

## Summary

### Unit 11 - Animal Physiology Current



Subject	Year	Start date	Duration
Biology	IB1	Week 1, May	<span>4 weeks</span> 16 hours

Course Part

## Curriculum

### Aims

- Appreciate scientific study and creativity within a global context through stimulating and challenging opportunities
- Acquire a body of knowledge, methods and techniques that characterize science and technology
- Apply and use a body of knowledge, methods and techniques that characterize science and technology
- Develop an ability to analyse, evaluate and synthesize scientific information
- Develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities
- Develop experimental and investigative scientific skills including the use of current technologies
- Develop and apply 21st century communication skills in the study of science
- Become critically aware, as global citizens, of the ethical implications of using science and technology
- Develop an appreciation of the possibilities and limitations of science and technology
- Develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge

### Objectives

#### Demonstrate knowledge and understanding of

- facts, concepts, and terminology
- methodologies and techniques
- communicating scientific information

#### Apply

- facts, concepts, and terminology
- methodologies and techniques
- methods of communicating scientific information

## Syllabus Content

### Additional higher level

#### 11. Animal physiology

##### 11.1 Antibody production and vaccination

###### Nature of science:

Consider ethical implications of research - Jenner tested his vaccine for smallpox on a child.

###### Understandings:

Every organism has unique molecules on the surface of its cells.

Pathogens can be species-specific although others can cross species barriers.

B lymphocytes are activated by T lymphocytes in mammals.

Activated B cells multiply to form clones of plasma cells and memory cells.

Plasma cells secrete antibodies.

Antibodies aid the destruction of pathogens.

White cells release histamine in response to allergens.

Histamines cause allergic symptoms.

Immunity depends upon the persistence of memory cells.

Vaccines contain antigens that trigger immunity but do not cause the disease.

Fusion of a tumour cell with an antibody-producing plasma cell creates a hybridoma cell.

Monoclonal antibodies are produced by hybridoma cells.

###### Applications and skills:

Application: Smallpox was the first infectious disease of humans to have been eradicated by vaccination.

Application: Monoclonal antibodies to HCG are used in pregnancy test kits.

Application: Antigens on the surface of red blood cells stimulate antibody production in a person with a different blood group.

Skill: Analysis of epidemiological data related to vaccination programmes.

##### 11.2 Movement

###### Nature of science:

Developments in scientific research follow improvements in apparatus - fluorescent calcium ions have been used to study the cyclic interactions in muscle contraction.

###### Understandings:

Bones and exoskeletons provide anchorage for muscles and act as levers.

Synovial joints allow certain movements but not others.

Movement of the body requires muscles to work in antagonistic pairs.

Skeletal muscle fibres are multinucleate and contain specialized endoplasmic reticulum.

Muscle fibres contain many myofibrils.

Each myofibril is made up of contractile sarcomeres.

The contraction of the skeletal muscle is achieved by the sliding of actin and myosin filaments.

ATP hydrolysis and cross bridge formation are necessary for the filaments to slide.

Calcium ions and the proteins tropomyosin and troponin control muscle contractions.

Applications and skills:

Application: Antagonistic pairs of muscles in an insect leg.

Skill: Annotation of a diagram of the human elbow.

Skill: Drawing labelled diagrams of the structure of a sarcomere.

Skill: Analysis of electron micrographs to find the state of contraction of muscle fibres.

### 11.3 The kidney and osmoregulation

Nature of science:

Curiosity about particular phenomena - investigations were carried out to determine how desert animals prevent water loss in their wastes.

Understandings:

Animals are either osmoregulators or osmoconformers.

The Malpighian tubule system in insects and the kidney carry out osmoregulation and removal of nitrogenous wastes.

The composition of blood in the renal artery is different from that in the renal vein.

The ultrastructure of the glomerulus and Bowman's capsule facilitate ultrafiltration.

The proximal convoluted tubule selectively reabsorbs useful substances by active transport.

The loop of Henle maintains hypertonic conditions in the medulla.

ADH controls reabsorption of water in the collecting duct.

The length of the loop of Henle is positively correlated with the need for water conservation in animals.

The type of nitrogenous waste in animals is correlated with evolutionary history and habitat.

Applications and skills:

Application: Consequences of dehydration and overhydration.

Application: Treatment of kidney failure by hemodialysis or kidney transplant.

Application: Blood cells, glucose, proteins and drugs are detected in urinary tests.

Skill: Drawing and labelling a diagram of the human kidney.

Skill: Annotation of diagrams of the nephron.

#### 11.4 Sexual reproduction

##### Nature of science:

Assessing risks and benefits associated with scientific research - the risks to human male fertility were not adequately assessed before steroids related to progesterone and estrogen were released into the environment as a result of the use of the female contraceptive pill.

##### Understandings:

Spermatogenesis and oogenesis both involve mitosis, cell growth, two divisions of meiosis and differentiation.

Processes in spermatogenesis and oogenesis result in different numbers of gametes with different amounts of cytoplasm.

Fertilization in animals can be internal or external.

Fertilization involves mechanisms that prevent polyspermy.

Implantation of the blastocyst in the endometrium is essential for the continuation of pregnancy.

HCG stimulates the ovary to secrete progesterone during early pregnancy.

The placenta facilitates the exchange of materials between the mother and fetus.

Estrogen and progesterone are secreted by the placenta once it has formed.

Birth is mediated by positive feedback involving estrogen and oxytocin.

##### Applications and skills:

Application: The average 38-week pregnancy in humans can be positioned on a graph showing the correlation between animal size and the development of the young at birth for other mammals.

Skill: Annotation of diagrams of seminiferous tubule and ovary to show the stages of gametogenesis.

Skill: Annotation of diagrams of mature sperm and egg to indicate functions.

## ATL Skills

### Approaches to Learning



#### Thinking

- In this unit, we will

ask students to formulate a reasoned argument to support their opinion or conclusion

give students time to think through their answers before asking them for a response

reward a new personal understanding, solution or approach to an issue

ask open questions

set students a task which required higher-order thinking skills (such as analysis or evaluation)

build on a specific prior task

help students to make their thinking more visible (for example, by using a strategy such as a thinking routine)

require students to take an unfamiliar viewpoint into account when formulating arguments

ask questions that required the use of knowledge from a different subject from the one you are teaching

include a reflection activity

make a link to TOK



#### Social

- In this unit, we will

have students work in small groups

allocate, or ask students to allocate among themselves, different roles in a classroom discussion or activity

have students peer assess their group performance or process

support students in resolving a conflict in a team

give a group assessment task

give students feedback on how they worked as a group

have students discuss their understanding of a text or idea among themselves and come up with a shared understanding

provide an opportunity for students to analyse the impact of their behaviour on the class or on a group performance

encourage students to consider alternative points of view or to take the perspective of others

provide opportunities for students to make decisions



## Developing IB Learners

### ☆ Learner Profile



Inquirers



Knowledgeable



Thinkers



Principled



Reflective