LEVEL 1 BIOL UNITS - BY UNIT NUMBER

Code	Title
BIOL10111	Introductory Chemistry
BIOL10212	Biochemistry
BIOL10221	Molecular Genetics
BIOL10232	From Molecules to Cells
BIOL10382	A History of Biology in 20 Objects
BIOL10401	Introduction to Laboratory Science
BIOL10402	Introduction to Experimental Biology
BIOL10511	Biodiversity
BIOL10521	Genes, Evolution and Development
BIOL10532	Microbes, Man and the Environment
BIOL10811	Body Systems
BIOL10822	Drugs: From Molecules to Man
BIOL10832	Excitable Cells

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BIOL10111	Introductory Chemistry
BIOL10532	Microbes, Man and the Environment
BIOL10221	Molecular Genetics

INTRODUCTORY CHEMISTRY BIOL10111

Unit Coordinator(s): Dr Ewan Blanch (E.Blanch@manchester.ac.uk) Semester 1
Credits 10

Aims
To provide a basic introduction, approximating to 'A' level standard, to the principles and concepts of chemistry, suitable for biologists.

Intended Learning Outcomes
After completing the course unit, participants should be able to demonstrate a working knowledge of the basic principles of physical, inorganic and organic chemistry sufficient to recognise their involvement in biological and other areas.

Lecture Content

- Atoms, ions and molecules; the periodic table and periodicity; atomic structure; electron configurations.
- Chemical bonding and non-covalent interactions.
- Resonance and aromatics; stereochemistry and chirality.
- Functional group recognition and properties.
- Equilibria, pH and buffers; basic thermodynamics.
- Oxidation and reduction; reaction rates.

Assessment
A 2-hour examination in January contributes 80% to the Unit mark. Learning Module assessment contributes 20% to the Unit mark.

Learning Module Content

- 5 assessments and 1 revision learning module will cover the material in the above sections
- 5 clinics that cover the online section of the course along with additional online material will support the assessed online course work

Feedback
Feedback via problem solving clinics, revision workshops and eLearning Modules.

Prerequisites

None.

Recommended Reading

Holum JR *Fundamentals of General, Organic and Biological Chemistry* (6th edition) 1998 Wiley is the main recommended reading material. Lecturers may also refer you to a specific section of one or more of the following optional books for particular parts of the unit.

- Housecroft C, Constable, E *Chemistry: An introduction to organic, inorganic and physical chemistry' (2nd edition)* 2002 Prentice-Hall
- Hill G, Holman J *Chemistry in Context (5th edition)* 2000 Nelson Thornes
- Jones L, Atkins P *Chemistry: Molecules, Matter and Change (4th edition)* 2000 WH Freeman
- Holum JR *Fundamentals of General, Organic and Biological Chemistry (6th edition)* 1998 Wiley
- Housecroft & Constable: *www.booksites.net/housecroft/*
- Hill & Hollman *www.chemistry-in-context.co.uk/chem_in_cont.htm*
- Jones & Atkins *www.whfreeman.com/gchem/*

Teaching Staff

Dr Ewan Blanch; Professor Andrew Doig; Professor Andrew Munro; Dr Steve Prince

BIOCHEMISTRY BIOL10212

Unit Coordinator(s): Professor Robert Ford (robert.ford@manchester.ac.uk) Semester 2 Credits 10

Aims

To provide grounding in the basic principles of Biochemistry for students in Life Sciences. To provide a description of the principal components of cells. To demonstrate how energy is harvested from sunlight, converted and stored in food and then released into high-energy compounds capable of driving biochemical reactions.

Intended Learning Outcomes

To understand: basic chemical properties of molecules that make life possible, and how these properties relate to specific macromolecular structures and functions; proteins and cell membrane structure. Structural proteins, enzymes and macromolecular complexes as protein machines will be understood. An introduction to biochemical and biophysical methods will be given. The functions of mitochondria and chloroplasts in oxidative phosphorylation and photosynthesis respectively will be discussed as well as how energy can be released during catabolism and how it can be stored during anabolism.

Lecture Content

Structure and chemical components of cells: chemical bonds, molecules in cells, protein structure and function, purification of proteins, protein function during catalysis, enzymes as catalysts, naming of enzymes, chemical reactions, activation energy barrier, importance of enzymes, how enzymes work, active site, co-factors, specificity, activation, enzyme substrate binding.

Factors affecting enzymes: rates of reaction, effect of temperature, pH, concentration, Michaelis-Menton, Lineweaver-Burk, enzyme inhibition/regulation reversible, non-reversible, allosteric molecules.

Membrane structure: fluid mosaic model, phospholipid bilayer, proteins in membranes, membrane fluidity and the role of cholesterol, use of detergents to solubilize cell membranes and membrane proteins.

Biochemical and biophysical methods: Protein folding, the Levinthal paradox, diseases in protein folding. Protein purification and detection methods, chromatography, electrophoresis, mass spectrometry, use of antibodies.

Metabolism and bioenergetics: concept of high energy carriers, ATP, acetyl CoA, and co-factors NAD+, NADP+, catabolism and anabolism, free energy changes, glycolysis, the citric acid cycle, glycogen breakdown, gluconeogenesis, fatty acid metabolism, amino acid metabolism.

Electron transport and oxidative phosphorylation: the mitochondrion and the chemiosmotic theory, proton motive force and the production of ATP, ATP synthase.

Photosynthesis: the chloroplast, light capturing pigments, light reactions, photosystems, electron transport, dark reactions, carbon fixation, synthesis of sucrose and starch.

Assessment

1 hour examination involving 50 multiple choice questions (85% of unit credits) in the semester 1 examination period. Electronically marked Blackboard e-learning assessments (15% of unit credits).

Feedback - Feedback will be via mid-semester exam marks & guidance; Blackboard e-Learning modules; Blackboard Discussion Board.

Prerequisites - None.

Recommended Reading

- Horton, R et al *Principles of Biochemistry (4th edition)* 2006 Prentice Hall

Teaching Staff - Dr Johanna Avis; Professor Robert Ford

MOLECULAR GENETICS BIOL10221

Unit Coordinator(s): Dr David Boam (dave.boam@manchester.ac.uk) Semester 1
Credits 10

Aims
To provide a general introduction to the molecular basis of genetics, how genes are maintained from one generation to the next and how their expression is regulated in various systems.

Intended Learning Outcomes
Students will understand the basis of genome maintenance and gene expression, and appreciate the concept of mutation at the level of the genotype and how this manifests at the phenotypic level. The major concepts and principles underlying recombinant DNA technology will be understood, along with major applications and associated issues relating to the public understanding of science.

Lecture Content

Part I - Structure and Function of DNA
- DNA as the heritable material
- Biochemical properties and structure of DNA
- DNA replication: semi-conservative replication, origins of DNA replication, elongation at replication forks, DNA polymerases, cell cycle control of DNA replication; replication of telomeres, consequences of defects in telomerase
- DNA repair: fidelity of replication, DNA damage, DNA repair mechanisms
- The Genome: structure and function of chromosomes, advances in genome analysis

Part II - Gene expression
- From DNA to RNA: the structure and function of the gene, promoters and terminators. Transcriptional initiation, elongation and termination, RNA polymerases
- Structure, function and Biochemical properties of RNA
- From RNA to Protein: the genetic code, codons & anticodons, the ribosome & translation
- Gene expression in Prokaryotes: the Lac operon
- Gene expression in Eukaryotes I: regulation of transcription, promoters, enhancer elements; RNA splicing, post-transcriptional and post-translational regulation

Part III - Molecular basis of mutation
- Consequences of mutation: genotype versus phenotype, molecular basis of dominant and recessive alleles, somatic versus germline mutations
- Gene mutations: missense versus nonsense mutations, insertions, deletions and frameshifts. Genetic reversion and suppression
- Chromosomal mutations: changes in chromosome number or structure. Consequences for fertility
- Occurrence of mutations: spontaneous mutations and effects of environmental factors

Part IV - Recombinant DNA Technology
- Principles of Genetic Engineering: gene cloning and genomics
- Perspectives in Genetic Engineering: applications, moral and ethical issues

Assessment
1 hour examination (95%) and an eLearning exercise (5%).

Feedback
An eLearning component of the unit assessment allows students to monitor their own progress. An additional optional eLearning exercise will allow students to practice MCQs based on various parts of the lecture unit. An online discussion forum is available for communication between students and staff.

Prerequisites - None

Recommended Reading
- Alberts B et al. *Essential Cell Biology 2nd Edition* 2003 Garland Science
- Alberts B, Johnson A, Lewis J, Raff M, Roberts K & Walter P *Molecular Biology of the Cell (4th edition)* 2002 Garland Science

Teaching Staff - Dr David Boam; Professor Colin Stirling

FROM MOLECULES TO CELLS BIOL10232

Unit Coordinator(s): Professor Viki Allan (viki.allan@manchester.ac.uk) Semester 2
Credits 10

Aims

To provide a general introduction to molecular cell biology for students in Life Sciences. To demonstrate how molecular cell biology explains cell function at the level of an individual cell, and as part of a tissue or organism.

Intended Learning Outcomes

Students will understand the fundamental processes that govern how and when a cell communicates, grows, interacts with its neighbours, divides and dies, and how these processes go awry during cancer. Students will have insight into how cells produce and export proteins, and how material is endocytosed.

Lecture Content

Introduction to Cell Biology: cell types and techniques

Intracellular compartments and transport: protein sorting; membrane-bounded organelles, the endoplasmic reticulum; the secretory pathway and vesicular transport; the cell membrane and endocytic pathway; compartments, transport and disease.

Cell response to the environment: cell communication and signalling.

The cytoskeleton and cell movement: microtubules, actin filaments and intermediate filaments. Molecular motors.

Cycles of division and growth in cell populations: cell division; cell cycle; control of cell proliferation and differentiation; cancer; cell death

Interactions between cells in multicellular systems: extracellular matrix and connective tissue; epithelia and cell junctions.

Assessment

1 hour examination consisting of 50 multiple choice questions (95%) in the semester 2 examination period. eLearning exercise (5%).

Feedback

Feedback will be provided via Learning Modules, Bulletin Board, and by question and answer exercises during the lectures.

Prerequisites

None.

Recommended Reading

- Alberts B et al. *Essential Cell Biology 2nd Edition* 2003 Garland Science

Teaching Staff

Professor Viki Allan; Dr Anne-Marie Buckle; Professor Stephen High

A HISTORY OF BIOLOGY IN 20 OBJECTS BIOL10382

Unit Coordinator(s): Dr Carsten Timmermann (carsten.timmermann@manchester.ac.uk) **Semester 2** **Credits 10**

Aims

This course provides students with a broad perspective on how today's life sciences have grown out of past investigations of nature. It creates a historically-grounded framework for the knowledge and skills they will acquire as undergraduates. By focusing on "objects" - topics of inquiry and the tools used to carry out those inquiries - students will see the history of their subject not as something done in the past by a series of "great men", but as something that helps us understand our present. What are now everyday laboratory objects were once associated with exciting new developments and cutting edge research; the reasons why these objects and approaches were adopted tells us a great deal about how biology works, how it has changed, and gives us some insight into how it may change again in the 21^{st} century. Students will gain an insight into the motivations that inspired scholars in the past to study nature, as well as the links between the contexts in which research was pursued and the products of this research. The result will be that students look at their laboratory work, and at the material they are taught in other units, in a different light.

Intended Learning Outcomes

The central questions we will address are:

- What did it mean to investigate nature, to develop a science of life at various points in history?
- Who was interested in this?
- How was this done, in different historical, i.e. national, social or institutional settings?
- Why did biology develop the way it did?

The course will look and feel rather different from history courses that students may have been exposed to in school. We will not be talking primarily about great men (and women) and their dates of birth or death. Lectures will be organised around "objects": topics of inquiry, key organisms or research tools. We will work with images and (short) original texts, and students will be confronted with stories which they may or may not associate with the life sciences and might find surprising (and hopefully illuminating and entertaining). We will also explore ways in which the history of the life sciences could have taken a different course. What if, for example, Charles Darwin had known about Gregor Mendel's breeding experiments? What if the inventor of the ultracentrifuge had never become interested in proteins?

Lecture Content

There will be 20 lectures on the history of selected objects and a poster workshop. The lectures are arranged in approximate chronological order, introducing the historical contexts, social, political and institutional, from which respective objects emerged and discussing what happened to these objects since they became part of biology. Students will be assigned to small study groups that work together on developing a poster on the history of an object; a tool, concept or key organism. They can either meet physically or use Blackboard to collaborate, or any combination of meetings and online work. We will encourage students to link the poster exercise with research that is currently pursued within FLS.

Accompanying lectures, students will be required to read a selection of short, original texts (for example the 2-page 1953 paper by Watson and Crick, introducing their proposed structure of DNA) and discuss these in Blackboard chat rooms, guided by a set of questions. Lectures will also be accompanied by online quizzes in Blackboard, guided by questions relating to lectures and required readings. Some of these will be exercises in "counterfactual history": what would today's life sciences look like if things had turned out differently?

Assessment

Examination: multiple-choice and short note answer questions - 70%
Poster on the history of an object, tool, concept or key organism (peer reviewed) - 20%
Participation in online discussions and seminars - 10%

Feedback - Feedback will be provided via Blackboard, in response to chat room postings. Students will be able to gauge their understanding of topics by completing online quizzes throughout the term.

Prerequisites - none.

Recommended Reading

- Allen, Garland E., *Life Science in the Twentieth Century* (Cambridge University Press, 1975)
- Bowler, Peter J. and Iwan Rhys Morus, *Making Modern Science: A Historical Survey* (University of Chicago Press, 2005).
- Cobb, Matthew, *The Egg & Sperm Race: The Seventeenth-Century Scientists who unlocked the Secrets of Sex and Growth* (The Free Press, 2006)
- Morange, Michael, *A History of Molecular Biology* (Harvard University Press, 1998)

Teaching Staff

Dr Matthew Cobb, Prof. John Pickstone, Dr Carsten Timmermann, Prof. Michael Worboys. With guest lectures by Drs Ian Burney, Robert Kirk and Duncan Wilson.

INTRODUCTION TO LABORATORY SCIENCE BIOL10401

Unit Coordinator(s): Dr Ruth Grady (ruth.grady@manchester.ac.uk) Semester 1
Credits 10

Aims

To introduce students to the basic skills and techniques that underpin laboratory investigation; to build the expertise and knowledge that will be required by students to undertake both the Introduction to Experimental Biology unit offered in the second semester, and the practical modules offered at level 2.

Intended Learning Outcomes

By the end of their first year students are expected to: be competent in a range of practical techniques and skills appropriate to the biosciences; conduct experiments taking into consideration health and safety requirements; make detailed experimental observations, and record, analyse and evaluate experimental and other scientific data; analyse experimental data using appropriate statistical methods; be able to modify or design related experiments; communicate experimental work by means of written, or computer-assisted, reports and assignments; use information technology in the research, analysis and presentation of scientific data; relate knowledge acquired in the laboratory to theoretical material covered in the lecture units; work both independently and as part of a team; be able to make critical evaluation of both their own work and that of their peers; and reflect upon their skills development during their first year.

Practical Content

The unit consists of ten practical sessions introducing the fundamental experimental approaches in bioscience and biomedical research. Students will study the human cardiovascular and respiratory systems; gain experience in working with a diverse array of experimental organisms ranging from microbes to plants to humans; and gain expertise in working with DNA, proteins and other biomolecules. The 10 practicals are as follows (although these may be subject to change):

The Diversity of Life

1. The evolution of complexity: unicellular to multicellular organisms
2. Cell behaviour: how *Paramecium* feed

Shedding Light on Biomolecules

3. Using spectrophotometry to characterise vitamin B_{12} and lysozyme
4. Photosynthetic pigments in Seaweeds

DNA & Proteins

5. Plasmid DNA preparation and agarose gel electrophoresis
6. The Fish-fingerprinting lab: visualising proteins by SDS PAGE gel electrophoresis

Switching on Genes

7. Expression of the Lactose (*lac*) operon of *Escherichia coli*

Human Biology

8. Haematology and the histology of blood
9. Pulses, blood pressure, and the anatomy of circulation
10. Lung mechanics and the anatomy of the respiratory system

Assessment

100% coursework.

Students will be assessed by their satisfactory completion of experimental work during the laboratory sessions (20%) and by short written assignments based on each of the ten practicals (80%).

Short written assignments relating to Practicals 1-4 will be assessed by peer-marking: critical appraisal of the work of others is a key skill in all fields of science and is an intended learning outcome for this unit – participation in the peer-marking sessions is compulsory and failure to do so will result in a deduction of 50 % of the marks for Practicals 1-4.

Short written assignments accompanying Practicals 5-10 will be assessed using Assessment21 software. The questions will be available during weeks 7-11 and are to be answered online. It is the student's responsibility to ensure that s/he can access the online assessment questions well in advance of the deadline – inability to "log on" will not be an accepted excuse for late submissions. Details of how to access and submit online will be available within the practical manuals and via Blackboard.

Please note: Attendance at practical sessions is compulsory. The attendance mark (20%) will be awarded only if attendance and completion of practicals is judged to be 'satisfactory' (defined as attending and completing at least 80% of the practicals); otherwise attendance is judged to be 'unsatisfactory' and will be awarded a mark of 0. Further penalties for absences are detailed in the practical manual. Missing more than 2 practicals for whatever reason will trigger a meeting with the Senior Advisor. A mark of at least 40% is required to pass this unit. Failure of this unit will result in a loss of compensation for other failed first year examinations.

Feedback
During the practical sessions, you will be able get immediate feedback on your technical performance by talking to staff, demonstrators and your peers. The questions or exercises in the practical manual are there to test your understanding and you should get feedback on your answers from staff or demonstrators before you leave each laboratory session. After each practical, there are additional 'quiz questions' available on Blackboard for you to judge your understanding later. In week 7, you will undertake 'peer marking' of the assessment coursework questions for Practicals 1-4, allowing you to judge your own understanding compared to one of your peers. Feedback regarding assessment of Practicals 5-10 will take place via a 'feedback lecture' in week 12. Any queries regarding this unit can be addressed to staff or other students via communication boards on Blackboard. You will get feedback on your overall performance for the unit in the form of the final mark released at the beginning of Semester 2.

Prerequisites - None

Teaching Staff
Dr Amanda Bamford; Dr Shazia Chaudhry; Dr Maggy Fostier; Dr Ruth Grady; Dr Michelle Keown; Dr Tristan Pocock; Dr Liz Sheader; Dr Tracey Speake; Dr Carol Wakeford

INTRODUCTION TO EXPERIMENTAL BIOLOGY BIOL10402

Unit Coordinator(s): Dr Maggy Fostier (Maggy.Fostier@manchester.ac.uk)

Semester 2
Credits 10

Aims

To equip students with the basic laboratory skills necessary to study the Life Sciences. This unit will provide the foundation for more advanced level 2 laboratory skills units.

Intended Learning Outcomes

Upon completion of this unit, students will be proficient in a number of basic laboratory techniques appropriate to their specialist degree programme. By the end of their first year students are expected to: be competent in a range of practical techniques and skills appropriate to the biosciences; conduct experiments taking into consideration health and safety requirements; make detailed experimental observations, and record, analyse and evaluate experimental and other scientific data; analyse experimental data using appropriate statistical methods; be able to modify or design related experiments; communicate experimental work by means of written reports and assignments; use information technology in the research, analysis and presentation of scientific data; relate knowledge acquired in the laboratory to theoretical material covered in the lecture units; work both independently and as part of a team; be able to make critical evaluation of both their own work and that of their peers; and reflect upon their skills development during their first year.

Practical Content

Students will undertake two of the following experimental strands, as determined by their Programme Director. Together, these programmes encompass widely used modern techniques and more specific techniques appropriate to each student's degree programme. In addition, all students will take the Biomathematics session which provides complementary training in statistical analysis.

- Strand 1 - Drugs and the Nervous System
- Strand 2 - Molecular Genetics for Human Biologists
- Strand 3 - Cells and Genes
- Strand 4 - Organisms and the Environment
- Strand 5 - Inside the Cell: from DNA to Protein
- Biomathematics session

Assessment

100% coursework.

Students will be assessed by their satisfactory completion of experimental work during the laboratory sessions (10%), by short written assignments based on the subject of the practicals (30%) and by a full experimental report for one practical (60%).

Some short written assignments will be assessed by Computer Assisted Assessment. It is the student's responsibility to ensure that s/he can access the online assessment questions well in advance of the deadline – inability to "log on" will not be an accepted excuse for late submissions. Details of how to access and submit CAA will be available within the practical manuals and on Blackboard.

Please note: Attendance at practical sessions is compulsory; including the induction session for this unit timetabled in week 1 of semester 2. The attendance mark (10%) will be awarded only if attendance and completion of practicals is judged to be 'satisfactory' (defined as attending and completing at least 80% of the practicals). Attendance judged to be 'unsatisfactory' will be awarded a mark of 0 and depending on circumstances marks may get deducted out of your overall unit score (see details in the practical manual). A mark of at least 40% is required to pass this unit. Failure of this unit will result in a loss of compensation for other failed first year examinations.

Feedback

During the practical sessions, there will be many opportunities for you to get feedback from staff or demonstrators on your technical performance. Moreover, the short answer questions or exercises in the practical manual are there to test your understanding and you should get feedback from staff or demonstrators on your answers. You will get feedback on your overall performance in the form of the final mark for the unit and will get individual feedback on your lab report from your tutor.

Prerequisites - None

Teaching Staff
Dr Amanda Bamford; Dr Jason Bruce; Dr. Shazia Chaudhry; Dr Bip Choudhury; Dr Sheena Cruickshank; Dr Maggy Fostier; Dr Ruth Grady; Dr Kath Hinchliffe; Dr Michelle Keown; Dr. Josip Lovric; Dr Tristan Pocock; Dr Gino Poulin; Dr Daniel Rozen; Dr Liz Sheader; Dr Tracey Speake; Dr Carol Wakeford; Dr Donald Ward

BIODIVERSITY BIOL10511

Unit Coordinator(s): Dr Liz Sheffield (liz.sheffield@manchester.ac.uk) Semester 1
Credits 10

Aims
To consider the entire breadth of organismal diversity and the depth of particular examples of scientific, environmental or economic importance. To focus on "ways to make a living" involving everything from the smallest microbes to the mightiest redwoods and whales - emphasising that organisms should not be considered in isolation, as they naturally team up with others, share resources, or compete with each other in richly diverse ecosystems.

Intended Learning Outcomes
Students will understand how eukaryotes arose from prokaryotes; multicells from unicells; sexual from non-sexual organisms; complex life forms from simple ones.

Lecture Content
Emphasises the enormous periods of the earth's history that elapsed before mammals and angiosperms came to dominate the human perspective. Tolerance of extremes and metabolic plasticity - key to the success of a diverse range of photosynthetic prokaryotes - e.g. cyanobacteria.

Eukaryotic diversity. Euglenoids and dinoflagellates illustrate the lack of easy distinction between plants and animals. Biochemical and reproductive advances which led to green plants. *Chlamydomonas* (to illustrate sexual reproduction). Terrestrial adaptation is key to modern plant diversity. Diversification of body forms and reproductive mechanisms produced all present-day successful strategies. Reliance on motile sperm does not preclude terrestrial existence. The evolution of seed plants. How angiosperms and animals have shaped one another's evolution.

Deep sea vent communities. Slime moulds to animals. Body plans, segmentation and support - their role in colonisation of land by animals. Arthropods. Horseshoe crab. Vertebrates. Endoskeletons, brains and the amniotic egg - features that have allowed the survival of modern terrestrial reptiles, birds and mammals.

Partners and robbers. Partnerships allow survival in otherwise inhospitable or highly competitive habitats - corals, jellies, rattans, lichens. Hemi-parasites; full parasites; carnivorous plants.

Retracing steps: aquatic mammals and angiosperms.

Assessment
90% for a one hour written examination (MCQs and SNQs), in the semester 1 examination period, 5% for eLearning exercises and 5% for collaborative ePoster.

Feedback
Will be provided via: verbal comments during lecture sessions; generic guidance after mid-semester examinations; eLearning guidance; written comments on ePoster; Bulletin Board comments.

Prerequisites - None.

Recommended Reading

- Campbell N and Reece J *Biology (8th edition)* 2008 Benjamin Cummings
- Sadava, D et al *Life. The Science of Biology* 2008 Sinauer
- Hickman CP, Roberts LS, I'Anson H & Larson A *Integrated Principles of Zoology* 2003 McGraw-Hill
- Ennos R and Sheffield E *Plantlife* 2000 Blackwell Science

Teaching Staff - Dr Liz Sheffield

GENES, EVOLUTION AND DEVELOPMENT BIOL10521

Unit Coordinator(s): Dr David Hughes (david.a.hughes@manchester.ac.uk)

Semester 1
Credits 10

Aims

To provide a general introduction to the patterns and principles of heredity. To investigate the process of evolutionary change and to relate genetic mechanisms to evolutionary outcomes. To provide an overview of the principles of developmental biology and the relationship between development and evolution.

Intended Learning Outcomes

To understand basic genetic principles, both at the individual and population level, and to appreciate the concept of natural selection as the driving force of evolution. To appreciate how interactions between organisms and the environment, between individuals within a species, and between individuals of different species can shape selective forces and evolutionary outcomes. To understand how genes control the development of organisms and to appreciate the importance of development in evolutionary change.

Lecture Content

Patterns and Principles of Inheritance - Mendelian inheritance and probability; relationship between Mendelism and the behaviour of chromosomes during meiosis; gene interactions including multiple alleles, complications in the concept of dominance, penetrance and expressivity; sex determination and sex-linked inheritance; genetic linkage and gene mapping; maternal inheritance and organelles; genetics of complex characters; human genetics.

Mechanisms of Evolution - Descent with modification: a Darwinian view of life; population genetics and genetic variation; Hardy-Weinberg equilibrium; processes that change genotype and allele frequencies; natural selection as a mechanism of adaptive evolution; sexual selection; evolution at the molecular level; speciation; the evolution of interactions among species.

Developmental Biology - Overview of the principles of animal development: how does a single-celled fertilised egg becomes an embryo and then a fully formed adult body. Cell fate and differentiation: overview of the mechanisms of developmental commitment and maintenance of cell differentiation. Experimental developmental biology: model organisms and the main techniques to study development. Development and evolution: the evo-devo concept.

Assessment

80 marks awarded for a one hour written examination (MCQs) in the semester 1 examination period, 20 marks awarded for coursework/ eLearning

Feedback

Feedback via mid-semester exam marks & guidance, eLearning Modules; Problem Sets; Bulletin Board.

Prerequisites - None.

Recommended Reading

- Campbell N and Reece J *Biology (8th edition)* 2008 Benjamin Cummings
- Russell PJ *Genetics: A Molecular Approach: International Edition* 2006 Benjamin Cummings
- Coyne JA *Why Evolution is True* 2009 Oxford University PressWolpert L *Principles of Development (2nd edition)* 2002 Oxford University Press

Teaching Staff

Dr Maggy Fostier; Dr David Hughes; Dr Matthew Cobb

MICROBES, MAN AND THE ENVIRONMENT BIOL10532

Unit Coordinator(s): Dr Geoff Robson (geoff.robson@manchester.ac.uk) Semester 2
Credits 10

Aims
To investigate the diversity of form and function of microbes in relation to environmental niches. To consider the breadth of microbial interactions with other organisms in the ecosystem and the impact of those interactions on human affairs.

Intended Learning Outcomes
Students will understand how microbes evolved structurally and metabolically from primitive organisms diversifying into new niches. Students will appreciate the breadth of microbes and their critical role in the global ecosystem and understand how microbes form associations and interactions with plants, animals and insects, and how these associations continue to impact on our everyday lives.

Lecture Content

Microbial evolution and nutrition: The origin of life, phylogeny, evolution of bacteria, Archaea and fungi; Evolution of microbes into diversifying ecosystems; Diversity of energy-generating systems of microbes.

Microbial structure, replication and motility: Bacterial replication, structure, adhesion, motility and growth; Fungal replication, yeasts, moulds and spores; Diversity of viruses & viral replication.

Microbes in the environment: Carbon cycling in the ecosystem. Brown rots and white rot fungi; Nitrogen cycling in the ecosystem. Ammonification, nitrification and de-nitrification.

Microbial partnerships: Microbial associations with plant roots. Legumes, rhizobia and nitrogen fixation. Mycorrhizal associations with plant roots, from trees to orchids; Microbial associations with animals and insects. Ruminants and hind gut fermenters. Cellulose digestion, methanogens and chytrids. Termites and leaf cutter ants.

Microbes as pathogens: Human-microbe interactions; Introduction to bacterial pathogenicity; Bacterial exotoxins and endotoxins as virulence factors; Viral diseases of man; Epidemiology; the spread of disease through the population; Microbial pathogens of plants and insects. Colonisation and invasion strategies; Viral diseases of man. Antimicrobials and targets; Antibiotics; targets and modes of action; Emergence and mechanism of antibiotic resistance.

Microbial Biotechnology: Microbes & food. Use of microbes in food and beverage production. Food spoilage & toxins; Exploitation of natural microbial communities in the treatment of sewage; Exploitation of bacteria for plant transformation for the production of genetically modified crops; Use of bacterial toxins and resistance genes for novel pest and ween control.

Assessment - 95 marks awarded for a one hour examination which includes 50 MCQs, in the semester 2 examination period, and 5 marks awarded for an ePBL exercise.

Feedback - Feedback is through eLearning modules running throughout the unit.

Prerequisites - None

Recommended Reading
Madigan, Martinko, Dunlap & Clark (Eds.) *Brock:Biology of Microorganisms 12th edition* 2009 Pearson:Benjamin Cummings

Teaching Staff - Dr Pauline Handley; Dr Geoff Robson, Prof Simon Turner

BODY SYSTEMS BIOL10811

Unit Coordinator(s): Dr Nick Ashton (nick.ashton@manchester.ac.uk) Semester 1

Credits 10

Aims

To introduce students to the concepts that underpins physiology: homeostasis, and the major tissue types that form the body structures. To consider the detailed anatomy and physiology of the human cardiovascular and respiratory systems.

Intended Learning Outcomes

To understand the interrelationship between structure and function of each of the cardiovascular and respiratory systems and how these two systems contribute to homeostasis. To understand how some common diseases of the cardiovascular and respiratory systems can be interpreted in terms of altered physiology and anatomy.

Lecture Content

Homeostasis and Control System Evolution of an internal 'sea' (the extracellular fluid) and maintenance of a relative constancy in its composition. Endocrine and neural control systems. The autonomic nervous system and the concept of dual control.

Tissue Diversity An introduction to the various tissue types that form the body structures. Lining and covering tissues, muscle tissues, supporting tissues, haemopoietic tissues and the physiology of blood.

The Cardiovascular System Structure and physiology of blood vessels. The gross anatomy of the circulations. The anatomy of the heart and initiation of the heart beat. Energetics of the circulation and the cardiac cycle. The control of cardiac output and of blood pressure. Local control of the circulation. Physiology of the coronary and pulmonary circulations. Diseases of the cardiovascular system.

The Respiratory System Anatomy of the respiratory tract and lungs. Anatomy and physiology of ventilation. Gaseous exchange in the lungs. Transport of oxygen and carbon dioxide in blood. The control of breathing. Diseases of the lung.

Assessment

95% examination (one hour multiple choice question (MCQ) examination) and 5% coursework, comprising a number of short online assessments.

Feedback - Feedback via eLearning Modules and Mid-semester formative assessment.

Prerequisites - None.

Recommended Reading

A number of anatomy and physiology textbooks are appropriate for this unit. A selection of good ones has been listed and all are available in the library. Reading the relevant information in more than one book is a good habit to get into as different books will explain things in different ways and aid your understanding. If you prefer to buy your own textbook it is suggested that you try before you buy. Use the books in the library to help you make your choice and base your choice on the book that most suits your learning style.

- Marieb, E.N. & Hoehn, K. *Human Anatomy & Physiology* Pearson Education
- Martini, F.H. *Fundamentals of Anatomy and Physiology (8th edition)* 2008 Pearson Education
- MariebTortora, G.J. & Dickenson B.H. *Principles of Anatomy and Physiology* (12^{th} Edition) 2009 Wiley

Teaching Staff - Dr Nick Ashton; Professor Mark Dunne; Dr Niggy Gouldsborough; Dr Michelle Keown

DRUGS: FROM MOLECULES TO MAN BIOL10822

Unit Coordinator(s): Dr Richard Prince (richard.prince@manchester.ac.uk)

Semester 2
Credits 10

Aims

To introduce the major concepts underpinning pharmacology. To describe the main molecular mechanisms of action of some important classes of drugs acting on the cardiorespiratory system and relate these mechanisms to their cellular, tissue, organ and whole animal effects.

Intended Learning Outcomes

To understand: the molecular targets for drugs and examples of drugs acting at several target types; the basic concepts of drug receptor interactions; the importance of drug structure in their ability to interact with their targets; the mechanisms of the major drug classes used to treat hypertension, angina, cardiac failure, cardiac dysrhythmias and asthma.

Lecture Content

Introduction to pharmacology: History and scope of pharmacology. How drugs are discovered.
Introduction to drug targets: Structure, function and cellular location of ligand-gated channels, voltage gated channels, enzymes, nuclear hormone receptors, transporters and pumps, G-protein coupled receptors.
Nature of drug receptor interactions: Agonists, antagonists and partial agonists, efficacy, drug structures, pharmacophores and selectivity. Concentration-response relationships. Gaddum, Schild analysis.
Drugs acting on the cardiovascular/respiratory systems: Antihypertensive drugs, antidysrhythmic drugs, drugs used to treat angina and cardiac failure, drugs used to treat asthma.

Assessment

95 marks awarded for a one hour examination, which will include 50 MCQs in the semester 2 examination period, and 5 marks awarded for an electronically marked exercise.

Feedback

Feedback will be provided via automated eLearning module responses; post-examination guidance (if requested)

Prerequisites - None

Recommended Reading

- Rang HP, Dale MM, Ritter JM & Flower, R *Rang & Dale's Pharmacology (6th Edition)* 2007 Churchill Livingstone For purchase if studying Pharmacology in Years 2 & 3
- Waller DG, Renwick AG & Hillier K *Medical Pharmacology and Therapeutics (2nd Edition)* 2005 WD Saunders
- Dale, MM & Haylett, DG *Pharmacology Condensed* 2004 Churchill Livingstone

Teaching Staff - Dr Richard Prince; Dr Mauro Esposti

EXCITABLE CELLS BIOL10832

Unit Coordinator(s): Dr Owen Jones (owen.t.jones@manchester.ac.uk) Semester 2
Credits 10

Aims

To consider the major concepts underlying the basis of cell excitability, the structure and function of excitable cells and their contribution to muscle and nervous system function.

Intended Learning Outcomes

Students will understand what excitable cells are and what makes them important; the techniques used to study them; the structure and function of muscles and the nervous system; invertebrate and vertebrate learning.

Lecture Content

Overview. The cytosol, extracellular fluids, membranes. The proteins - ion channels, pumps and transporters. Diffusion, permeability, electricity. Origin of resting membrane potentials. Radiotracers, dyes, electrophysiology. Patch Clamp Techniques. The action potential. Gross organization of musculature. Cellular structure of muscle. Excitation-contraction coupling in muscle cells.

Gross organization of the nervous system. Cellular organization of the nervous system. Transmission. Saltatory conduction. Electrical synapses. Chemical transmission. A model synapse - the neuromuscular junction. Synaptic integration. Synaptic modulation. Simple nervous systems: invertebrate learning. Vertebrate nervous systems: learning.

Assessment

95 marks awarded for a one hour examination which will consist of 50 MCQs, in the semester 2 examination period, and 5 marks awarded for an eLearning Module exercise.

Feedback

Feedback will be provided verbally in lectures, automatically for eLearning assignments and in response to email enquiries and via post-exam guidance.

Prerequisites

None.

Recommended Reading

- Bear M F, Connors B W & Paradiso M *Neuroscience; exploring the brain* 2001 Lippincott Williams & Wilkins

Teaching Staff

Professor David Eisner; Dr Owen Jones; Dr Cathy McCrohan