LEVEL 1 BIOL UNITS - BY UNIT NUMBER

Code	Title
BIOL10111	Introductory Chemistry
BIOL10212	Biochemistry
BIOL10221	Molecular Genetics
BIOL10232	From Molecules to Cells
BIOL10381	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
HSTM10221/ 10721	Science & the Modern World
HSTM10272/ 10772	Bodies in History: An Introduction to the History of Medicine

LEVEL 1 BIOL UNITS - BY UNIT NAME

Code	Title
BIOL10382	A History of Biology in 20 Objects
BIOL10212	Biochemistry
BIOL10511	Biodiversity
BIOL10811	Body Systems
BIOL10822	Drugs: From Molecules to Man
BIOL10832	Excitable Cells
BIOL10232	From Molecules to Cells
BIOL10521	Genes, Evolution and Development
BIOL10402	Introduction to Experimental Biology
BIOL10401	Introduction to Laboratory Science
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.

Employability Skills

Oral Communication - Students are encouraged to ask and answer questions during lectures and workshops.
Analytical skills - Analytical skills may be developed through problem-solving clinics and eLearning modules
Problem solving - Students have the opportunity to develop their problem solving skills in problem-solving clinics and eLearning modules

Pre-/Co-requisites
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 & 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
1.5 hour examination involving 50 multiple choice questions (85% of unit credits). Electronically marked Blackboard eLearning assessments (15% of unit credits).

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

Employability Skills

Analytical skills - Developed through eLearning exercises on Blackboard 9.
Problem solving - Developed through eLearning exercises on Blackboard 9.

Pre-/Co-requisites
None.

Recommended Reading

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

Teaching Staff

Professor Jeremy Derrick; 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, Function and Replication of DNA

- DNA as the heritable material
- Structure of DNA
- DNA replication: semi-conservative replication, DNA polymerases, events at the replication fork, replication of the lagging strand, replication of telomeres, consequences of defects in telomerase
- Replication of genomes: origins of replication, cell cycle control of DNA replication
- Structure of chromosomes: DNA packaging, features of metaphase chromosomes

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: regulation of transcription, promoters, enhancer elements; RNA splicing, post-transcriptional and post-translational regulation

Part III - Molecular basis of mutation

- Causes of mutations: replication errors, mutagens
- Repair of mutations: direct repair of damaged nucleotides, repair by excision and DNA resynthesis
- Effects of mutations on the information content of a gene, examples of mutations that result in human genetic disease
- Effects of mutations on organisms: genotype and phenotype, sex-linked mutations, chromosome abnormalities

Part IV - Recombinant DNA Technology

- Principles of Genetic Engineering: gene cloning and genomics

Assessment - 1 hour examination (90%) and an eLearning exercise (10%).

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. An online interactive feedback and revision surgery is operated.

Employability Skills

Research - Students must complete eLearning assessments based on lecture material and supplementary lecture-related material. Research and reading is required to complete these. There is a voluntary competition where students must identify, and describe unknown molecluar structures.

Analytical skills - Some areas of the online assessment and exam questions require analytical skills.
Problem solving - Some areas of the online assessment and exam questions require problem solving skills.

Pre-/Co-requisites
None

Recommended Reading

- Brown T *Introduction to Genetics: A Molecular Approach* 2012 Garland Science
- 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 Terry Brown

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.

Employability Skills

Oral communication - Students are encouraged to answer questions during lectures.
Research - Students are presented with current Faculty research during lectures, and are asked research-based questions in some lectures. Some e-pbl material is research-based.
Analytical skills - Several e-pbl modules and some lectures require the students to analyse research data and experimental results.
Problem solving - eLearning modules provide opportunities for problem solving.

Pre-/Co-requisites
None.

Recommended Reading

- Alberts B et al. *Essential Cell Biology 3rd Edition* 2010 Garland Science

Teaching Staff
Professor Viki Allan; Professor Stephen High, Dr Claudia Wellbrock

A HISTORY OF BIOLOGY IN 20 OBJECTS BIOL10381

Unit Coordinator(s): Dr Carsten Timmermann Semester 1
(carsten.timmermann@manchester.ac.uk) Credits 10

Aims

1. This course aims to provide students with a broad perspective on how today's life sciences have grown out of past investigations of living nature and the nature of life.
2. By focusing on "objects": topics of inquiry and tools used to carry out these inquiries we will bring biology's past to life, as something that helps us understand our present.
3. Looking at these objects can tell us a great deal about how biology works, how it has changed, and even how it may develop in the 21st century.
4. Students will gain insight to the motivations that inspired scholars in the past to study living things and the circumstances in which such research was pursued.

Intended Learning Outcomes

We will address the following central questions:

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

The course will look and feel different from history courses that students may remember from school. We are not particularly interested in the deeds of 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. 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.

Objects include:

- The human body (as studied by anatomists since antiquity)
- Sex (and reproduction)
- Plants (collected and classified by botanists)
- Skeletons and Embryos (exhibited in museums)
- The Field (and voyages of discovery)
- The Cell (one of the unifying concepts in modern biology)
- The Kymograph (an important device used by physiologists)
- The Pigeon (and other animals studied by Darwin)
- The Gene (another unifying concept)
- Behaviour (Pavlov, Skinner and others)
- Populations (and the role of statistics in biology)
- Standardised laboratory animals
- The ultracentrifuge (and the birth of molecular biology)
- Information (and the structure of DNA)

Assessment

1 hour examination: multiple-choice questions and one essay-style question - 70%
Group project 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 in a weekly seminar and via Blackboard, in discussion boards. Students will be able to gauge their understanding of topics by completing an online quiz.

Employability Skills

Oral communication - Teaching includes a weekly seminar where students are invited to discuss topics addressed in the lectures.
Written communication - Students write a project proposal for the group work component of the unit. There are also discussion boards inviting students to share opinions on pieces of reading, broadcasts and other materials.
Group/Team working - A group project forms an integral part of the unit. Students work in groups of four creating a resource on the history of a concept or object of choice.
Project management - Project management is needed for the group project.
Leadership - Leadership skills help with the group project.
Innovation/Creativity - The group project invites students to create various forms of resource, including web based time lines, or audio or video clips.
Research - The group project relies on independent research.

Pre-/Co-requisites
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).
- Coleman, William, *Biology in the Nineteenth Century: Problems of Form, Function and Transformation* (Wiley 1971).
- Mayr, Ernst, *This is Biology: The Science of the Living World* (Belknap Press, 1997).

Teaching Staff
Professor Matthew Cobb, Dr Carsten Timmermann, Professor Michael Worboys. With guest lectures by Robert Kirk and Duncan Wilson.

INTRODUCTION TO LABORATORY SCIENCE BIOL10401

Unit Coordinator(s): Dr Ruth Grady **Semester 1**
(Ruth.Grady@manchester.ac.uk) **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 (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

Assessment
20% satisfactory attendance and completion of practicals; 80 % examination.

Students will be assessed by their satisfactory completion of experimental work during the laboratory sessions (20%), and by a 1 hour examination consisting of short answer questions in January (80%).

NB. 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 Unit Coordinator &/or 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. 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 in Semester 2. Additional practice problems/questions [including some with model answers or feedback] will be made available during the semester and should support your preparation for the written examination.

Employability Skills

Written communication - Students need to present data and answer questions in written format in order to show their understanding of the science. This is practised informally during the practical classes, and is formally assessed in written end of unit examinations.
Group/Team working - All practicals require students to work either in a pair or in larger groups (4-6) to share equipment; coordinate experimental techniques; contribute to, and share, class data to improve the validity of the experiments.
Research - The students are required to answer research questions by perfecting and performing experimental techniques, gathering data and reaching justifiable conclusions.
Analytical skills - All data generated in the practical sessions need to be analysed using mathematical/statistical methods and presented in appropriate ways.
Problem solving - The whole point of the practicals is to enable students to tackle research problems in future. The formal written assessment asks the students to design and improve experiments, use mathematical concepts and make sense of data to solve biological problems. They practise these skills in the practical classes.
Other - Time management - the students have 3 hrs to complete practicals that they can easily do in 2-2.5 hrs if they plan well and time manage properly.

Pre-/Co-requisites
None

Teaching Staff
Professor Amanda Bamford, Dr Shazia Chaudhry, Dr Maggy Fostier, Dr Ruth Grady, Dr David Hughes, 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

Assessment
Students will be assessed by a full experimental report for one practical (50%) and a 1 hour examination consisting of a problem (50%).

NB: Attendance at practical sessions is compulsory. Attendance judged to be unsatisfactory will lead to marks getting 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 resit written examination and loss of compensation for other failed first year examinations.

- A minimum of 50% attendance in required topass this unit. Failure to do so will result in a resit practical examination and 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 and on your conceptual understanding of the practical tested through the questions and exercises posed in the practical manual. This feedback along with additional practice problems and their model answers (including a mock paper), a Biomaths clinic, and the data handling skills modules should support your preparation for the written examination. For the experimental laboratory report, support and feedback will be provided by your academic advisor. 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.

Employability Skills

Written communication - Students have to write up their first laboratory report with support from their tutor. It requires searching for references and referencing. It requires following instructions to conform to the format of each section. It also requires choosing the best way to present information and writing concisely and precisely.
Group/Team working - During the practicals, students always work as part of a team (often a pair) and they have to organise their time.
Research - For the laboratory report, students need to understand the content of some starting references and fond others to get more relevant information.
Analytical skills - During all the practical sessions and through the assessment (examination and laboratory report), analytical skills are constantly developed. Students usually spend a large part of the session analysing their own data or model data.
Problem solving - During all the practical sessions and through the assessment (examination and laboratory report), problem solving skills are constantly developed. This can be done along the analytical skills through formal problems in the manual, or through the technical problems that always occur along the way. These problems are solved either by the students or the staff, but everyone learns something from it.

Pre-/Co-requisites
None

Teaching Staff
Professor Amanda Bamford, Dr Jason Bruce, Dr Shazia Chaudhry, , Dr Maggy Fostier, Dr Stefan Gabriel, Dr Alexander Golovanov Dr Ruth Grady, Dr Ken Grieve, Dr Kath Hinchliffe, Dr David Hughes, Dr David Leys, Dr Josip Lovric, Dr Michelle Keown, Dr Jaleel Miyan, Dr Jon Pittman, Dr Tristan Pocock, , Dr Liz Sheader, Dr Tracey Speake.

BIODIVERSITY BIOL10511

Unit Coordinator(s): Professor 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 - are 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. Structural 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
Feedback on your work may be given in one or more of a range of methods. The most usual vehicle will be Blackboard and the most obvious way to obtain feedback is via the Learning Modules for the unit. Each response you give will be evaluated and comments provided that expand correct answers, and help you understand what was wrong about incorrect answers.You may also receive verbal feedback (e.g. during lectures or face to face with the Unit Coordinator), and comments may be made on entries posted on the Discussion Board for this unit.

There will be peer feedback and formative feedback from the Unit Coordinator on your draft e-poster. There will also be answers provided to all the mid-semester examinations with generic feedback on student performance in that exam. If you fail the January examination please consult the generic feedback that will be published on the answers given in that exam. You may also see the Unit Coordinator for individual feedback on your examination paper.

Employability Skills

Oral communication - Students encouraged to answer questions during lectures.
Written communication - Collaborative ePoster and short note questions in examination.
Group/Team working - Collaborative ePoster is a project undertaken by a group of 5-6.
Project management - Collaborative ePoster is a project undertaken by a group of 5-6 over 5 weeks.
Leadership - Collaborative ePoster has leader who takes responsibility for final form.
Innovation/Creativity - Collaborative ePoster is designed to be appealing to younger target audience.
Research - Collaborative ePoster.
Analytical skills - Collaborative ePoster requires analysis of some primary sources and data and several eLearning modules require students to analyse data and experimental results.
Problem solving - eLearning modules questions based on problem solving.

Pre-/Co-requisites
None

Recommended Reading

- Campbell N & Reece J (2011) *Biology (9th edition).* Benjamin Cummings
- Ennos R and Sheffield E (2000) *Plantlife.* Blackwell Science
- Hickman CP, Roberts LS, l'Anson H & Larson A (2003) *Integrated Principles of Zoology.* McGraw-Hill
- Sadava, D (2011) *Life. The Science of Biology.* Sinauer - Freeman

Teaching Staff
Professor 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 introduce Darwin's theory of evolution by natural selection as the key concept in making sense of biology. To provide an overview of the principles of developmental biology and the relationship between development and evolution. To provide an introduction to the principles of inheritance and to appreciate the importance of genetics in understanding evolutionary and developmental processes.

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

Mechanisms of Evolution - Descent with modification: a Darwinian view of life; the evidence for evolution; major transitions in the evolution of life; speciation and its mechanisms; levels of selection; sexual selection; social evolution; population genetics and genetic variation; Hardy-Weinberg equilibrium; processes that change genotype and allele frequencies; evolution at the molecular level.
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.
Patterns and Principles of Inheritance - Mendelian inheritance and probability; relationship between Mendelism and the behaviour of chromosomes during meiosis; gene interactions; sex determination and sex-linked inheritance; genetic linkage and gene mapping; maternal inheritance and organelles; genetics of complex characters; human genetics.

Assessment

1 hour written examination (MCQs) in the semester 1 examination period (80%). Coursework/eLearning (20%) made up of eLearning exercises (5%) and three problem sets (15%) completed online.

Feedback

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

Employability Skills

Analytical skills - Problem sets/eLearning activities will require students to think analytically.
Problem solving - Problem sets/eLearning activities will require problem solving skills.

Pre-/Co-requisites

None

Recommended Reading

- Campbell N and Reece J (2011) *Biology (9th edition).* Benjamin Cummings
- Coyne, JA (2009) *Why Evolution is True.* Oxford University Press
- Savada D (2011) *Life: The Science of Biology (9th edition)*. Sinauer-Freeman

Teaching Staff

Professor Enrique Amaya, Professor Matthew Cobb, Dr David Hughes

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 weed control.

Assessment
95%awarded for a one hour examination which includes 50 MCQs, in the semester 2 examination period, and 5%awarded for eLearning exercises.

Feedback
Feedback is through eLearning modules running throughout the unit.

Employability Skills

Analytical skills - Students may have the opportunity to develop these skills through eLearning exercises which contribute towards 5% of the unit mark.
Problem solving - Students may have the opportunity to develop these skills through eLearning exercises which contribute towards 5% of the unit mark.

Pre-/Co-requisites
None

Recommended Reading

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

Teaching Staff
Dr Nicola High, Dr Geoff Robson, Professor 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 underpin 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 will be given via Blackboard Learning Modules and Mid-semester formative assessment.

Employability Skills

Research - Students are encouraged to read around the lecture material
Analytical skills - Coursework comprises of short online assessments which may require students to analyse material to choose the correct answer.
Problem solving - Coursework comprises of short online assessments which may require a degree of problem solving.

Pre-/Co-requisites
None

Recommended Reading
A number of anatomy and physiology textbooks are appropriate for this unit. 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.

The following book is recommended, but others are equally good.

- Martini, F.H. (2012) *Fundamentals of Anatomy and Physiology (9th edition).* Pearson Education

Teaching Staff
Dr Nick Ashton, Professor Mark Dunne, Dr Michelle Keown, Dr Frances Shaw

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 equation

Role of specialized disciplines within pharmacology: toxins from animal and plant sources, molecular and cellular techniques in pharmacology, discovering the structure of G protein coupled receptors

Drugs acting on the cardiovascular/respiratory systems: Antihypertensive drugs, antidysrhythmic drugs, drugs used to treat angina and cardiac failure, lipid lowering drugs, drug used to treat and prevent thrombosis, drugs used to treat asthma.

Assessment
95%awarded for a one hour examination, which will include 47 MCQs and one short note question (from a choice of three) in the semester 2 examination period, and 5% awarded for an electronically marked exercise.

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

Employability Skills - Handling complex data, time management

Analytical skills - Data handling ePBL
Problem solving - Data handling ePBL

Pre-/Co-requisites
- BIOL10811 Body Systems (Strongly Recommended)

Recommended Reading
- Rang HP, Dale MM, Ritter JM & Flower, R *Rang & Dale's Pharmacology (7th Edition)* 2011 Churchill Livingstone Available as an eBook via JRUL website.
- Katzung BG et al., Basic and Clinical Pharmacology (11th Ed) 2009. Lange. Available as an eBook via JRUL website.

Teaching Staff
Dr Richard Prince

EXCITABLE CELLS BIOL10832

Unit Coordinator(s): Professor Richard Baines
(Richard.baines@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; development of neural circuits and memory & 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. Circuit development. Simple nervous systems: invertebrate learning. Vertebrate nervous systems: learning.

Assessment
95% awarded for a one hour examination which will consist of 30 MCQs and 5 short answer questions, in the semester 2 examination period, and 5% 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.

Employability Skills
Problem solving - Part of unit includes ePBL exercises that count for 5% of the total mark - these are problem solving questions online.

Pre-/Co-requisites
None.

Recommended Reading
- Bear M F, Connors B W & Paradiso M *Neuroscience; exploring the brain* 2001 Lippincott Williams & Wilkins
- E.R. Kandel, J.H Schwartz, T.M. Jessell. *Principles of Neural Science (any edition)*

Teaching Staff
Dr Helena Bailes, Professor Richard Baines, Professor David Eisner
David Berrisford, Dr John M Gardiner, Dr David Leys, Dr Ramesh Vasudevan

SCIENCE AND THE MODERN WORLD HSTM10221/HSTM10721

Unit Coordinator(s): Dr Vladimir Jankovic **Semester 1**
(vladimir.jankovic @manchester.ac.uk) **Credits 10/20**

Aims
To provide a general introduction to science as a central part of our cultural, economic and political life. To explore the place of science and scientific knowledge in human affairs through a study of its historical and social context. To introduce students from all backgrounds to different ways of thinking about science in the past and the present through the use of a variety of resources and media, including literature and film. In addition, the 20 credit unit aims to give students the opportunity of exploring in detail some aspect of the relationship between science and the modern world through an individually supervised research project.

Intended Learning Outcomes
Students will have an appreciation of the complexity of the modern sciences in the broad context of their historical development; understand a range of ways of thinking about the sciences and contemporary society and the relationships between them; be able to reflect critically on the role of the sciences in modern culture; develop their communication and group-working skills; in addition, the 20 credit unit will extend and develop their research and writing skills through an individual research project.

Lecture Content
Lectures form a connected series of case studies of various aspects of science in society and culture, based on the following themes:

- What is Science? Trust and Authority
- Truth and Method
- God and Nature
- Politics and Ideology
- Strange Science and Controversies
- Gender and Science
- Science and Money
- Risk and Post-normal Science
- Science and Democracy

Seminars consolidate lecture material through a set weekly reading. Students are required to answer a short series of questions based on the set text; these questions form the basis of the seminar discussion.

Assessment
Both lecture and seminar content are assessed by:
10 credit unit (HSTM10221) - 1,000-word essay (50% of overall mark), a 1.5 hour exam (50% of overall mark)

20 credit unit (HSTM10721) - 1,000-word essay (25% of overall mark), a 1.5 hour exam (25% of overall mark) and a 3,000-word individual research project (50% of overall mark).

Feedback
Students may ask questions at any time during lectures and seminars. Teaching staff can usually answer specific queries by email or during office hours, and will provide contact details in the course handbook or at lectures. All submitted coursework will be returned with annotations and comments on Blackboard explainig the rationale for the marks given. All feedback on written coursework will be given within two weeks time, unless otherwise specified.

Employability Skills
Critical analysis and independent evaluation of arguments in relevant literature. Communication skills developed during seminars. Effective writing skills (abstract summaries) and extended composition for

Essays. Independent research, time management and organization of data for Projects. Team work in preparation for in seminars. Effective learning and revision techniques.

Oral Communication - Students do not have a formal oral presentation in this unit but they are asked to read a text for the seminars during which an oral interaction takes form of a discussion on a topic of relevance for science and society issues - usually on a topical issue such as the role of commercialization or patenting on biological research, or the role of lab work in the production of biological knowledge. The seminars are lively and sometimes demanding in that they require the skills of real-time dialoguing and defending opposing cases.

Written Communication
1. Non-assessed one paragraph summaries of the readings which are used to provide students with feedback on their reading and writing abilities. These abstracts are meant to introduce skills that could be applied in essay writing.
2. Essays on select topics, precirculated. The essays are 1000 words long and are meant to enable students to produce a short but coherent review of the arguments related to the theme and venture into developing their own views on the subject.

Innovation/Creativity - Essays are based on students's own interests and ideas and it is the requirement of the unit that they offer their own views on existing debates or issues. This ethos is further strengthened by the class discussions in which a controlled improvisation is necessary to produce a viable argument. The key in all such exercises is the ability to understand the logic of sustainable claims with relevance to non-scientific discourse.

Research - Students perform research for essays. The are given a list of initial readings but are not fed into reproducing the consensus. They are told how to use databases, how to avoid unreliable public domain resources and how to develop the criteria for judging the quality of academic work.

Analytical skills - Analytical skills are at the core of all the above exercises.

Pre-/Co-requisites
None.

Recommended Reading
- Bowler PJ & Morus I *Making Modern Science* University of Chicago Press 2005
- Jerry Ravetz, *The No-nonsense Guide to Science*, Oxford 2006.
- Collins H and Pinch T *The Golem: What Everyone Should Know About Science* Cambridge University Press1998

Teaching Staff
Dr Vladimir Jankovic

BODIES IN HISTORY: AN INTRODUCTION TO THE HISTORY OF MEDICINE

HSTM10272/HSTM10772

Unit Coordinator(s): Dr Ian Burney
(ian.burney@manchester.ac.uk)

Semester 2
Credits 10/20

Aims
To provide an introduction to medicine in modern Western culture, from c 1500- c 2000. To show how, through a focus on bodies (human and social), historians of medicine address themes such as class, race, gender, national identity, economic life and cultural production, and how scientific and medical theories and practices can be understood as part of wider histories.

Intended Learning Outcomes
By the end of this unit, students will have acquired a knowledge of the outlines of modern history of medicine; skills in linking 'body histories' to wider contexts; critical abilities in analyzing historical arguments; experience of presenting historical arguments in written seminar responses; and experience of presenting oral arguments in seminar discussions. In addition, students taking the 20 credit unit will be able to find and research a topic of their own choosing; to find and assess critically primary and secondary sources; to write, with full scholarly apparatus, a report on their individual research project.

Lecture Content
- Bodies in History: A Course Introduction
- Bodies Explored: Renaissance Anatomy
- Bodies Ordered: Enlightenment Taxonomies
- Bodies Analyzed: The Medicine of Hospitals and Corpses
- Dirty Bodies : Constitution, Contagion, and 19th-Century Epidemics
- Bodies and Minds: Psychiatry and Fin-de-Siécle Culture
- Infected Bodies: Germs, Microbiology and Everyday Life
- Better Bodies: Evolution and Eugenics at the Turn of the Century
- Calibrating Bodies: Scientific Medicine and the Machine Age
- Productive Bodies: Modern States and the Price of Health
- Bodies at Risk: Biomedicine and the Postwar West
- Patient Bodies: Medicine and Consumerism, 1950-2010

Practical Content
The course meets for one two-hour session. These will include a lecture followed by a practical workshop. The lectures will treat the subject synthetically; the workshops are intended for closer critical investigation of particular issues raised in the week's required reading. Attendance at **BOTH** lectures and workshops is required.

Assessment
10 credit unit (HSTM10272) – Two hour examination (50%); practical assessment (50%)
20 credit unit (HSTM10772) – Two hour examination (25%); practical assessment (25%); written project (50%)

Feedback
Students may ask questions at any time during lectures and seminars. Teaching staff can usually answer specific queries by email or during office hours, and will provide contact details in the course handbook or at lectures. All submitted coursework will be returned with annotations and an assessment sheet explaining the mark awarded.

Employability Skills

Oral communication - Experience of presenting oral arguments in seminar discussions

Written communication - Written seminar responses
Innovation/creativity - Students have the opportunity to be innovative in terms of how they address their essay topic
Analytical skills - Students will develop critical abilities in analysing historical arguments

Pre-/Co-requisites
None.

Recommended Reading

- Conrad L *et al* eds, *The Western Medical Tradition 800 BC to AD 1800* (1995)
- Bynum W *et al* eds, *The Western Medical Tradition 1800 to 2000* (2006)

Teaching Staff
Dr Ian Burney