

FOUN005 Human Biology

Section 1: General Information

1.1 Administrative Details

Subject:	Human Biology
Code:	005
Stream	Health Science and Life Science
Points	12
Pre-requisite	Bridging Programme/ Level 2 Biology

1.2 Subject Workload

Number of timetabled hours per week	Number of Personal study hours per week	Total workload hours per week
4	4	8

1.3 Pre-requisites

Students are required to have undertaken a pre-requisite subject.

The prerequisite is Bridging Programme or some science /biology at senior high school.

1.4 Other resource requirements

List specialist facilities and/or equipment required for the delivery of this subject:

Use of University Laboratory/ own lab coats

Section 2: Academic Details

2.1 Subject Overview

The aim of this paper is to provide students with the necessary knowledge and skills to successfully study biology at undergraduate university level.

Focus areas for this paper include:

- The major human biological systems.
- Genetics.
- Evolution.

By the end of this paper, students should be able to:

1. Demonstrate an understanding of the basic ideas and language of human biology.
2. Understand the basic structure and function of the major human biological systems.
3. Understand and apply basic principles of genetics and evolution.
4. Perform a range of activities in the laboratory including dissections.
5. Demonstrate critical thought in the analysis and presentation of biological data.

2.2 Learning Objectives and Outcomes

Lecture 1 Mammals and human body systems

- Understand the Paper format: the lecture, laboratory and assessment programme and how to use the tutorial book.
- Describe the characteristics of mammals.
- Distinguish between the three sub-classes of mammals: the monotremes, marsupials and placentals.
- Describe the types of tissues, the organs and the organ systems found in the human body.

Lecture 2 The digestive system 1

- Describe the meaning of the term digestion and its importance for an organism.
- Distinguish between physical (mechanical) digestion and chemical digestion.
- Describe the chemical digestion of carbohydrates, proteins, lipids and nucleic acids in terms of the products formed and the hydrolytic enzymes involved (amylases, proteases, lipases, nucleases).
- Describe the passage of food through the alimentary canal naming the parts and what happens in each part (mouth, oesophagus, stomach, the duodenum and ileum of small intestine and the colon and rectum of the large intestine).
- Explain how the structure of the villi enables the small intestine to effectively absorb digested food.

Lecture 3 The digestive system 2

- Describe the variety of types of teeth in both herbivores and carnivores (incisors, canines, premolars and molars).
- Outline the role of the pancreas, liver and Gall bladder in digestion..
- Compare the diets and alimentary canals of herbivores and carnivores.
- Understand the role of the caecum and rumen in digesting cellulose in herbivores.
- The first lab. session is a rat dissection looking specifically at the digestive system.

Lecture 4 The skeletal system

- Describe the variety of functions of the human skeleton.
- Describe the axial and appendicular parts of the human skeleton.
- Identify and name the following bones: skull, jaw, vertebrae, pelvis, sternum, humerus, radius, ulna, femur, tibia, fibula.
- Distinguish between bone and cartilage in terms of structure and function.
- Identify the main parts of a : long bone, moveable joint, vertebrae and explain the function(s) of the parts
- Distinguish between ligaments and tendons, yellow and red marrow.

Lecture 5 The muscular system

- Describe the location, function, appearance and type of control of the 3 main types of muscle tissue:
Cardiac
Smooth
Skeletal
- Describe how skeletal muscles work in antagonistic muscle pairs and how antagonistic

muscles work together.

- Outline how skeletal muscle cells contract and the role of actin and myosin.
- Identify the following skeletal muscles: biceps brachii,, triceps brachii, deltoid, trapezius, latissimus dorsi, pectoralis major, rectus abdominus, external oblique, gluteus maximus.

Lecture 6 The circulatory system : Heart and blood vessels

- Understand that the circulatory system is made up of the blood, the blood vessels (arteries, veins and capillaries) and the heart.
- Name and describe the structures of the heart including, the major blood vessels attached, using a labelled diagram.
- Distinguish between the pulmonary, systemic and coronary parts of the circulation system.
- Distinguish between oxygenated and deoxygenated blood and trace the flow of blood through the heart.
- Compare and contrast the structure and function of arteries, veins and capillaries with emphasis on the exchange of materials between the capillaries and body cells.
- Distinguish between systolic and diastolic blood pressure.
- Describe the effect of exercise on blood pressure and pulse rate.

Lecture 7 The circulatory system : Blood

- Analyse the composition of blood in terms of the plasma component and the blood cell types.
- Describe the structure and function(s) of red blood cells, white blood cells and platelets.
- List the substances transported in the blood plasma and describe their use(s) for the body.
- Outline the steps involved in the process of blood clotting.
- Describe the structure and function of the lymph system.
- A lab. session involving the dissection of a sheep's heart is part of the course.

Lecture 8 The respiratory system

- Describe the structure and function of the following parts of the respiratory system: trachea, bronchi, bronchioles, alveoli, ribs, intercostal (rib) muscles, diaphragm, pleural membranes, using labelled diagrams.
- Describe how gas exchange occurs in the alveoli and how the alveoli are adapted for this process (large surface area, large blood supply, thin membranes, moist surfaces).
- Outline the mechanisms (use of diaphragm and rib muscles) involved in breathing in (inspiration) and breathing out (expiration).
- A lab. session involves the dissection of a sheep's respiratory system.

Lecture 9 The urinary system

- Outline the functions of the urinary system as excretion of metabolic wastes and osmoregulation.
- Describe the structures of the urinary system: kidneys, renal arteries and veins, ureters, bladder and urethra, using a labelled diagram.
- Describe the internal structure of a kidney (cortex, medulla and pelvis), using a labelled diagram.
- Describe the structure of a nephron (glomerulus, Bowman's capsule, kidney tubule) using a labelled diagram and describe the processes that occur in each section of the nephron.
- Explain the role of the hormone ADH in osmoregulation.

- A lab. session involving the dissection of a sheep's kidney and the chemical analysis of urine is part of the paper.

Lecture 10 The nervous system 1

- Outline the arrangement of the nervous system as involving receptors (sense organs), the peripheral nervous system (sensory and motor), the central nervous system (spinal cord and brain) and effectors (muscles and glands).
- Describe the variety of stimuli received by the human body and the receptors that detect these stimuli.
- Describe the structure of a neuron using a labelled diagram and describe the function(s) of the parts of a neuron.
- Distinguish between sensory and motor neurons
- Describe resting potential in a neuron and the processes involved when resting potential changes to action potential.
- Define the term synapse and describe how a nerve impulse passes across a synapse (neurotransmitters).

Lecture 11 The nervous system 2

- Identify the main parts of the brain: cerebrum (cerebral hemispheres), cerebellum, mid-brain, medulla, hypothalamus and briefly describe the function of these parts.
- Describe the structure and function of the spinal cord.
- Distinguish between grey matter and white matter and describe where they are located in the brain and spinal cord.
- Describe how the central nervous system is protected: bone (cranium and vertebrae), meninges and cerebrospinal fluid.
- Describe the components of a reflex arc using a labelled diagram and explain how reflex actions occur and their value to a person.
- Describe the peripheral nervous system including the functioning of the autonomic system (sympathetic and parasympathetic nerves).

Lecture 12 The endocrine system

- Define the meaning of the terms hormone and endocrine gland.
- Describe the following endocrine glands (hypothalamus, pituitary gland, thyroid gland, adrenal glands, pancreas, ovaries and testes) in terms of:
 - their location in the body.
 - the hormone(s) they produce.
- Describe the function of the following hormones: TSH (thyroid stimulating hormone), thyroxine, adrenaline, insulin, glucagon and ADH (antidiuretic hormone).
- Explain the importance of the hypothalamus and the pituitary gland and compare the difference in the relationship between the hypothalamus and both the anterior and posterior pituitary.
- Explain the importance of the hypothalamus and the pituitary gland and the relationship between the two.
- Define the terms homeostasis and negative feedback and explain the importance of these two processes.
- Use the specific examples of blood sugar levels and body temperature to further explain how negative feedback leads to homeostasis.

Lecture 13 The Immune system (1)

- Define the following terms: disease, pathogen, infectious disease and non-infectious disease with examples.
- Identify the external barriers the body has to prevent infection (skin, tears, mucus, cilia, stomach acid, lysozyme) and explain how they function.
- Define the following terms: phagocyte (neutrophils and macrophages), phagocytosis, T - lymphocytes (T - cells), B - lymphocytes (B - cells), antigen, antibody and immunity.
- Distinguish between specific and non-specific internal barriers to infection.
- Describe phagocytosis using labelled diagrams.
- Distinguish between cell-mediated (T - cells) and antibody-mediated (B - cells) immunity.

Lecture 14 The immune system (2)

- Explain how immunological memory develops after infection (specific antigen specific memory cells).
- Analyse data/graphs showing the development of immunological memory.
- Distinguish between natural and artificial immunity and active and passive immunity.
- Describe the process of vaccination.
- Describe allergic reactions, autoimmune diseases and immune deficiency diseases as examples of the immune system malfunctioning. Use AIDS and tissue transplant rejection as specific examples here.

Lecture 15 Human reproduction

- Describe the structures and function(s) of the male reproductive system (including the accessory glands: prostate gland, Cowper's gland and the seminal vesicles), using a labelled diagram.
- Describe the structures and function(s) of the female reproductive system using a labelled diagram.
- Describe the development of the zygote → embryo → foetus → baby.
- Describe the structure and function of the placenta and umbilical cord.
- Describe the processes of labour and birth.
- Outline the menstrual cycle with emphasis on ovulation and the preparation of the uterus for implantation.
- Describe the role of FSH, oestrogen and LH in the menstrual cycle.

Lecture 16 Mendelian genetics: monohybrid crosses

- Describe Mendel's experiments with peas and explain his conclusions.
- Define the following genetic terms: monohybrid cross, gene, allele, dominant allele, recessive allele, heterozygous, homozygous (pure breeding), genotype and phenotype.
- Understand Mendel's Law of Segregation (Mendel's First Law).
- Calculate the genotypes, phenotypes and expected ratios of the offspring from monohybrid crosses using suitable symbols and Punnet squares.
- Analyse pedigrees (family trees) showing single gene inheritance.

Lecture 17 Mendelian genetics: Dihybrid crosses

- Define the term dihybrid cross.
- Distinguish between linked genes and genes not linked.

- Calculate the genotype, phenotype and expected ratios of the offspring from dihybrid crosses involving unlinked genes.
- Recognise, and understand, why Mendel's ratios do not apply for dihybrid crosses involving linked genes.
- Understand that genes are located on chromosomes (gene Locus) and in meiosis, when the chromosomes separate, they carry the genes with them.
- Explain what happens to linked genes during crossing over using a labelled diagram.
- Draw and analyse genetic (chromosome) maps using percentage crossing over data.

Lecture 18 Variations on Mendel's ratios (1)

- Describe and analyse, using selected examples, the following:
 - incomplete dominance and co-dominance.
 - multiple alleles (blood groups).

Lecture 19 Variations on Mendel's ratios (2)

- Sex linkage (haemophilia and colour blindness).
polygenes.
- Explain the that the environment has on phenotypes using selected.

Lecture 20 The evidence for evolution

- Explain the concept of biological evolution.
- Analyse the following pieces of evidence explaining why they support the concept of evolution:
 - artificial selection
 - fossil evidence
 - embryology
 - homologous and analogous structures (comparative anatomy)
 - intermediate forms
 - biochemical similarities (comparing DNA and proteins)

Lecture 21 Mechanisms of Evolution, Natural Selection

- Explain Darwin's theory of evolution by natural selection.
- Explain the role of geographic isolation and adaptive radiation in the process of speciation.
- Distinguish between divergent evolution (adaptive radiation) and convergent evolution.
- Explain how the modern understanding of genetics, DNA and mutation, support the concept of evolution.
- Explain the meaning of the terms gene pool, allele (gene) frequency and gene flow.
- Explain evolution in terms of changes in allele frequencies in populations over time.

2.3 Subject Content

2.4 Teaching Method/Strategies

Lectures with lecture slides available on blackboard after lectures, small class tutorials where students can work independently, or in pairs and small groups to tackle practise questions and develop their knowledge and understanding of the course content. This is a time where individuals can seek individual help from the tutor. Consultations provide an additional time for individual help. The laboratory sessions reinforce the material covered in lectures and tutorials and give students the opportunity to experience practical work.

2.5 Assessment

Assessment Type	When	Weighting	Learning Outcomes Assessed
Internal Labs	Every third week – 3 labs	10%	
Mid semester test	Week 7	20%	Covers first 11 lectures
Final Examination	Week 13 onwards	70%	Covers all lectures

2.5.1 Assessment Details

Assessment	Content/ Format	Time	Details
Internal Assessment Task 1	Lab 1 exit test	Last 15 minutes of lab	Identify specific organs and tissues found in the body cavity of a rat Describe the general organization of internal organs. Describe the passage of food through the digestive system Link laboratory work to lectures 2 and 3 on the digestive system
Internal Assessment Task 2	Lab 2 exit test	Last 15 minutes of lab	Identify the main features of the heart and lungs Dissect the heart and lungs and observe their structure Relate the structure of each organ to its function Link laboratory work to lectures 6, 7 and 8 on the circulation and respiratory systems.
Internal Assessment Task 3	Lab 3 exit test	Last 15 minutes of lab	Examine the structure of the kidney from mammal. Analyse the composition of urine. Link the laboratory work to lecture 9 on the Urinary system
Internal assessment	Mid semester test	45 minutes	Learning objectives from lectures 1-11

Final Examination		2 hours	Learning objectives from lecture 1-22
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2.5.2 Hurdle Requirement

In order to pass this paper, students must obtain an overall mark of 50% (C-) or better.

2.6 Prescribed and Recommended Reading

Prescribed Text:

Produced Foundation Year Human Biology Book

Recommended Reading: Optional extension

Anatomy and Physiology: Patton Thibodean

3. Subject Details

3.1 Weekly Schedule

Lecture	Topic	Labs
1	Mammals and the Human Body Systems	
2	Digestive system I	
3	Digestive system II	Lab 1: Digestion
4	Skeletal system	
5	Muscular system	
6	Circulatory system: Heart and Blood vessels	
7	Circulatory system: Blood	
8	Respiratory system	Lab 2: Heart and Lungs
9	Urinary system	Lab 3: Kidneys and urine
10	Nervous system I	
11	Nervous system II	
12	Endocrine system	
13	Immune system 1	
14	Immune system II	
15	Human reproductive system	
16	Mendelian Genetics: Monohybrid crosses	
17	Mendelian Genetics: Dihybrid crosses	
18	Variations on Mendel's Ratios I	
19	Variations on Mendel's Ratios II	
20	Evidence for Evolution	
21	Mechanisms of Evolution, Natural Selection	
22	Consolidation	
23	Consolidation	