemistry The main objective is to provide a strong background so that readers will be able to follow and understand the new developments in research and the basic principles involved in the new instrumentation used in these areas of science at present The topics included cover all the fundamental Laws of Physics relevant to understanding how physics impacts biological sciences and the interaction between live organisms and the environment **Physics for Applied Biologists** N. C. Hilyard, H. C. Biggin, 1977 *Physics of Life* Clas Blomberg, 2007-10-01 The purpose of the book is to give a survey of the physics that is relevant for biological applications and also to discuss what kind of biology needs physics The book gives a broad account of basic physics relevant for the applications and various applications from properties of proteins to processes in the cell to wider themes such as the brain the origin of life and evolution It also considers general questions of common interest such as reductionism determinism and randomness where the physics view often is misunderstood The subtle balance between order and disorder is a repeated theme appearing in many contexts There are descriptive parts which shall be sufficient for the comprehension of general ideas and more detailed formalistic parts for those who want to go deeper and see the ideas expressed in terms of mathematical formulas Describes how physics is needed for understanding basic principles of biology Discusses the delicate balance between order and disorder in living systems Explores how physics play a role high biological functions such as learning and thinking

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