

MODULE 1: CELLS AS THE BASIS OF LIFE

Cells:

Cell: A cell is the smallest structural and functional unit of a living organism. Every living organism is made of cells.

- A cell is a sac (**cell membrane** {all cells have a membrane}) which has fluid (**cytoplasm**) and floaty things (**organelles**)
- The bigger the cell, the more nutrients it needs, smaller its SA:V ratio
- If the cell is too big, it will not be able to get the nutrients it needs, and get rid of its wastes quick enough to survive.

What are organelles? An organelle is a membrane bound compartment which each have their own job of keeping the cell alive.

Discuss the nucleus: The nucleus is the powerhouse of the cell, which contains all the genetic information (DNA). The nucleus is also needed for growth, repair and proper functioning.

What consists within the nucleus: Nucleolus.

Discuss the Nucleolus: A nucleolus is mainly made up of ribonucleic acid (RNA), and is also where the ribosomes are made.

What are ribosomes: Ribosomes make protein, they are made out of ribosomal RNA dna protein, and are found connected to the endoplasmic reticulum (ER).

Discuss endoplasmic reticulum: Endoplasmic reticulum is a network of flattened interconnected membranes where the substances can move through their tunnel like structure. There are two types of ER

- > rough ER (has ribosomes) - processes and modifies pro-teins
- > smooth ER (not have ribosomes) - makes lipids

Golgi bodies/ apparatus are: Golgi bodies are flattened membrane stacks (like pancakes, **WHICH ARE NOT INTERCONNECTED**, job to process and package substances the cell creates (like proteins made though ER).

What is the pinched organelle around the Golgi bodies: The product of a Golgi body is pinched off around the substance to form a vesicle. Vesicle transfers the packages to specific locations within the cell, or even excreted out of the cell, an example of a vesicle is a lysosome.

What do lysosomes contain: Lysosomes contain digestive enzymes which are used to break down substances such as; cellular waste and foreign particles.

Energy transformation: Cell wall is found in: plant, fungal and prokaryotic cells. The cell wall is the external structure surrounding the cell membrane which gives the cell strength and protection

Discuss chloroplast: Chloroplast is a disk shaped organelle which is only found in plants. They have a double membrane, have their own DNA, packed with chlorophyll. Chloroplast captures light energy(sun) and uses it to perform photosynthesis (created glucose +sugar) ***LIGHT ENERGY INTO CHEMICAL ENERGY.**

Discuss mitochondria: Mitochondria is found in both animal and plant cells. They also contain a double membrane, their own DNA, and their function is to perform chemical respiration: oxygen + glucose = ATP *The amount of mitochondria in a cell depends on how much energy the cell type needs.

Structure and function

Biology Modules

**Elena Taverna, Felipe Mora-
Bermúdez, Giuseppe Testa**



Biology Modules:

Systems Biology Lilia Alberghina, Hans V. Westerhoff, 2007-10-04 For life to be understood and disease to become manageable the wealth of postgenomic data now needs to be made dynamic This development requires systems biology integrating computational models for cells and organisms in health and disease quantitative experiments high throughput genome wide living cell in silico and new concepts and principles concerning interactions This book defines the new field of systems biology and discusses the most efficient experimental and computational strategies The benefits for industry such as the new network based drug target design validation and testing are also presented *Advanced Biology for You* Gareth Williams, 2000 Designed to be motivating to the student this book includes features that are suitable for individual learning It covers the AS Level and core topics of almost all A2 specifications It provides many questions for students to develop their competence It also includes sections on Key Skills in Biology Practical Skills and Study Skills A Guide to Undergraduate Science Course and Laboratory Improvements National Science Foundation (U.S.). Directorate for Science Education, 1979

Explanation in Biology Pierre-Alain Braillard, Christophe Malaterre, 2015-06-10 Patterns of explanation in biology have long been recognized as different from those deployed in other scientific disciplines especially that of physics Celebrating the diversity of interpretative models found in biology this volume details their varying types as well as explaining their relationships to one another It covers the key differentials with other sciences in the nature of explanation such as the existence in biology of varieties unheard of in the physical sciences such as teleological evolutionary and even functional explanations Offering a wealth of fresh analysis of the phenomenon chapters examine aspects ranging from the role of mathematics in explaining cell development to the complexities thrown up by evolutionary developmental biology where explanation is altered by multidisciplinarity itself They cover major domains such as ecology and systems biology as well as contemporary trends such as the mechanistic explanations spawned by progress in molecular biology With contributions from researchers of many different nationalities the book provides a many angled perspective on a revealing feature of the discipline of biology **Systems Biology** Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald, 2016-06-27 This advanced textbook is tailored for an introductory course in Systems Biology and is well suited for biologists as well as engineers and computer scientists It comes with student friendly reading lists and a companion website featuring a short exam prep version of the book and educational modeling programs The text is written in an easily accessible style and includes numerous worked examples and study questions in each chapter For this edition a section on medical systems biology has been included Systems Biology Robert A. Meyers, 2012-07-02 Systems biology is a relatively new biological study field that focuses on the systematic study of complex interactions in biological systems thus using a new perspective integration instead of reduction to study them Particularly from year 2000 onwards the term is used widely in the biosciences and in a variety of contexts Systems biology is the study of the interconnected aspect of molecular cellular tissue whole

animal and ecological processes and comprises mathematical and mechanistic studies of dynamical mesoscopic open spatiotemporally defined nonlinear complex systems that are far from thermodynamic equilibrium Math and Bio 2010 Lynn Arthur Steen, 2005 Math and bio 2010 grew out of Meeting the Challenges Education across the Biological Mathematical and Computer Sciences a joint project of the Mathematical Association of America MAA the National Science Foundation Division of Undergraduate Education NSF DUE the National Institute of General Medical Sciences NIGMS the American Association for the Advancement of Science AAAS and the American Society for Microbiology ASM Foreword p vi

Advances in Systems Biology Igor I. Goryanin, Andrew B. Goryachev, 2011-12-08 The International Society for Systems Biology ISSB is a society aimed at advancing world wide systems biology research by providing a forum for scientific discussions and various academic services The ISSB helps coordinate researchers to form alliances for meeting the unique needs of multidisciplinary and international systems biology research The annual International Conference on Systems Biology ICSB serves as the main meeting for the society and is one of the largest academic and commercial gatherings under the broad heading of Systems Biology *Systems Biology* Fred Boogerd, Frank J. Bruggeman, Jan-Hendrik S. Hofmeyr, H.V. Westerhoff, 2007-03-20 Systems biology is a vigorous and expanding discipline in many ways a successor to genomics and perhaps unprecedented in its combination of biology with a great many other sciences from physics to ecology from mathematics to medicine and from philosophy to chemistry Studying the philosophical foundations of systems biology may resolve a longer standing issue i.e. the extent to which Biology is entitled to its own scientific foundations rather than being dominated by existing philosophies Answers the question of what distinguishes the living from the non living An in depth look to a vigorous and expanding discipline from molecule to system Explores the region between individual components and the system

Evolutionary Systems Biology Anton Crombach, 2021-08-05 This new edition captures the advances made in the field of evolutionary systems biology since the publication of the first edition The first edition focused on laying the foundations of evolutionary systems biology as an interdisciplinary field where a way of thinking and asking questions is combined with a wide variety of tools both experimental and theoretical computational Since publication of the first edition evolutionary systems biology is now a well known term describing this growing field The new edition provides an overview of the current status and future developments of this interdisciplinary field Chapters highlight several key achievements from the last decade and outline exciting new developments including an understanding of the interplay between complexity and predictability in evolutionary systems new viewpoints and methods to study organisms in evolving populations at the level of the genome gene regulatory network and metabolic network and better analysis and modeling techniques that will open new avenues of scientific inquiry Cell biology of brain development and evolution Elena Taverna, Felipe

Mora-Bermúdez, Giuseppe Testa, 2023-04-20 *Nelson Modular Science* Paul Collison, Peter Ellis, 2003 The Nelson Modular Science series is made up of three books divided into single double and triple award modules presented in an accessible

format Book 1 covers the six single award and one coursework modules Book 2 contains six double award modules and Book 3 covers the six triple award modules Each module is covered in self contained units This teacher s file includes practical support sheets and addresses Sc1 investigations Works sheets are provided to integrate the use of ICT throughout science Additional GCSE style questions and modular tests should enhance learning and recall of information *System Biology Methods and Tools for Integrating Omics Data - Volume II* Liang Cheng,Lei Deng,Mingxiang Teng,2022-09-07 **Synthetic Biology for Therapeutics** Urartu Ozgur Safak Seker,2024-11-18 Synthetic biology is enabling scientists to use engineered genetic circuits in the cells as the basis for the development of new living therapeutics and as a powerful new weapon in the fight against diseases especially cancer Bacteria mediated therapy is a promising alternative cancer treatment The book covers the recent developments of cellular therapies from a synthetic biology perspective including engineered microbial therapies CAR T therapies etc and is an indispensable guide to scientists in both biotechnology and medicine

Application of Network Theoretic Approaches in Biology Rinku Sharma,Josh Clevenger,Mallana Gowdra Mallikarjuna,Sudeepto Bhattacharya,Manish Kumar Pandey,2023-08-25 The biological complexity essentially includes and involves processes that are mediated through explicitly non linear interactions that are often typically entangled in nature These comprise a myriad of interactions among a vast number of entities such as genes proteins metabolites and species widely varying in scale These interactions render biological systems across spatial and temporal scales as complex adaptive systems having features like self organisation modularity emergence non linear interactions collective response and adaptation The theory of complex networks offers an appropriate formal framework for modelling such complex systems The enormous wealth of biological data generated by high throughput techniques as also through empirical investigations can be analysed using the aforementioned formal framework to obtain important insights into biological complexity The concept of networks can be used 1 to explore the relationships between entities resulting in network generation 2 to guide the analytic procedure based on existing network s as prior knowledge and 3 to analyze the prior network s regarding their topology and attributes Complex networks being ubiquitous permeate the biological systems across spatial and temporal scales The objective of this collection is to highlight some very salient features of such inherent complexity in biological systems by adopting a network theoretic perspective The anticipated pay off is obtaining a deeper insight explicitly into the systems level interactions and the emergent complex behaviour of the systems Also investigating the propulsive forces which lend various networks with akin topological characteristics that would help to merge vivid information related to various molecular interactions into a single framework thereby permitting a structural perspective of the cellular dynamics The application may include exploring the disease environmental stress response and trait mechanism using different omics platforms candidate gene discovery and validation network guided discovery and deployment of omics approaches in biology modern genetic improvement methods for delivering genes in addition to high throughput and precise phenotyping methodologies exploring

the disease environmental stress response mechanism marker re prioritization network guided biomarker discovery etc

BioMath in the Schools Margaret B. Cozzens, Fred S. Roberts, 2011 Even though contemporary biology and mathematics are inextricably linked high school biology and mathematics courses have traditionally been taught in isolation But this is beginning to change This volume presents papers related to the integration of biology and mathematics in high school classes The first part of the book provides the rationale for integrating mathematics and biology in high school courses as well as opportunities for doing so The second part explores the development and integration of curricular materials and includes responses from teachers Papers in the third part of the book explore the interconnections between biology and mathematics in light of new technologies in biology The last paper in the book discusses what works and what doesn't and presents positive responses from students to the integration of mathematics and biology in their classes

Introduction to Bioorganic Chemistry and Chemical Biology David Van Vranken, Gregory A. Weiss, 2018-10-08 Introduction to Bioorganic Chemistry and Chemical Biology is the first textbook to blend modern tools of organic chemistry with concepts of biology physiology and medicine With a focus on human cell biology and a problems driven approach the text explains the combinatorial architecture of biooligomers genes DNA RNA proteins glycans lipids and terpenes as the molecular engine for life Accentuated by rich illustrations and mechanistic arrow pushing organic chemistry is used to illuminate the central dogma of molecular biology Introduction to Bioorganic Chemistry and Chemical Biology is appropriate for advanced undergraduate and graduate students in chemistry and molecular biology as well as those going into medicine and pharmaceutical science Please note that Garland Science flashcards are no longer available for this text However the solutions can be obtained through our Support Material Hub link below but should only be requested by instructors who have adopted the book on their course

Gene Regulation Explored by Systems Biology in Livestock Science Andressa Oliveira De Lima, Priyanka Banerjee, Aline Silva Mello Cesar, 2022-04-27 *Computational Methods in Systems Biology* David Gilbert, Monika Heiner, 2012-09-28 This book constitutes the thoroughly refereed conference proceedings of the 10th International Conference on Computational Methods in Systems Biology CMSB 2012 held in London UK during October 3-5 2012 The 17 revised full papers and 8 flash posters presented together with the summaries of 3 invited papers were carefully reviewed and selected from 62 submissions The papers cover the analysis of biological systems networks and data ranging from intercellular to multiscale Topics included high performance computing and for the first time papers on synthetic biology

The Role of Theory in Advancing 21st-Century Biology National Research Council, Division on Earth and Life Studies, Board on Life Sciences, Committee on Defining and Advancing the Conceptual Basis of Biological Sciences in the 21st Century, 2008-02-22 Although its importance is not always recognized theory is an integral part of all biological research Biologists theoretical and conceptual frameworks inform every step of their research affecting what experiments they do what techniques and technologies they develop and use and how they interpret their data By examining how theory can help

biologists answer questions like What are the engineering principles of life or How do cells really work the report shows how theory synthesizes biological knowledge from the molecular level to the level of whole ecosystems The book concludes that theory is already an inextricable thread running throughout the practice of biology but that explicitly giving theory equal status with other components of biological research could help catalyze transformative research that will lead to creative dynamic and innovative advances in our understanding of life

Biology Modules Book Review: Unveiling the Magic of Language

In a digital era where connections and knowledge reign supreme, the enchanting power of language has are more apparent than ever. Its ability to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Biology Modules**," written by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound affect our existence. Throughout this critique, we will delve to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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