

## TOPIC 1: CELL BIOLOGY

### 1.1. Introduction to cells

#### Cell theory:

- All living things are composed of cells
- The cell is the smallest unit of life
- Cells only arise from pre-existing cells

#### Atypical examples

- **Striated muscle** → (challenge: one nucleus) long and multi-nucleated
- **Fungal hyphae** → (challenge: single unit) very large, multi-nucleated, continuous cytoplasm
- **Chlamydomonas** → (challenge: simple and small) gigantic, complex form

#### Functions of life (MR TIGRIN)

1. **Metabolism** – all the chemical reactions in the cell which are responsible for all the actions of organisms (e.g. respiration)
2. **Response** – living things can respond to changes in the environmental conditions
3. **Homeostasis** – the maintenance and regulation of internal cell conditions (e.g. water and pH)
4. **Growth** – living things can grow or change in size/shape
5. **Reproduction** – living things reproduce offspring
  - **Sexual reproduction** (two parents)
  - **Asexual reproduction** (one parent)
6. **Excretion** – the removal of metabolic waste
7. **Nutrition** – feeding by either the synthesis of organic molecules (e.g. photosynthesis) or the absorption of organic matter

#### Surface Area : Volume

Plasma membrane is responsible for import/export in the cell.

#### SMALLER THE CELL:

- Better to **lose heat** so that enzymes do not denature
- Greater SA:Vol ratio for diffusion → **cell more efficient**
- Diffusion pathway is shorter → cell more efficient

#### GREATER THE CELL:

- Decreased SA:Vol ratio → cell conserve better heat

**Example 1:** Intestine folded covered of villi and microvilli → create larger SA:Vol → greater rate of absorption

**Example 2:** Lungs made of alveoli → create larger SA:Vol

#### Magnification Formula



$$1\text{mm} = 1000\mu\text{m (micrometres)}$$

$$1\text{mm} = 1.000.000\text{nm (nanometres)}$$

# Ib Biology Sl 2013 Paper 2

**Maurizio Ruzzi, Giuseppe Colla  
, Youssef Roupael**



## **Ib Biology SI 2013 Paper 2:**

*Introducing the IB Diploma Programme* Marc Abrioux, Jill Rutherford, 2013-02-14 Schools wishing to introduce the IB diploma programme are faced with major investment in terms of time effort and money in order to become authorised This manual is a resource for schools already offering the diploma as well as for prospective diploma schools

**Principles of Virology, Volume 2** S. Jane Flint, Vincent R. Racaniello, Glenn F. Rall, Theodora Hatzioannou, Anna Marie Skalka, 2020-08-03 Principles of Virology the leading virology textbook in use is an extremely valuable and highly informative presentation of virology at the interface of modern cell biology and immunology This text utilizes a uniquely rational approach by highlighting common principles and processes across all viruses Using a set of representative viruses to illustrate the breadth of viral complexity students are able to understand viral reproduction and pathogenesis and are equipped with the necessary tools for future encounters with new or understudied viruses This fifth edition was updated to keep pace with the ever changing field of virology In addition to the beloved full color illustrations video interviews with leading scientists movies and links to exciting blogposts on relevant topics this edition includes study questions and active learning puzzles in each chapter as well as short descriptions regarding the key messages of references of special interest Volume I Molecular Biology focuses on the molecular processes of viral reproduction from entry through release Volume II Pathogenesis and Control addresses the interplay between viruses and their host organisms on both the micro and macroscale including chapters on public health the immune response vaccines and other antiviral strategies viral evolution and a brand new chapter on the therapeutic uses of viruses These two volumes can be used for separate courses or together in a single course Each includes a unique appendix glossary and links to internet resources Principles of Virology Fifth Edition is ideal for teaching the strategies by which all viruses reproduce spread within a host and are maintained within populations This edition carefully reflects the results of extensive vetting and feedback received from course instructors and students making this renowned textbook even more appropriate for undergraduate and graduate courses in virology microbiology and infectious diseases

**Protein Misfolding** Rossen Donev, 2020-01-13 Protein Misfolding Volume 118 covers the wide spectrum of diseases and disorders that are attributed to protein misfolding including degenerative and neurodegenerative cardiovascular renal glaucoma cancer cystic fibrosis Gaucher's disease and many others Specific chapters cover Mass spectrometric approaches for profiling protein folding and stability Biomembranes a key player in protein misfolding how Genetic and environmental factors interact to disrupt proteostasis and trigger protein misfolding diseases Formation of oligomers and large amorphous aggregates by intrinsically disordered proteins Protein misfolding in ER stress with applications to cardiovascular and renal disease and much more Integrates methods for studying protein misfolding factors that trigger this process and its role in a wide spectrum of diseases and disorders Contains timely chapters written by well renowned authorities in their field Provides data that is well supported by a number of high quality illustrations figures and

tables and targets a very wide audience of specialists researchers and students

**Ehrlich's Geomicrobiology** Henry Lutz Ehrlich,Dianne K. Newman,Andreas Kappler,2015-10-15 Advances in geomicrobiology have progressed at an accelerated pace in recent years Ehrlich s Geomicrobiology Sixth Edition surveys various aspects of the field including the microbial role in elemental cycling and in the formation and degradation of minerals and fossil fuels Unlike the fifth edition the sixth includes many expert contributors

*Biostimulants in Agriculture II: Towards a Sustainable Future* Maurizio Ruzzi,Giuseppe Colla ,Youssef Rouphael,2024-06-11 Modern agriculture needs to review and broaden its practices and business models by integrating opportunities coming from different adjacent sectors and value chains including the bio based industry in a fully circular economy strategy Searching for new tools and technologies to increase crop productivity under optimal and sub optimal conditions and to improve resources use efficiency is crucial to ensure food security while preserving soil quality microbial biodiversity and providing business opportunities for farmers Biostimulants based on microorganisms or organic substances obtained from renewable materials represent a sustainable efficient technology or complement to synthetic counterparts to improve nutrient use efficiency and secure crop yield stability Under the new European Union Regulation 2019 1009 plant biostimulants were defined based on four agricultural functional claims as follows Plant biostimulants are products that stimulate plant nutrition processes independently of the product s nutrient content with the sole aim of improving one or more of the following characteristics of the plant and or the plant rhizosphere 1 nutrient use efficiency 2 tolerance resistance to a biotic stress 3 quality characteristics or 4 availability of confined nutrients in the soil or rhizosphere Many diverse natural substances and chemical derivatives of natural or synthetic compounds as well as beneficial microorganisms are cataloged as plant biostimulants including i humic substances ii plant or animal based protein hydrolysates iii macro and micro algal extracts iv silicon v arbuscular mycorrhizal fungi AMF and vi plant growth promoting rhizobacteria PGPR belonging to the Azotobacter Azospirillum and Rhizobium genera

**Backpacker** ,2001-03 Backpacker brings the outdoors straight to the reader s doorstep inspiring and enabling them to go more places and enjoy nature more often The authority on active adventure Backpacker is the world s first GPS enabled magazine and the only magazine whose editors personally test the hiking trails camping gear and survival tips they publish Backpacker s Editors Choice Awards an industry honor recognizing design feature and product innovation has become the gold standard against which all other outdoor industry awards are measured

**Proceedings of the Fourth World Conference on Floating Solutions: WCFS 2024; 2-4 December; Hong Kong** Xiao Lin Zhao,Jian-Guo Dai,Siwei Liu,Soon Heng Lim,2025-06-24 This book highlights recent research and development in floating solutions for sustainable ocean development and blue economy It covers the following key topics Architecture climate change and disaster environmental enhancement food security and food sustainability innovation and technology renewable energy urban planning policy social acceptance and legal matters This book is of interest to architectures engineers consultants manufactures government officials researchers academics and

postgraduate students related to floating solutions      *Anomaly Detection and Complex Event Processing Over IoT Data Streams* Patrick Schneider,Fatos Xhafa,2022-01-07 *Anomaly Detection and Complex Event Processing over IoT Data Streams With Application to eHealth and Patient Data Monitoring* presents advanced processing techniques for IoT data streams and the anomaly detection algorithms over them The book brings new advances and generalized techniques for processing IoT data streams semantic data enrichment with contextual information at Edge Fog and Cloud as well as complex event processing in IoT applications The book comprises fundamental models concepts and algorithms architectures and technological solutions as well as their application to eHealth Case studies such as the bio metric signals stream processing are presented the massive amount of raw ECG signals from the sensors are processed dynamically across the data pipeline and classified with modern machine learning approaches including the Hierarchical Temporal Memory and Deep Learning algorithms The book discusses adaptive solutions to IoT stream processing that can be extended to different use cases from different fields of eHealth to enable a complex analysis of patient data in a historical predictive and even prescriptive application scenarios The book ends with a discussion on ethics emerging research trends issues and challenges of IoT data stream processing Provides the state of the art in IoT Data Stream Processing Semantic Data Enrichment Reasoning and Knowledge Covers extraction Anomaly Detection Illustrates new scalable and reliable processing techniques based on IoT stream technologies Offers applications to new real time anomaly detection scenarios in the health domain      *Principles of Virology* Jane Flint,Vincent R. Racaniello,Glenn F. Rall,Theodora Hatzioannou,Anna Marie Skalka,2020-08-07 *Principles of Virology* the leading virology textbook in use is an extremely valuable and highly informative presentation of virology at the interface of modern cell biology and immunology This text utilizes a uniquely rational approach by highlighting common principles and processes across all viruses Using a set of representative viruses to illustrate the breadth of viral complexity students are able to understand viral reproduction and pathogenesis and are equipped with the necessary tools for future encounters with new or understudied viruses This fifth edition was updated to keep pace with the ever changing field of virology In addition to the beloved full color illustrations video interviews with leading scientists movies and links to exciting blogposts on relevant topics this edition includes study questions and active learning puzzles in each chapter as well as short descriptions regarding the key messages of references of special interest Volume I Molecular Biology focuses on the molecular processes of viral reproduction from entry through release Volume II Pathogenesis and Control addresses the interplay between viruses and their host organisms on both the micro and macroscale including chapters on public health the immune response vaccines and other antiviral strategies viral evolution and a brand new chapter on the therapeutic uses of viruses These two volumes can be used for separate courses or together in a single course Each includes a unique appendix glossary and links to internet resources *Principles of Virology Fifth Edition* is ideal for teaching the strategies by which all viruses reproduce spread within a host and are maintained within populations This edition carefully reflects the results of

extensive vetting and feedback received from course instructors and students making this renowned textbook even more appropriate for undergraduate and graduate courses in virology microbiology and infectious diseases

**Riverine Ecology Volume 2** Susanta Kumar Chakraborty, 2021-02-27 This book is part of a two volume set that offers an innovative approach towards developing methods and tools for assigning conservation categories of threatened taxa and their conservation strategies by way of different phases of eco restoration in the context of freshwater river systems of tropical bio geographic zones The set provides a considerable volume of research on the biodiversity component of river ecosystems seasonal dynamics of physical chemical parameters geo hydrological properties types sources and modes of action of different types of pollution river restoration strategies and methodologies for the ongoing ecological changes of river ecosystems Volume 2 highlights biodiversity potential in aiding the resistance and resilience of riverine ecosystem functioning and their synergistic effects on ongoing environmental perturbations Comprehensive information on the conservation of river associated wildlife is provided covering the impacts of pollution land use changes river policies and ecosystem restoration strategies The book offers an innovative approach towards developing methods and tools for assigning conservation categories of threatened taxa and covers their conservation strategies by way of different phases of eco restoration in the context of freshwater river systems of tropical bio geographic zones

*Ebook: Child Development: An Introduction* John Santrock, 2014-10-16 Accurate Reliable Engaging These are just a few of the words used by adopters and reviewers of John Santrock s Child Development The new topically organised fourteenth edition continues with Santrock s highly contemporary tone and focus featuring over 1 000 new citations The popular Connections theme shows students the different aspects of children s development to help them better understand the concepts Used by hundreds of thousands of students over thirteen editions Santrock s proven learning goals system provides a clear roadmap to course mastery

Role of Lipids in Virus Assembly Jamil S. Saad, Delphine M. Muriaux, 2015-07-28 RNA enveloped viruses comprise several families belonging to plus and minus strand RNA viruses such as retroviruses flavoviruses and orthomyxoviruses Viruses utilize cellular lipids during critical steps of replication like entry assembly and egress Growing evidence indicate important roles for lipids and lipid nanodomains in virus assembly This special topic covers key aspects of virus membrane interactions during assembly and egress especially those of retroviruses and Ebola virus EBOV Virus assembly and release involve specific and nonspecific interactions between viral proteins and membrane compartments Retroviral Gag proteins assemble predominantly on the PM Despite the great progress in identifying the factors that modulate retroviral Gag assembly on the PM there are still gaps in our understanding of precise mechanisms of Gag membrane interactions Studies over the last two decades have focused on the mechanisms by which other retroviral Gag proteins interact with membranes during assembly These include human immunodeficiency virus HIV Rous sarcoma virus RSV equine infectious anemia virus EIAV Mason Pfizer monkey virus M PMV murine leukemia virus MLV and human T lymphotropic virus type HTLV 1 Additionally assembly of filoviruses such as EBOV also occurs on the

inner leaflet of the PM The articles published under this special topic highlight the latest understanding of the role of membrane lipids during virus assembly egress and release      *Encyclopedia of the World's Biomes* ,2020-06-26 Encyclopedia of the World's Biomes is a unique five volume reference that provides a global synthesis of biomes including the latest science All of the book's chapters follow a common thematic order that spans biodiversity importance principal anthropogenic stressors and trends changing climatic conditions and conservation strategies for maintaining biomes in an increasingly human dominated world This work is a one stop shop that gives users access to up to date informative articles that go deeper in content than any currently available publication Offers students and researchers a one stop shop for information currently only available in scattered or non technical sources Authored and edited by top scientists in the field Concisely written to guide the reader through the topic Includes meaningful illustrations and suggests further reading for those needing more specific information      **Developing Solid Oral Dosage Forms** Yihong Qiu,Yisheng Chen,Geoff G.Z. Zhang,Lawrence Yu,Rao V. Mantri,2016-11-08 Developing Solid Oral Dosage Forms Pharmaceutical Theory and Practice Second Edition illustrates how to develop high quality safe and effective pharmaceutical products by discussing the latest techniques tools and scientific advances in preformulation investigation formulation process design characterization scale up and production operations This book covers the essential principles of physical pharmacy biopharmaceutics and industrial pharmacy and their application to the research and development process of oral dosage forms Chapters have been added combined deleted and completely revised as necessary to produce a comprehensive well organized valuable reference for industry professionals and academics engaged in all aspects of the development process New and important topics include spray drying amorphous solid dispersion using hot melt extrusion modeling and simulation bioequivalence of complex modified released dosage forms biowaivers and much more Written and edited by an international team of leading experts with experience and knowledge across industry academia and regulatory settings Includes new chapters covering the pharmaceutical applications of surface phenomenon predictive biopharmaceutics and pharmacokinetics the development of formulations for drug discovery support and much more Presents new case studies throughout and a section completely devoted to regulatory aspects including global product regulation and international perspectives      **Iguazu Falls** Marcelo José da Silva de Magalhães,2021-01-01 Dear reader I am sure that the Iguazu National Park is among the tourist places where the natural beauty most enchanted me Even after visiting it for the second time the excitement is still the same This majestic park is the most visited in Argentina and is among the three most visited tourist spots in Brazil It is among the most well classified tourist sites as World Heritage Site Just visit it to understand these numbers Its beauty may not be described through words or photos It is necessary to be there and feel to live the essence of that place Iguazu River is huge noisy and is characterized by numerous waterfalls which are simply fantastic In the second half of the book will be presenting to you the bird park that is located in Brazil near the Iguassu National Park The bird park is a must see tourist spot for nature lovers I

hope this book can give you an idea of the magic of that place I hope you can one day visit and share the same opinion

**Biological Invasions and Its Management in China** Fanghao Wan, Mingxing Jiang, Aibin Zhan, 2017-04-25 The book discusses invasive species problems in agriculture forests and aquatic ecosystems highlighting the invasive mechanisms and management of the selected invasive species Biological invasion has become a serious global ecological and economic problem that deserves particular attention from both government officials and scientists This volume focuses on three key scientific areas 1 population establishment and spreading mechanisms of the selected invasive species 2 ecology adaptation population growth expansion and evolution of invasive species and 3 impact of bio invasion on the ecosystem structure and function at community and ecosystem levels The presented research will result in techniques for better management of invasive species

Space Physiology and Medicine Arnauld E. Nicogossian, Richard S. Williams, Carolyn L. Huntoon, Charles R. Doarn, James D. Polk, Victor S. Schneider, 2016-12-13 As space medicine evolved from the late 1950s onward the need arose for a ready reference for students and practitioners on the basic concepts of this new specialty Through three editions edited by leaders in the development of space medicine this classic text has met the need This fourth edition of Space Physiology and Medicine provides succinct evidence based summaries of the current knowledge base in space medicine and serves as a source of information on the space environment responses and practices Additionally there is extensive online material available for each chapter featuring overviews and self study questions

*Tapirs of the World* Mario Melletti, Rafael Reyna-Hurtado, Patrícia Medici, 2024-12-03 This beautifully illustrated book is the first comprehensive work ever published on all four tapir species worldwide filling a gap in the scientific literature The book provides information on the systematics phylogeny evolution ecology conservation and management of all tapir species This volume is aimed at a wide range of readers including researchers wildlife managers zoologists conservation biologists ecologists veterinarians zoo staff students and environmental policy makers

**Bad Bugs in the XXIst Century: Resistance Mediated by Multi-Drug Efflux Pumps in Gram-Negative Bacteria** Attilio Vittorio Vargiu, Klaas Martinus Pos, Keith Poole, Hiroshi Nikaido, 2016-08-12 The discovery of antibiotics represented a key milestone in the history of medicine However with the rise of these life saving drugs came the awareness that bacteria deploy defence mechanisms to resist these antibiotics and they are good at it Today we appear at a crossroads between discovery of new potent drugs and omni resistant superbugs Moreover the misuse of antibiotics in different industries has increased the rate of resistance development by providing permanent selective pressure and subsequently enrichment of multidrug resistant pathogens As a result antimicrobial resistance has now become an urgent threat to public health worldwide <http://www.who.int/drugresistance/documents/surveillancereport/en> The development of multidrug resistance MDR in an increasing number of pathogens including *Pseudomonas* *Acinetobacter* *Klebsiella* *Salmonella* *Burkholderia* and other Gram negative bacteria is a most severe issue Membrane efflux pump complexes of the Resistance Nodulation cell Division RND superfamily play a key role in the development of MDR in these



bacteria RND pumps together with other transporters contribute to intrinsic and acquired resistance to most if not all of the antimicrobial compounds available in our drug arsenal Given the enormous drug polyspecificity of MDR efflux pumps studies on their mechanism of action are extremely challenging and this has negatively impacted both the development of new antibiotics that are able to evade these efflux pumps as well as the design of pump inhibitors The collection of articles in this eBook published as a Research Topic in Frontiers in Microbiology section of Antimicrobials Resistance and Chemotherapy aims to update the reader about the latest advances on the structure and function of RND efflux transporters their roles in the overall multidrug resistance phenotype of Gram negative pathogens and on strategies to inhibit their activities A deeper understanding of the mechanisms by which RND efflux pumps alone or synergistically with other efflux pumps are able to limit the concentration of antimicrobial compounds inside the bacterial cell may pave the way for new more directed inhibitor and antibiotic design to ultimately overcome antimicrobial resistance by Gram negatives

*The Red Cell Life-Cycle From Erythropoiesis to Clearance* Lars Kaestner, Anna Bogdanova, 2019-02-05 The eBook The red cell life cycle from erythropoiesis to clearance continues the discussion of questions like What are the changes associated with red blood cell maturation adulthood and senescence What are the determinants of red blood cell life span and clearance What are the mechanisms in control of red blood cell mass in healthy humans and patients with various forms of anaemia Can red blood cells be trained to provide the body with more oxygen during endurance exercises What are the markers of circulating red blood cell senescence and in cells during storage and transfusion And what can be learned from various species that developed advanced adaptations to maintain oxygen delivery under stress conditions such as exercising to the limit diving or living in anaerobic aquatic habitats or at high altitude Within the approximately 120 days or 40 in a mouse or 150 170 in a horse life span of healthy red blood cells many cellular properties change leading to aged mixed cell populations in the circulation Red blood cells seem to be genetically terminated by the time they become red blood cells and the contributions of this eBook increase the understanding of this process There are surprisingly versatile remodeling processes happening during the red blood cell life span Numerous disorders are associated with the premature onset of the ageing process of red blood cells Furthermore in vitro ageing and or modifications as well as the slowing down of the modifications is an important issue in transfusion medicine Many of the molecular mechanisms behind such effects are elucidated in this eBook

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