Programme
Guide

Undergraduate Foundation Programme

Medicine

ONCAMPUS
Achieve more.

Programme Details

Who is this programme designed for?

This Medicine Undergraduate Programme (MUFP) is designed to prepare international students, who have completed senior secondary education and met the academic requirements listed, to apply for undergraduate study for a Medicine degree.

How long will I study for?

This programme lasts one academic year (nine months). The year is divided into three terms of approximately 10 weeks. On average, you will undertake between 21 and (up to) 27 hours of classroom-based study per week.

An Extended programme is available which comprises one term of English language, followed by three terms as described above

Please note: Minimum and maximum hours are estimated, hours may vary depending on your academic and English level and may be adjusted throughout the course.

What will I study?

This programme includes four core modules, taken by all students throughout the course. These modules are: Medical Biology, Chemistry for Medicine, Pure Maths with Statistics and English. Students will also study a Medicine Skills module.

You will have a Personal Tutor to support you throughout the programme. Your Personal Tutor will help you adjust to life and study in the UK, support you to become a successful medicine student, and prepare you for your university interview.

English Language forms up to six hours of your timetable, is compulsory for students who are below the required level for progression, and will be integrated into the teaching of academic subjects as well as being taught separately if you need additional support. Students who are at or above the required English level for progression are likely to follow a reduced timetable.

Students will be expected to timetable self-study hours in addition to the classroom-based hour

How will I be assessed?

You will be assessed by exam for Maths and English, and by a combination of exam and practical work for Biology and Chemistry.

Entry to Medicine is competitive and whilst students who are predicted to achieve the required grades are guaranteed an interview at UCLan and RCSI, there is no guarantee of acceptance on to the course. Students must have met all pre-requisites to be considered for Medicine at our partner universities.

Modules

Modules taught at **ON**CAMPUS UK North are as shown in the table below. All students will have English incorporated into their study plan.

Centre	Chemistry for Medicine	Medical Biology	Pure Maths for Statistics	Medicine Skills
ONCAMPUS UK NORTH	✔	✔	✔	✔

Chemistry for Medicine

The Medicine Undergraduate Foundation Programme Chemistry module has been carefully designed to cover the most relevant chemistry content at A Level that you will need in order to have a strong Chemistry foundation to study Medicine at undergraduate level. For each topic that you study, you are advised to think like a healthcare practitioner, particularly on the application aspects.

During the course, you will study Module 1 (Foundation Chemistry), Module 2 (Lab Practical Skills) and Module 3 (mainly Organic and Physical Chemistry).

The depth of study of each topic depends on how important the topic is in medicine at this stage.

Term 1

01
Structure of an atom

1. Describe properties of sub-atomic particles
2. Draw Bohr's simple model of an atom for elements with atomic numbers 1-20
3. Define: atomic number, mass number, isotopes, relative atomic mass and relative molecular mass
4. Calculate: number of protons, electrons, neutrons in an atom, isotope or ion
5. Calculate mass number of an element

02
Electronic configuration

1. Deduce the electronic configuration of isolated atoms of the elements Hydrogen to Krypton and their ions using s,p, d, f and 'electrons-in-boxes' notations
2. Interpret the electronic configuration of isolated atoms and their ions of the elements Hydrogen to Krypton in terms of chemical stability

03
Ionisation energies

1. Construct successive ionisation equations for elements with atomic numbers between 1 and 20
2. Interpret ionisation energies of chemical species in terms of chemical reactivity
3. Define ionisation and successive ionisation energies

04
Mass spectrometer

1. Draw a simple labelled diagram of a mass spectrometer
2. Explain the functions of the main parts
3. List and explain the main processes involved
4. Calculate Ar given isotopic composition and relative abundances

05
Calculations involving Mass, Mole and Gas Voumes

1. Define relative atomic mass (Ar)
2. Define relative molecular mass (Mr)
3. Define Avogadro Constant (NA)
4. Define molar volume (Vm)
5. Construct chemical formulae for compounds using their oxidation states
6. Construct balanced chemical equations
7. Recall and apply the formula: N = n(x)*NA where N is number of particles (atoms, molecules or ions)
8. Calculate Mr
   Mr = Σ(Ar X no. of atoms) for each element
9. Recall and apply the formula
   n(x) = m(x)
   M
   where M-molar mass
10. Recall and apply the formula:
    n(x) = V(x)
    Vm
    *Vm = 24.0 dm3.mol-1 at r.t.p

06
Calculations involving Concentration, Empirical and Molecular Formulae

1. Recall and apply the formula
   c(x) =
   n(x)
   V
   Or
   c(x) = m(x)
   V
2. Recall and apply the formula
   C1V1 = nC2V2
   Where n is a stoichiometric coefficient

07
Empirical and Molecular Formulae

1. Define molecular formula (E.F)
2. Define empirical formula (M.F)
3. Calculate the E.F of a substance given its constituent elements and their respective mass compositions
4. Calculate the M.F of a substance given its relative molecular mass (Mr) and its E.F

07

Types of chemical bonds

1. Define the following chemical bonds: covalent, ionic and metallic bond
2. Draw dot-cross diagrams to represent formation of covalent bonds e.g. for: H2, NH3, CH4, O2, N2, HCl etc
3. Draw dot-cross diagrams to represent formation of ionic bonds e.g. for: NaCl, MgCl2, LiF, etc
4. Define electronegativity
5. Use electronegative values to deduce bond polarity in covalent bonds
6. Explore I.M forces in S.molecules

08

Types of structures of substances

1. Describe the different types of structures of substances (simple molecular, giant molecular, giant ionic and metallic structures)
2. Compare the different types of structures of substances according to their properties: bond types, interaction forces, boiling/melting temp, electrical conductivity and physical states at r.t.p
3. Compare the physical properties of diamond, graphite and fullerenes and link these to their uses
4. Explore potential uses of nanoparticles in medicine
5. Explore some physical properties of some specific metals e.g. electrical conductivity and link these to the applications of the metal

09

Shapes of molecules

1. Recall the Valence Shell Electron-Pair Repulsion Theory (VSEPR)
2. Use the VSEPR Theory to deduce shapes (electron geometry or molecular geometry) of some simple molecules and ions
3. Use the VSEPR Theory to construct shapes (electron geometry or molecular geometry) of some simple molecules and ions, also state the bond angles
4. Deduce polarity of some simple molecules

10

Introduction to The Periodic Table

1. Explain how elements are generally arranged in order of increasing atomic numbers on the Periodic Table (P.T)
2. Explain how elements are arranged in groups and in periods on the P.T
3. Explore the similarities in properties of elements in the same group or period.
4. Recall family names of elements in groups 1, 2, 7 and 8
5. Explore the trends in atomic properties of elements in the same period
6. Construct the full electronic configurations for the element's hydrogen to krypton (1-36)
7. Explore the trends in physical properties of elements in P.3 e.g. melting and boiling points and electrical conductivity, and explain in terms of structure and bonding
8. Describe and explain the trend in first ionisation energies (1st I.Es) in Period 3
9. Explore metallic and non-metallic properties of Group 4 elements and the trends in these properties
10. Explore trends in chemical and physical properties of G.2 elements including any anomalies

11. Construct balanced chemical equations for reactions of G.2 metals with: O2, Cl2 and H2O. Describe any observations

12. Construct balanced chemical equations for reactions of G.2 oxides with: H2O, dilute HCl and HNO3. Describe any observations

13. Construct balanced chemical equations for reactions of G.2 hydroxides with: dilute HCl and HNO3. Describe any observations

14. Explain the trends in solubility of G.2 sulphates and hydroxides

15. State and explain the trends in thermal stability of G.2 carbonates and nitrates

16. Construct balanced chemical equations of thermal decomposition reactions of G.2 carbonates and nitrates

11

Chemical and Physical Properties of Halogens

1. Explore the general trends in chemical and physical properties of G.7 elements and link these to their applications

2. Predict displacement reactions of halogens and some halide ions

3. Construct some balanced chemical equations for displacement reactions of halogens

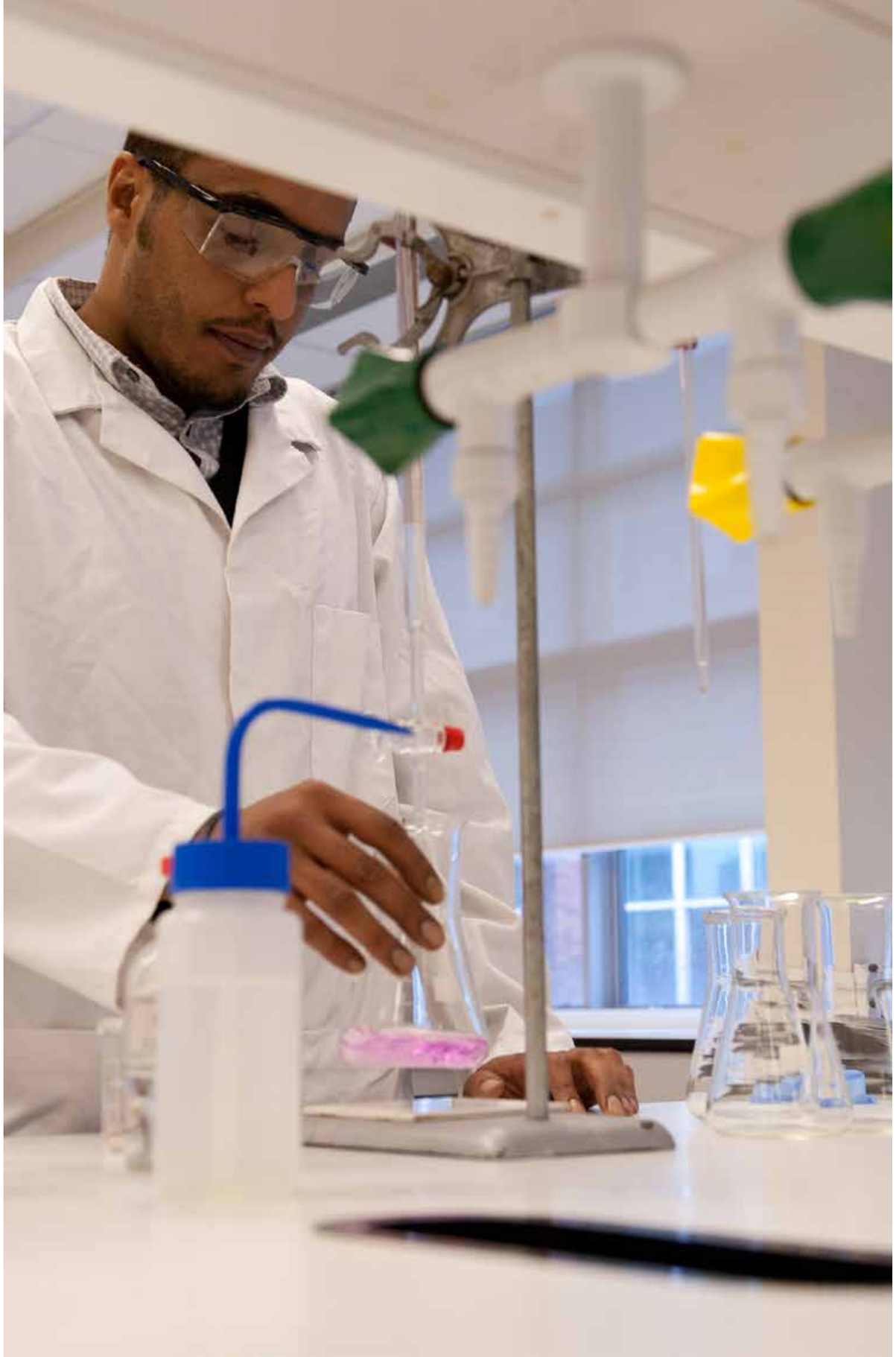
4. Predict some colour observations when displacement reactions of halogens occur

5. Describe how to test for the presence of halide ions using acidified silver nitrate, dilute and concentrated ammonia solutions

6. Construct half-equations for the reactions between halide ions (X-1) and acidified silver nitrate (Ag+1) stating the colour of the precipitate formed in each case

7. Define disproportionation reaction

8. Demonstrate disproportionation by means of chemical reactions



12

Oxidation States

1. Recall that the oxidation state of an element is 0

2. Recall oxidation states of common ions

3. Deduce the oxidation state of an element from the formula of an inorganic species

13

Redox Reactions

1. Define: oxidation, reduction, oxidising agent and reducing agent in terms of electron transfer. (Electron loss or gain)

2. Give examples of strong and weak oxidising agents

3. Give examples of strong and weak reducing agents.Construct ionic half-equations and use them to deduce complete balanced chemical equations for redox processes. Identify 'spectator' ions

4. Define a spectator ion

Term 2

01

Enthralpy Level Diagrams

1. Sketch simple, well labelled enthalpy level diagrams for endothermic and exothermic reactions
2. Define: calorimetry and specific heat capacity
3. List and compare the different types of calorimeters used to find out enthalpy change of a reaction
4. Recall that density of H2O = 1g/cm3 therefore 1cm3 = 1g
   Recall and apply the formulae:
   $q = mc\Delta T$
5. $\Delta H = \frac{q}{n}$
   *q is negative (-) for neutralisation & combustion reactions
6. Recall Hess Law
7. List standard conditions
8. Define: ΔH , ΔHRϴ, ΔHFϴ , ΔHCϴ, ΔHNϴ, exothermic reaction, endothermic reaction, (mean) bond enthalpy
9. Recall and apply the following formulae to work out ΔHRϴ:

   ΔHRϴ = ΣΔHFϴ(products)- ΣΔHFϴ(reactants)

   ΔHRϴ = ΣΔHCϴ(reactants)- ΣΔHCϴ(products)

   ΔHRϴ = ΣE in bonds broken- ΣE in bonds made

02

Collision Theory

1. Recall Collision Theory
2. Sketch and interpret Energy Profile Diagrams of reactions with EA
3. Define:
   Rate of reaction
   Homogeneous reaction
   Heterogeneous reaction
   Activation energy (EA)
   Catalyst
   Homogeneous catalyst
   Heterogeneous catalyst
4. List and explain factors that affect rate of reaction using Collision Theory
5. Sketch Maxwell-Boltzmann distribution curves to explain rate of reaction at different temperatures (higher/lower) and the effect of a catalyst
6. Interpret Maxwell-Boltzmann distribution curves

03

Le Chateliers Principle

1. Explain Le Chatelier's Principle
2. Define dynamic equilibrium
3. Define position of equilibrium
4. List and explain the factors that affect the position of equilibrium
5. Explain why a catalyst does not affect the position of equilibrium
6. With reference to a specific chemical equilibrium, state the effect of changing each factor and briefly explain
7. Explain compromised conditions on given reactions

04

Nomenclature

1. Define homologous series
2. Define a functional group
3. Recall all homologous series relevant to this syllabus and their corresponding functional groups
4. Use IUPAC rules to name aliphatic compounds relevant to this syllabus
5. Construct structures for aliphatic compounds relevant to this syllabus
6. Define: isomerism, structural isomers, stereo-isomers and optical isomers
7. Deduce and name isomers for given organic compounds that have: chain isomers, position isomers, functional group isomers and cis-trans isomers
8. Define: a chiral C and a racemic mixture
9. Explore applications of optical isomers in biochem e.g. lactic acid, alanine, serine and leucine
10. Explore potential impact of racemic mixtures in drug therapy e.g. thalidomide disaster
11. Describe dispensable and indispensable amino acids citing examples in each case
12. Define: an electrophile, a nucleophile and a free radical
13. Describe bond breaking (homolytic & heterolytic) with the aid of diagrams

14. Classify organic reactions into the following 7 main types: addition, elimination, condensation polymerisation, substitution, redox, hydrolysis and addition polymerisation reaction

15. Construct balanced chemical equations for the reactions of alkanes in terms of combustion and substitution by halogens showing the mechanism of free radical substitution

16. Construct balanced chemical equations for the following addition reactions of alkenes:
1. The addition of H2 with a Ni catalyst to form an alkane
2. The addition of halogens to produce di-substituted halogenoalkanes
3. The addition of hydrogen halides to produce halogenoalkanes
4. Oxidation of the double bond by potassium permanganate to produce a diol

17. Construct electrophilic addition reaction mechanism for reactions between alkenes with halogens, hydrogen halides and hydrogen

18. Describe the chemical test for the presence of C=C bond using: bromine water and acidified potassium manganate (VII)

05

Classification of Alcohols

1. Classify alcohols into primary, secondary and tertiary alcohols

2. Construct general structural formulae for primary, secondary and tertiary alcohols

3. Construct balanced chemical equations for reactions of alcohols with: -O2; -Na; -PCl5, their oxidation with acidified K2Cr2O7, with -COOH group (esterification) and with Al2O3 (dehydration)

4. Describe positive chemical tests for:
Alkenes, Halogenoalkanes, Alcohols (primary and secondary), Carbonyls(C=O): Aldehydes & Ketones and Carboxylic acids

5. Give examples of molecules that contain amine and amide F.Gs

6. Describe reactions to investigate the typical behaviour of primary amines:
1. Characteristic smell
2. Miscibility with water as a result of hydrogen bonding and the alkaline nature of the resulting solution
3. Formation of salts
5. Treatment with ethanoyl chloride and halogenoalkanes, e.g. making paracetamol

7. Describe the reduction of aromatic nitro-compounds using tin and concentrated hydrochloric acid to form aromatic amines

8. Describe the reaction of aromatic amines with nitrous acid to form benzenediazonium ions followed by a coupling reaction with phenol to form a dye

9. Describe the synthesis of amides using acyl chlorides

01

Bronsted and Lowry Acid-Base Theory

1. Define an acid using Bronsted and Lowry Acid-Base Theory
2. Define a base using Bronsted and Lowry Acid-Base Theory
3. Explain conjugate acid-base pairs by means of a chemical equation
4. Define:
   a strong acid
   a strong base
   pH
   Kw
5. Recall the expression for pH, pH = -lg[H+]
6. Recall the expression for Kw, Kw = [H+]* [OH-]
7. Calculate pH/pOH for strong acids or strong bases (pH = -lg[H+], pOH = -lg[OH-])
8. Calculate [H+], ([H+] = 10-pH)
9. Define a weak acid
10. Define a weak base
11. Recall the expression for Ka and its units
    $(K_a = \frac{[H^+]^2}{[HA]}$
    Units: $mol.dm^{-3})$
12. Calculate pH for weak acid ($[H^+] = \sqrt{K_a} * [HA]$ then pH = -lg[H+])
13. Demonstrate understanding of acid-base titration
14. Calculate the pH of a titrand/ analyte
15. Interpret titration curves of common acid-base titrations
16. Define a buffer solution
17. List natural and artificial applications of buffer solutions
18. Calculate [H+] of a buffer solution ([H+] = Ka* [Acid] /[Salt]
19. Calculate pH of a buffer solution
    pH = pKa + lg([Salt]/ [Acid])
20. Calculate pH of a buffer solution after addition of a small amount of an acid

02

Investigating rates of reactions

1. Demonstrate an understanding of the terms: rate of reaction; order of reaction; rate constant; half-life and rate-determining step
2. Investigate reactions which produce data that can be used to calculate the rate of the reaction, its half-life from concentration or volume against time graphs, e.g. a clock reaction
3. Present and interpret the results of kinetic measurements in graphical form, including concentration-time and rate concentration graphs
4. Deduce from experimental data for reactions with zero, first and second order kinetics:
   i. half-life (the relationship between half-life and rate constant will be given if required)
   ii. order of reaction
   iii. rate equation
   iv. rate-determining step related to reaction mechanisms
5. Deduce from experimental data the activation energy

03

Relationship between equilibrium concentrations of reactants and products

1. Use practical data to establish the idea that a relationship exists between the equilibrium concentrations of reactants and products which produces the equilibrium constant for a particular reaction
2. Construct expressions for Kc and Kp for homogeneous and heterogeneous systems, in terms of equilibrium concentrations or equilibrium partial pressures, perform simple calculations on Kc and Kp and work out the units of the equilibrium constants
3. Apply knowledge of the value of equilibrium constants to predict the extent to which a reaction takes place

04

Electronic spectrum and its effects on molecules

1. Explain the effect of different types of radiation on molecules and how the principles of this are used in chemical analysis and in reactions
2. Explain the use of high resolution nmr spectra to identify the structure of a molecule:
   1. based on the different types of proton present from chemical shift values
   2. by using the spin-spin coupling pattern to identify the number of protons adjacent to a given proton
3. Explain the use of magnetic resonance imaging as a non-invasive technique
4. Demonstrate an understanding of the use of IR spectra to follow the progress of a reaction involving change of functional groups, e.g. in the chemical industry to determine the extent of the reaction
5. Interpret IR spectra to identify functional groups and the fingerprint region
6. Interpret simple mass spectra to suggest possible structures of a simple compound from the m/e of the molecular ion and fragmentation patterns

Medical Biology

This module covers aspects of human physiology at Level 3. The course has been designed such that it forms a basic set of information about the human body and leads you to integrate topics such that the human can be seen as a whole working organism.

Practical work aims to complement theory and develop observational, analytical and skills required for future scientific study.

01

Cells ultrastructure and microscopes

1. The human body is a complex multicellular structure which can be divided into organ systems, organs and tissues each with a specific function
2. Students will be familiar with the type of images produced by light, scanning and transmission electron microscopy
3. Explain how resolution is increased using electron microscopes compared to light microscopes
4. Compare uses of light and electron microscopy
5. Students will be able to calculate actual sizes or magnifications from images
6. Understand the organisation of eukaryotic cells as illustrated by a typical animal cell (the liver cell is suggested)
7. Describe the structure and roles of the nucleus, nucleolus, rough and smooth endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, ribosomes, cell membrane, centrioles and microtubules
8. Be able to apply knowledge of above features in explaining the adaptations of eukaryotic cells
9. Recognise and identify these structures in EMs of animal cells (the liver cell is suggested)
10. Describe the structure of a bacterial cell and it's inclusions as illustrated by E. coli
11. Describe the roles of: the capsule, cell wall, the cell membrane, flagella, bacterial chromosome, plasmids, glycogen granules and lipid droplets. Recognise and identify these structures in EMs of bacterial cells

02

Transport across the cell membrane

1. Transport across the Cell Membrane
2. Describe the structure, properties and roles of the cell membrane
3. Interpret the structure and properties of phospholipids for their role in cell membranes
4. Interpret the structure of proteins and modified proteins for their role as channels, carriers, receptors or recognition molecules in cell membranes
5. Explain the principles of osmosis in terms of the diffusion of water molecules from a higher to a lower water potential through a selectively permeable membrane
6. Relate factors that affect water potential to their effects on cells
7. Interpret protein structure and function as it relates to the role of transport proteins in the cell membrane (the ability of proteins to undergo reversible conformational changes in response to environmental influences)
8. Use the principles involved in passive transport by diffusion and facilitated diffusion to interpret movement of substances through membranes
9. Know the factors involved in active transport, endocytosis and exocytosis to interpret actions of the plasma membrane

03

Introduction to carbohydrates, lipids and proteins

1. Recall that hexoses and pentoses are monosaccharides and can be monomers
2. Recall the structure and roles of the monosaccharides alpha and beta glucose, ribose and deoxyribose
3. Know the monomers of and roles of the disaccharides sucrose, maltose and lactose in humans
4. Recall the structure and the roles of the polysaccharides starch (amylose and amylopectin), cellulose and glycogen; relate structure to function of these polysaccharides
5. Lipids can be fats, oils or waxes and all are hydrophobic
6. Recall the general structure of a triglyceride synthesised from glycerol and fatty acids
7. Triglycerides contain ester bonds. Interpret the nature of saturated and unsaturated fatty acids in their roles in cell membranes
8. Describe the roles of lipids as energy stores, and, in protection, waterproofing and insulation
9. Compare phospholipid and triglyceride structures. Interpret the

role of phospholipids in membranes

10. Amino acids are monomers of polypeptides and proteins. Recall the general formula and structure of amino acids and role of R-groups in tertiary structure (details of the structures and formulae of specific amino acids are not required)

11. Describe peptide bonds and the formation as condensation reactions

12. Describe protein structure in terms of primary, secondary, tertiary and quaternary structure. Know their importance for the structure of enzymes and other proteins

13. Interpret the roles of ionic, hydrogen and disulphide bonds in the structure of proteins as illustrated by insulin and collagen

14. Roles of fibrous and globular proteins as illustrated by collagen and insulin

04

Introduction to DNA - The genetic code and protein synthesis

1. DNA carries information which influences the physical form (phenotype) of an organism

2. DNA is in all living organisms: In the nucleus of eukaryotes and in the cytoplasm of prokaryotes

3. Ribonucleic acid (RNA) and deoxyribonucleic acid (DNA) are composed of mononucleotides

4. Recall the basic structure of a nucleotide; thymine, uracil and cytosine as pyrimidines; adenine and guanine as purines

5. Condensation reactions are involved in the formation of mononucleotides and polynucleotides (DNA and RNA)

6. Recall the structure of DNA as a double helix and the role of base pairing to maintain its structure

7. Interpret information about the mechanism of replication of DNA (semi-conservative), including the roles of the enzymes DNA Helicase, DNA Polymerase and DNA Ligase

8. Interpret information about the genetic code. Know that a gene is a sequence of bases on the DNA molecule. The gene also contains transcriptional controlling areas as well as sequences which code for the amino acids in the polypeptide chain

9. Describe the process of transcription, and the roles of the enzymes helicase and RNA polymerase. Know that premessenger RNA is transformed into functional mRNA by splicing. Know the difference between introns and exons and 'junk' DNA

10. Recall that amino acid sequences are specified by DNA and know the function of the large and small ribosomal subunits; compare codons to anticodons in relation to messenger and transfer RNA

11. Use RNA codon tables to determine the amino acid se-quence which will result from an mRNA sequence. Students will be aware that AUG (methionine) is the 'start' codon, and that there are stop codons. Recall the role of releasing factors

05

Enzymes

1. The structure of enzymes as globular proteins, and the concept of the active site and specificity

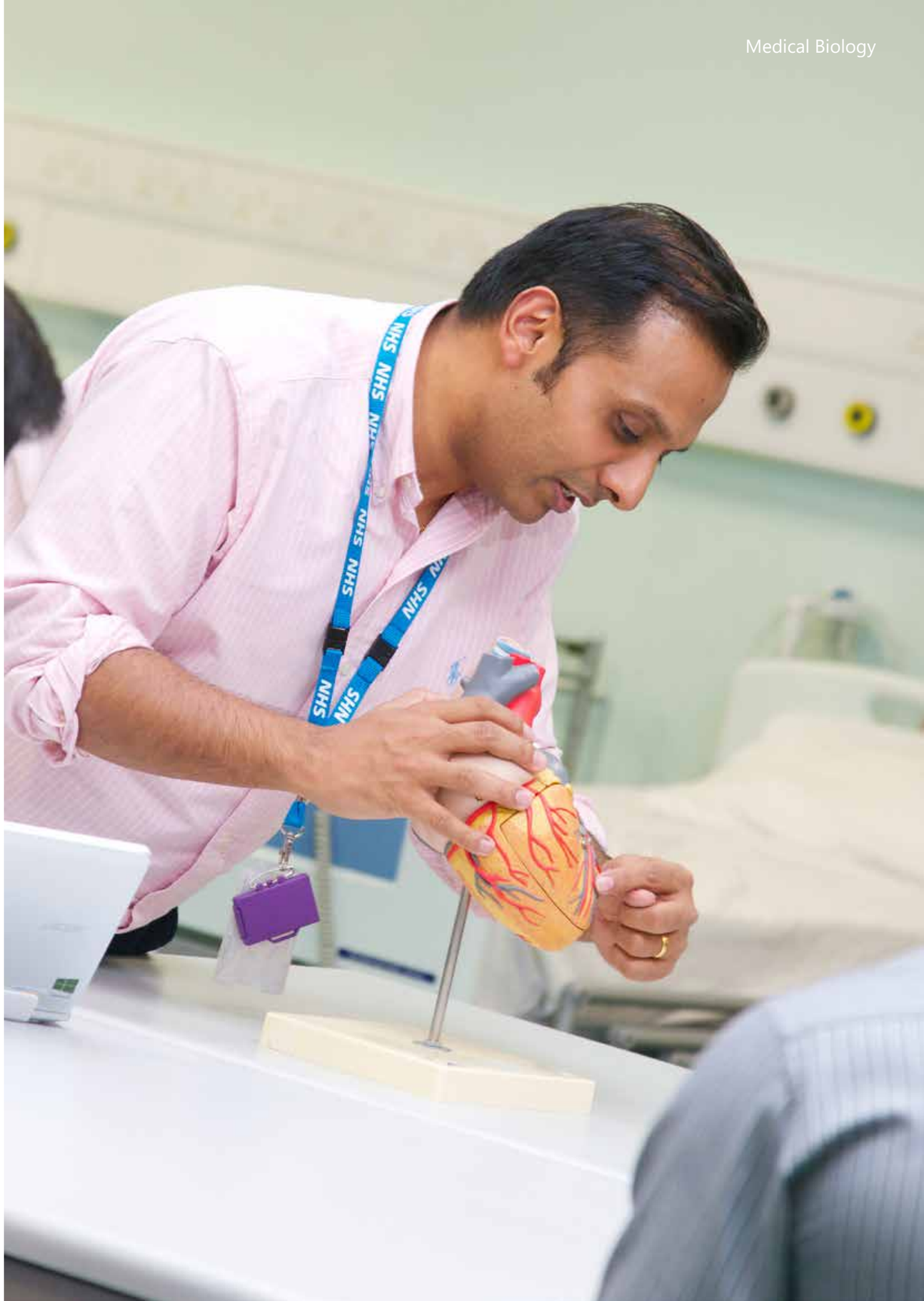
2. Recognize that enzymes are catalysts which reduce activation energy

3. Explain how enzyme activity is affected by temperature, pH, substrate and enzyme concentrations

4. Compare and explain competitive and non-competitive inhibition of enzyme action

5. Appreciate the commercial uses of enzymes as illustrated by glucose oxidase in chemical identification

6. Discuss the advantages of the immobilisation of commercial enzymes, as illustrated by lactase



06

Circulatory system: Vascular system and transport of oxygen

1. The circulatory system as a mechanism for the transport of respiratory gases, metabolites, metabolic wastes and hormones as well as the distribution of heat
2. Describe the structure and roles of blood vessels
3. Recall the function of arteries as blood vessels which carry blood away from the heart. Recall an example of an artery which carries deoxygenated blood. Recall the structures and functions of the tunica external, tunica media and tunica intima in arteries
4. Recall that arterioles are smaller arteries. Understand the role as controlling blood flow to specific tissues or organs
5. Recall the function of capillaries as blood vessels which carry blood through tissues. Recall and understand the function of the endothelium in capillaries
6. Recall the function of veins as blood vessels which carry blood towards the heart. Recall an example of a vein which carries oxygenated blood. Recall the functions and relative thicknesses of the tunica externa, tunica media and tunica intima in veins. Explain how blood flows along veins
7. Recall that venules are smaller veins
8. Identify the major arteries and veins feeding the key organ systems of the body
9. Describe the components of blood as plasma and blood cells, to include erythrocytes, leucocytes, (neutrophils, eosinophils, monocytes and lymphocytes) and thrombocytes
10. Describe the structure of erythrocytes and explain their adaptations to their role in transport
11. Explain the mechanisms of the transport of oxygen and carbon dioxide
12. Interpret and explain disso-ciation curves of haemoglobin and the Bohr effect. Relate differ-ences in dissociation curves of the foetus and different conditions of oxygen availability – altitude, hypoxia. Explain the role of myoglobin
13. Recall the causes and symptoms of iron deficiency anaemia
14. Explain in terms of pressure, water potential gradients and diffusion the interchange of materials between capillaries and tissue fluid, including the formation of lymph

07

Circulatory system: The heart

1. Discuss the advantages of the double circulation system and flow of blood through the body
2. Describe the structure and functions of the human heart and coronary circulation including: superior and inferior vena cavae, right atrium, tricuspid valve, right ventricle, pulmonary artery, pulmonary vein, left atrium, bicuspid valve, left ventricle, aorta and coronary arteries, apex, septum, chordae tendineae, papillary muscles, purkinje fibres and bundles of His
3. Interpret and explain diagrams and graphs of the cardiac cycle
4. Describe myogenic stimulation and how the cardiac cycle is regulated by nervous control
5. Describe a normal ECG, relate the P wave, QRS complex and T wave to events in the cardiac cycle and evaluate the role of artificial pacemakers

08

Defence against disease

1. Role of skin and other organs preventing entry of pathogens
2. Role of platelets and plasma in blood clotting
3. Secondary defences
4. The role of phagocytes and macrophages – innate immune responses
5. Humeral responses - adaptive immune sytem
6. Structure and features of antibodies
7. The roles of B & T lymphocytes in the secretion of antibodies and destruction of antigens
8. Explain the reasons for the primary and secondary immune response. Describe the differences between artificially and naturally induced immunity

09

Control systems and drugs

1. Recall the differences between the somatic and autonomic nervous systems. Evaluate the need for unconscious and conscious control systems
2. Recall the stages, structures and sequence of the reflex arc: Stimulus, Receptor, Sensory neurone, Effector neurone, Effector, Response
3. Describe the structure of sensory, motor and relay neurones
4. Describe and explain the formation and nature of the nervous impulse
5. Describe and explain the mechanism of a synapse
6. Appreciate the nature of different transmitter substances and effects of drugs on nervous system
7. Explain the use of nervous control in maintenance of constant body temperature as inputs from skin and blood using the hypothal-amus as a control centre with responses in the skin

10

Endocrine systems

1. Explain role of chemical control and need for homeostasis
2. Compare the features of hormonal and nervous control
3. Blood glucose, insulin and diabetes
4. Recall that glucose is converted into glycogen by the liver, and that glycogen is then stored
5. Recall that the hormone insulin is produced by the islets of Langerhans (β-cells), understand that insulin causes glucose to be absorbed by cells to then be converted to glycogen (glycogenesis). Recall that liver (and other) cells have specific membrane receptors and that insulin acts as a signalling molecule. (No further details of the stages of this process in the cytoplasm are required.)
6. Recall that the hormone glucagon is produced by the pancreas (islets of Langerhans α-cells). Recall that glucagon causes target cells to convert glycogen to glucose (glycogenolysis). (No further details of the stages of this process are required.)
7. Describe how negative feedback maintains a constant blood glucose concentration
8. Explain why glucose is excreted in the urine of diabetics. Recall that urine can be tested for glucose as part of a series of tests to diagnose diabetes
9. Describe the roles of glucose in the body and problems caused by diabetes type 1 and type 2

11

Kidney & osmoregulation

1. Metabolic waste products are excreted to the environment in the nephron
2. Recall the names of the structures of the nephron and their basic functions
3. Explain mechanisms of: Ultrafiltration, Glucose reabsorption and the control of water reabsorption by ADH
4. Explain why water potential changes of the blood can affect tissue fluid formation and oedema
5. Hormonal control of reproduction
6. Describe the menstrual cycle and explain the roles of LH, FSH, oestrogen and progesterone. Describe how negative feedback is involved in the control of the menstrual cycle and results in its cyclical nature. Explain why the menstrual cycle is under hormonal control, rather than nervous control
7. Describe the functions of the placenta for the foetus including the role of controlling the passage of harmful substances (ref. to nicotine and alcohol, heroin and Rubella and HIV viruses). Explain why it is important to keep maternal and foetal blood separate
8. Recall the overall stages of birth and the control of birth by foetal and maternal hormones
9. Recall the control of colostrum and milk production by prolactin and oxytocin; the importance of colostrum

12

Breathing

1. Identify structures of the respiratory system (Nasal Cavity, mouth, epiglottis, larynx, trachea, cartilage rings, bronchi, bronchioles, lungs, alveoli, intercostal muscles, ribs/ ribcage and diaphragm) and their functions
2. Describe the mechanism of ventilation
3. Describe how a spirometer may operate and interpret spirometer data to calculate the breathing rate, tidal volume, vital capacity and ventilation rate

4. Explain how the breathing centre controls breathing rate and volume, the importance of stretch and chemoreceptors and recall their locations
5. Evaluate the effects of physical activity and increase in carbon dioxide concentration on breathing rate and volume

13

Respiratory diseases

1. Effect of smoking on lung structure – emphysema, chronic bronchitis, COPD.
2. Evaluate epidemiological evidence linking smoking to cancer. Describe how cancerous cells are different from normal cells
3. Causes, transmission, effects and treatment of tuberculosis

14

Skeletal system

1. Nature & roles of the skeletal system
2. Recall types of joints (synovial, cartilaginous, immoveable) and structure of a ball & socket joint
3. Outline the effects of ageing on skeletal system with reference to osteoarthritis and osteoporosis
4. Explain the need for antagonistic muscles
5. Describe the ultrastructure of striated muscle and relate to the sliding filament theory of muscle contraction
6. Explain how a nerve impulse can cause a muscle to contract

15

Ceullular respiration

1. Release of energy as production of ATP
2. Describe the conversion of monosaccharides to pyruvate during glycolysis; the phosphorylation of hexose molecules; breakdown to glycerate-3-phosphate (GP); production of reduced coenzyme (NADH + H) and ATP (details of intermediate compounds not required)
3. Explain how, during complete oxidation of pyruvate, the events of the Krebs cycle result in the production of carbon dioxide and more reduced coenzyme (NADH + H) and ATP (details of Krebs cycle stages not required)
4. Explain the role of the electrontransport chain in generating ATP (oxidative phosphorylation)
5. Explain the role of molecular oxygen as a hydrogen acceptor forming water
6. Recall the structure of a liver mitochondrion; identify inner and outer membranes and the inter-membranal space. Describe the role of mitochondria as the site of Krebs cycle and electron carriers with the role of oxidoreductases

7. Link the situations in which the pyruvate formed in glycolysis may not undergo complete oxidation to exercise and the formation of lactic acid in muscle. Contrast the advantages and disadvantages of forming lactic acid

16

Fitness

1. Define aerobic and anaerobic respiration

2. Compare and explain the differences in the yields of ATP from the complete oxidation of glucose and from the fermentation of glucose to lactic acid

3. Describe the immediate effects of exercise on the body, concept of oxygen debt and lactate production

4. Describe and explain the effects of exercise on aerobic fitness and long term beneficial effects. Relate to decrease in disease

5. Define basal metabolic rate (BMR) and relate causes of change in metabolic rate to activity

17

Nutrition

1. Recall the concept of a balanced diet, components of a diet and know about the Recommended Daily Amounts

2. Evaluate the relationship between energy intake and use with respect to different activity levels

3. Interpret data of the nutrient requirements of different people with reference to diet choice, gen-der, age, activity, pregnancy and lactation

4. Describe the consequences of malnutrition with reference to obesity, starvation, protein deficiency, anorexia nervosa, deficiencies of vitamin C & D

18

The human digestive system

1. The structure and function of the human digestive system

2. Describe the structure of the alimentary canal in relation to digestion and absorption

3. Recall the locations and functions of the following structures of the digestive system: The mouth (including the teeth, tongue and the salivary glands, epiglottis, oesophagus, stomach (including the cardiac and pyloric sphincters), duodenum, gallbladder, pancreas, ileum, colon, appendix and rectum

4. Recall the components of saliva as water, salivary amylase, sodium hydrogen carbonate and mucin) and describe their functions

5. Recall the components of pancreatic juice as sodium hydrogen carbonate, proteases, pancreatic amylase, lipase and nuclease and describe their functions

6. Descibe the structures, functions and interconverstions of mono-,di-, and polysaccharides and of amino acids to proteins

7. Describe the sources and effects of secretions concerned with the digestion of carbohydrates (Salivary amylase, pancreatic amylase, sucrase, lactase, and maltase) and of proteins (pepsin, trypsin, endopeptidases, exopeptidases, aminopeptidase & dipeptidase)

8. Evaluate the function of mastication and movement of food along the gut (peristalsis in the oesophagus)

9. Describe the nervous (as a result of the presence of food in the mouth and the stretching of the stomach wall) and hormonal control (the presence of food in the stomach triggering the release of gastrin) of the secretion of gastric juice

10. Recall the components of gastric juice (to include Pepsinogen, Hydrochloric acid and mucus, with no mention of rennin) and their functions

11. The ileum as an exchange surface

12. Explain that nutrients are exchanged with the environment through the ileum wall

13. Describe the absorption of glucose through the ileum wall by cotransport with sodium. Explain that sodium is actively pumped out of the absorptive cells to allow cotransport to continue

14. Describe the histology of the ileum wall, including the structure of a villus (Epithelial lining, capillaries and lacteal) and muscles

15. Describe the features of the ileum wall which aid passive and active transport, a good blood supply, a thin membrane and the features which increase surface area (the length of the ileum, folded mucosa, villi and microvilli)

19

Cell division

1. Why cells divide: In growth and repair (mitosis) and in the formation of gametes (meiosis)
2. Chromosomes consist of DNA and histones in the nucleus of a eukaryotic cell
3. Define the terms diploid and haploid; explain where and why these chromosome numbers occur
4. Recall the cell cycle as the sequence of nuclear division followed by growth phases and the replication of DNA during interphase
5. Explain the significance of mitosis in growth and replacement and of the daughter nuclei with chromosomes identical in number and type (genetically identical)
6. Describe and explain the behaviour of chromosomes during the stages of the mitotic cell cycle. Describe the events of mitosis and recall the names of the stages
7. The production of new individuals involves the transfer of genetic information from parent to offspring. The role of fertilisation and gametes
8. Gamete formation involves reduction division (meiosis) giving haploid nuclei from a diploid nucleus
9. Describe chromosome be-haviour during meiosis and recall the names of the stages of meiosis
10. Predict the DNA content of nuclei at different stages of the cell cycle
11. Describe the histology of the ileum wall, including the structure of a villus (Epithelial lining, capillaries and lacteal) and muscles
12. Describe the features of the ileum wall which aid passive and active transport, a good blood supply, a thin membrane and the features which increase surface area (the length of the ileum, folded mucosa, villi and microvilli)

20

Patterns of inheritance

1. Compare base substitution and frameshift mutations and how these may result in differences the protein sequence
2. Recall that sickle cell anaemia is the result of a base substitution mutation, know that the mutation results in a change in the shape of haemoglobin and consequently the red blood cells. Explain the links to a reduction in the amount of oxygen carried, and increased risks of interruptions in blood flow
3. Recall that cystic fibrosis can be a result of a triple deletion mutation resulting in a non-functional transport protein and associated lung and pancreatic problems. Explain how this mutation causes symptoms of breathing difficulty
4. Define discontinuous variation and describe examples of single gene inheritance
5. Interpret evidence for envi-ronmental factors affecting gene expression
6. Define:- monohybrid inheritance, genotype, phenotype, homozygotes, heterozygotes, dominance, codominance and explain the differences
7. Construct monohybrid crosses using Punnett squares to illustrate and interpret the potential results of breeding organisms with particular genetic characteristics
8. Explain the ABO blood group system (IA, IB, IO alleles) as a multiple allele example
9. Explain that the different blood groups are the result of differing polysaccharides on the surface of erythrocytes, each created by a different allele. Each of these polysaccharides act as an antigen and that transfusion with certain blood groups can cause death, depending on the blood group of the individual receiving the trans-fusion. Recall that blood group O is the universal donor and blood group AB is the universal recipient

21

DNA technology

1. Describe how DNA replication can be achieved artificially using the polymerase chain reaction (PCR), explain the reasons for the stages of the PCR (melting, annealing and synthesis) and the need for differing temperatures for each stage
2. Describe genetic fingerprinting as a diagnostic tool. Explain, at a very basic level, how genetic fingerprinting is carried out (including the use of gel electrophoresis)
3. Explain how genetic fingerprinting can be used to determine paternity. Link this to the results of the inheritance of genetic traits from both parents
4. Genetic engineering
5. Describe the principles of genetic engineering as targeting, removing and inserting genes
6. Recall the method of action of restriction endonucleases and ligases
7. Interpret data from examples of gene transfer to explain the procedures
8. Describe how genes have been engineered and transferred into patients to combat disease
9. Explain how gene therapy can be used to treat cystic fibrosis and Severe Combined Immunodeficiency

Pure Maths with Statistics Module

Pure Mathematics with Statistics contains a significant part of the core material included in the GCE A level syllabus. The course units are as follows:

Core Mathematics (C1), Core Mathematics (C2), Part of the Core Mathematics (C3) and most of the Statistics 1 (S1).

Key Topics

Term 1

01

Simplification, Factorisation and Surds

1. Simplify an expression by collecting like terms
2. Expand and factorise expressions (including quadratics)
3. Use the laws of indices for all rational exponents
4. Use and manipulate surds including rationalising the denominators

02

Solving Equations and Sketching Quadratic Curves

1. Plot the graphs of quadratic functions and solve quadratic equations by factorisation
2. Solve quadratic equations by completing the square and using the quadratic formula
3. Sketch a quadratic function after completing the square

03

Simultaneous Equations and Inequalities

1. Solve simultaneous linear equations by both elimination and substitution
2. Solve simultaneous equations involving one quadratic and one linear
3. Solve both linear and quadratic inequalities

04

Sketching cubics, the reciprocal function and transformations

1. Sketch and interpret cubic functions
2. Sketch the reciprocal function
3. Use the intersection points of functions to solve equations
4. Perform transformations of curves using the rules

05

Equations of a straight line

1. Interpret straight lines in the forms y =mx+ c and ax+by+cy=0
2. Calculate both the gradient and equation of a line using the form y – y1 = m(x – x1)
3. Understand the conditions for parallel and perpendicular lines

Term 2

06 Sequences and Series - Arithmetic Series

1. Interpret sequences, using nth term (including Arithmetic)
2. Use a recurrence relationship/ formula
3. Use the sum to n terms of an Arithmetic Series
4. Use the Σ notation

07 Differentiation and Gradients

1. Differentiate a function (simplifying first if necessary) of the form axn and find the gradient at a point
2. Find the second derivative
3. Find the equation of the tangent and normal to a curve at a point

08 Integration

1. Integrate a function (simplifying first if necessary) of the form axn

09 Measures of location

1. Define discrete and continuous Variables and use frequency tables
2. Find the mean, median and mode from a frequency table
3. Choose the correct measure of location
4. Calculate averages from a grouped frequency table
5. Use coding method for calculations

10 Measures of spread

1. Find the Range, Quartiles and Percentiles - including the use of interpolation for grouped data
2. Find the Variance and Standard Deviation from a grouped frequency table
3. Use coding method for calculations

01 Probability

1. Use Venn Diagrams to find probabilities and solve problems
2. Define Mutually Exclusive and Independent events and calculate probabilities associated with these
3. Use Conditional Probability to solve problems
4. Use Tree Diagrams to solve problems

02 Correlation and Regression

1. Interpret Scatter Diagrams
2. Calculate the Product Moment Correlation Coefficient (r) and determine the strength of a linear relationship
3. Define independent and dependent variables
4. Calculate the equation of a regression line

03 Discrete random variables

1. Use and find the probability distribution and cumulative distribution function
2. Find the expected value (mean), variance and standard deviation of a discrete random variable

04 Algebra

1. Simplify algebraic fractions by division
2. Divide a polynomial by (x + p) or (x – p)
3. Factorise a polynomial using the factor theorem
4. Use the Remainder Theorem

05 Sine and Cosine rule

1. Use both the Sine Rule and Cosine Rule to find missing sides/ angles of triangles and A = 0.5absinC to find the area

Term 3

06 Logs, Bases and equations

1. Sketch the function y = ax
2. Write expressions as a logarithm
3. Use base 10 to calculate logarithms of any base
4. Use the laws of logs and be able to change the base
5. Solve equations of the form ax = b

07 Coordinate Geometry and Equation of a Circle

1. Sketch the function y=ax
2. Write expressions as a logarithm
3. Use base 10 to calculate logarithms of any base
4. Use the laws of logs and be able to change the base
5. Solve equations of the form ax =b

01 Binomial Expansions

1. Expand (ax + b)n using the Binomial expansion
2. Find approximations using the binomial expansion

02 Radians, Arcs and Sectors

1. Convert Degrees to Radians and vice-versa
2. Use the arc length and Area of a Sector formulae
3. Find the area of a Segment

03 Geometric series

1. Find the nth term of a Geometric Sequence/ Series
2. Find the sum to n terms of a Geometric Series

04 Differentiation 2

1. Use Differentiation to calculate when a function is increasing or decreasing, where the stationary points are and be able to determine their nature
2. Use Differentiation to Solve practical problems involving maximum and minimum

05 Trigonometry

1. Simplify trigonometric identities
2. Solve trigonometric equations, including quadratics

06 Integration 2

1. Solve problems involving definite integrals
2. Use integration to calculate the area under a curve and between two curves
3. Use the Trapezium Rule to estimate an area under a curve

07 Differentiation 3

1. Use Differentiation to calculate when a function is increasing or decreasing, where the stationary points are and be able to determine their nature
2. Use Differentiation to solve practical problems involving maximum and minimum

Medicine Skills Module

Medicine Skills module sessions are provided to ensure you are fully prepared to apply for and study medicine or courses that includes training in the NHS.

Tutors will help you to develop appropriate skills to submit a sound and relevant personal statement, transferable Skills Statement and prepare you for interview for MBBS and other life sciences pathways.

Tutors will also provide you with the opportunity to review and reflect upon your suitability to study medicine or other health profession courses and offer guidance in making progression choices.

You will also receive pastoral one to one guidance and group sessions on effective study skills and revision techniques.

Teaching methods will include – classes, whole cohort assemblies, tutorials, group work, directed study, independent learning and one to one meetings. You will be actively encouraged to use your own problem solving and critical thinking skills and be encouraged to behave like a typical student within a UK university and be self-motived.

There are no formal assessments on this module.

Key Topics and Learning

01

1. Progression pathways
2. Understanding the admissions process
3. UCAS registration

02

1. Understanding medicine, what do medical schools want to see?
2. What makes a good doctor/ Nurse/ Allied Health Care Professional?

03

1. How to write a personal statement
2. Why do you want to study your chosen course, what interests you about the subject?

04

1. What students can expect at medical school and what it will be like being a junior doctor

05

1. Study skills and revision techniques

06

1. Introduction to Transferrable Skills statement
2. Preparing for work experience
3. Personal insight

07

1. UCAS applications for alternative pathways

08

1. UCAS applications for alternative pathways
2. Introdution to medical ethics

09

1. Building an understanding of medicine

10

1. Reflective writing

11

1. UCAS applications
2. RCSI applications
3. Student presentations

12

1. Completion of TSS

13

1. Introduction to interviews
2. How much do you know about the NHS?
3. Teamwork in a health care setting

14

1. Medical ethics

15

1. Medical ethics

16

1. Patient care and professionalism
2. Patient confidentiality

17

1. Data analysis and interpretation

18

1. Data analysis and interpretation
2. Communicating in a challenging situation
3. The effect of body language on others and self
4. How it can impact on your confidence levels

19

1. Practise interview questions

20

1. Mock MMIs

2. Mock MMI feedback

21

1. 121 mock interviews

22

1. Replying to UCAS offers

Resources and reading list

Chemistry for Medicine

Edexcel AS Chemistry (2008) by Ann Fullick and Bob McDuell. ISBN 978-1-4058-9635-1
OCR A Level Chemistry 1 by John Older & Mike Smith. ISBN 978-1-4718-2706-8
Calculations for A-level Chemistry (Fourth Edition) by E.N.Ramsden. ISBN 978-0-7487-5839-5
Edexcel Chemistry for A2 (2009) by Graham Hill and Andrew Hunt. ISBN 978-0-340-95930-5
OCR A Level Chemistry 2 by John Older & Mike Smith. ISBN 978-1-4718-2718-1
Chemistry in Context by Graham Hill & John Holman. ISBN 978-0 00 322230 6
Chemistry, Third edition by Chris Conoley & Phil Hills. ISBN 978-0-00-726747-7

Medical Biology

Collins Advanced Science - Human Biology (3rd edition 2008) by Mike Boyle & Kathryn Senior (ISBN 978-0007267514)
Oxford AS and A-Level Biology Through Diagrams by W. R. Pickering (ISBN 978-0-19-918091-2)

Pure Maths with Statistics

Core Mathematics 1 (C1) - 9780435519100, May 2008
Core Mathematics 2 (C2) - 9780435519117, May 2008
Core Mathematics 3 (C3) - 9780435519094, December 2008

Example Timetable

Please note this is an example timetable and will vary for every student. Students should anticipate lessons starting earlier than 9am or later than 5pm. Students will be expected to allocate self study and revision hours within their timetable which will be given at the start of the academic term.

	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
Mon	English	English	Medicine Skills	Lunch	Chemistry for Medicine	Chemistry for Medicine		Personal Tutorial
Tues	Medicine Skills	Medical Biology	Medical Biology	Lunch	English	English		
Wed	Pure Maths with Statistics	English	English	Lunch	Chemistry for Medicine	Chemistry for Medicine		Pure Maths with Statistics
Thur	Medical Biology	Medical Biology	Chemistry for Medicine	Lunch	Pure Maths with Statistics	Pure Maths with Statistics		
Fri	Medical Biology	Medical Biology	Pure Maths with Statistics	Lunch	Pure Maths with Statistics			Chemistry for Medicine

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