BIOL10004 CELLS & ORGANISMS

BIOLOGY REVISION MODULE CONTENTS

MODULE 1

- Describe the major features of prokaryotic and eukaryotic cells and provide a brief evolutionary history of these two cell types that includes the importance of cyanobacteria.
- Describe the structure of the major groups of macromolecules (and their subunits) and the function of each within a cell.
- Explain division of labour within eukaryotic cells and identify the major organelles.
- Explain how the processes of primary and secondary endosymbiosis have led to the origin of mitochondria and chloroplasts in eukaryotes.
- Describe the processes and predict the outcomes of cell division in prokaryotic and eukaryotic cells.
- Relate the structure of lipids and phospholipids to membrane function and transport of materials across cell membranes.

MODULE 2

- Understand that all cells perform processes that are driven by the energy stored in the bonds of molecules such as ATP (adenosine triphosphate).
- Explain the overall processes of cellular respiration including; glycolysis, fermentation, Krebs' cycle, oxidative phosphorylation and the relative value of the energy released at each step.
- Compare the similarities in mitochondrion and chloroplast structure and the role of the electron transport chain in the production of proton gradients, ATP and high energy electron carriers in each.
- Explain photosynthesis and the steps involved where plants trap the energy of sunlight to convert atmospheric CO2 into organic molecules.
- Understand how C4 and CAM plants have modified photosynthesis to prevent photorespiration and conserve water.
- Compare the tissues and processes involved in the movement of water and assimilates through plants.
- Recognise the structures involved in Angiosperm reproduction and the basic role that pollen and ovules play in production of embryos and subsequent seeds and fruit.
- Describe both the tissues and the process involved in apical growth and secondary growth in plants.

MODULE 3

- Outline the concepts of homeostasis and internal regulation, including describing and explaining specific examples of these processes.
- Describe the cardiovascular and respiratory systems of different animal groups with reference to the relationship between structure and function.
- Diagram and outline the homeostatic mechanisms which regulate the cardiovascular and respiratory systems in animals.

- Identify the osmotic and thermoregulatory challenges faced by animals in different environments and discuss the different behavioural and physiological processes by which they regulate their body fluids and temperature in these environments.
- Explain the general process of digestion in a mammal and describe the specialisations that have evolved in broad dietary niches.

MODULE 4

Reproduction

- Describe and compare reproductive strategies used by different animals.
- Identify and describe the structure and function of male and female reproductive systems.
- Outline and identify the steps involved in spermatogenesis and oogenesis.
- Draw and discuss the hormonal regulation of gamete production, ovulation and menstruation, including clinical interventions like contraceptives.

Diversity and evolution

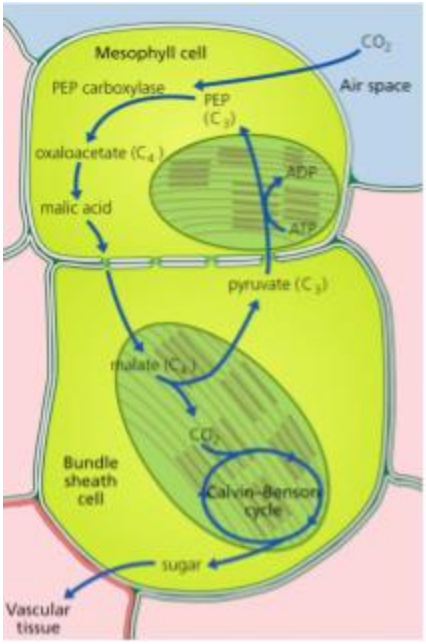
- Understand the nature of biological diversity and the evolutionary processes responsible for this diversity: mutation, migration, selection and drift.
- Recognise the nature of relationships between different species (e.g. predation, parasitism, and mutualism), and the co-evolutionary processes through which they evolve.
- Be able to articulate ways in which evolutionary theory can be applied to human issues, including human behaviour, medicine, agriculture and conservation.

Animal behaviour

- Describe examples of animal behaviour and explain these behaviours using ultimate (why) and proximate (how) explanations (e.g. parental behaviour, foraging behaviour, social behaviour).
- Appreciate the role of experiments in explaining animal behaviour.
- Describe examples of how animals obtain information about the environment.
- Understand the role of genes and learning in the expression of animal behaviour.

SAMPLE NOTES

C4 PHOTOSYNTHESIS



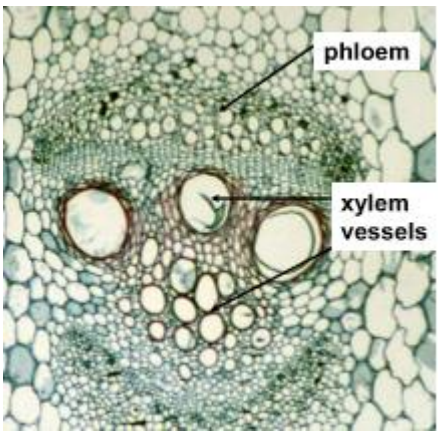
RuBisCO can bind to either CO2 or O2 during photosynthesis. Has a higher affinity for CO2 but when oxygen is more abundant may bind instead. O2 can become abundant when stomates are closed to preserve water. This happens particularly in hot/dry areas. When RuBisCO binds to O2, it enters photorespiration and instead produces CO2, undoing the work of the Calvin cycle.

To combat photorespiration, some cells undergo C4 photosynthesis, where CO2 is instead fixed to a C4 in the mesophyll cell by PEP, rather than RuBisCO. Malate (C4) is transported into a bundle sheath cell where it is split into pyruvate (C3) and CO2. The CO2 enters the Calvin cycle, where the C3 molecule is recycled into the mesophyll to create more C4 for binding.

CAM PHOTOSYNTHESIS

Similar to C4 photosynthesis, Co2 is converted to malate at night and stored for use during the day when the stomates are closed. Crassulacean Acid Metabolism.

PLANT TRANSPORTATION



Xylem transports water from the roots to the leaves, the *Phloem* transports photosynthetic products from the leaves to the sites where they are used or stored.

XYLEM

Water is lost from the plant to atmosphere through open stomates for gas exchange (95%). Dependant on size of stomatal pore, humidity & wind. Water evaporation from the stomata creates a vacuum at the top of the xylem column, this draws water up the Xylem from the roots, which is then replaced by water from the soil

Transpiration-cohesion theory of water movement, named such as water molecules stick together in the narrow xylem vessels (cohesion) due to their polar nature. The water column in the xylem is prone to breakage (cavitation) as if the tension is too great, the resulting air bubble forms a barrier to water flow. The xylem vessel diameter is a trade-off between maximising flow and minimising the risk of cavitation. These xylem cells are dead and are thickened with lignin (spirals) to prevent cells collapsing.