



NAME:

CLASS:

Year 12 HSC Biology

Module 5: Heredity

Workbook 1

Contextual Outline

Life continues through the processes of reproduction and heredity. Students expand their knowledge of evolution by understanding the cellular processes involved in increasing genetic diversity. They investigate reproduction and inheritance patterns in both plants and animals as well as the role of DNA in polypeptide synthesis and the uses of technologies in the study of inheritance patterns.

Students also learn about contemporary research and the work of geneticists across a variety of industries, including medical applications and agriculture. They explore the effects on society and the environment through the application of genetic research.

Course Outline

1. Reproduction
2. Cell Replication
3. DNA and Polypeptide Synthesis
4. Genetic Variation
5. Inheritance Patterns in a Population

Coaching in:	SCIENCE PHYSICS & CHEMISTRY BIOLOGY	Years 7 – 10 Years 11 – 12 Years 11 – 12
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MODULE 5: HEREDITY

Topic 1: Reproduction

Inquiry question: How does reproduction ensure the continuity of a species?

- Explain the mechanisms of reproduction that ensure the continuity of a species, by analysing sexual and asexual methods of reproduction in a variety of organisms, including but not limited to:
 - Animals: advantages of external and internal fertilisation
 - Plants: asexual and sexual reproduction
 - Fungi: budding, spores
 - Bacteria: binary fission
 - Protists: binary fission, budding
- Analyse the features of fertilisation, implantation and hormonal control of pregnancy and birth in mammals
- Evaluate the impact of scientific knowledge on the manipulation of plant and animal reproduction in agriculture

Topic 2: Cell Replication

Inquiry question: How important is it for genetic material to be replicated exactly?

- Model the processes involved in cell replication, including but not limited to:
 - Mitosis and meiosis
 - DNA replication using the Watson and Crick DNA model, including nucleotide composition, pairing, and bonding
- Assess the effect of the cell replication processes on the continuity of species

Topic 3: DNA and Polypeptide Synthesis

Inquiry question: Why is polypeptide synthesis important?

- Construct appropriate representations to model and compare the forms in which DNA exists in eukaryotes and prokaryotes
- Model the process of polypeptide synthesis, including:
 - Transcription and translation
 - Assessing the importance of mRNA and tRNA in transcription and translation
 - Analysing the function and importance of polypeptide synthesis
 - Assessing how genes and environment affect phenotypic expression
- Investigate the structure and function of proteins in living things

Topic 4: Genetic Variation

Inquiry question: How can the genetic similarities and differences within and between species be compared?

- Conduct practical investigations to predict variations in the genotype of offspring by modelling meiosis, including the crossing over of homologous chromosomes, fertilisation and mutations
- Model the formation of new combinations of genotypes produced during meiosis, including but not limited to:
 - Interpreting examples of autosomal, sex-linkage, co-dominance, incomplete dominance and multiple alleles
 - Constructing and interpreting information and data from pedigrees and Punnett squares
- Collect, record and present data to represent frequencies of characteristics in a population, in order to identify trends, patterns, relationships and limitations in data, for example:
 - Examining frequency data
 - Analysing single nucleotide polymorphism (SNP)

Topic 5: Inheritance Patterns in a Population

Inquiry question: Can population genetic patterns be predicted with any accuracy?

- Investigate the use of technologies to determine inheritance patterns in a population using, for example:
 - DNA sequencing and profiling
- Investigate the use of data analysis from a large-scale collaborative project to identify trends, patterns and relationships, for example:
 - The use of population genetics data in conservation management
 - Population genetics studies used to determine the inheritance of a disease or disorder
 - Population genetics relating to human evolution

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TOPIC 1: REPRODUCTION

How does reproduction ensure the continuity of a species?

REPRODUCTION

- Explain the mechanisms of reproduction that ensure the continuity of a species, by analysing sexual and asexual methods of reproduction in a variety of organisms, including but not limited to:
 - **Animals: advantages of external and internal fertilisation**
 - Plants: asexual and sexual reproduction
 - Fungi: budding, spores
 - Bacteria: binary fission
 - Protists: binary fission, budding

Reproduction

- Reproduction is defined as:

- Sexual reproduction involves the combination of genetic material from two parents to produce a genetically different offspring.
- Asexual reproduction produces offspring which are genetically identical to the parent.

Note: *Sexual reproduction always requires 2 parents; asexual reproduction only requires 1.*

Reproduction in Animals

- In animals, reproduction is solely sexual and requires the fertilisation of an egg with sperm.
 - Fertilisation is the union of gametes to form a new cell, known as the zygote.
- There are two types of fertilisation:

External Fertilisation

- External fertilisation takes place outside the body.
 - It is most common in aquatic organisms where gametes can be released directly into open water.

- In an aquatic environment, this method of fertilisation is successful due to the aqueous environment which allows for free movement of the gametes.
 - Again, large numbers of gametes must be produced to compensate for losses.
- In a terrestrial environment, gametes are unable to travel through the air, and so terrestrial animals cannot fertilise externally.

Advantages	Disadvantages

Internal Fertilisation

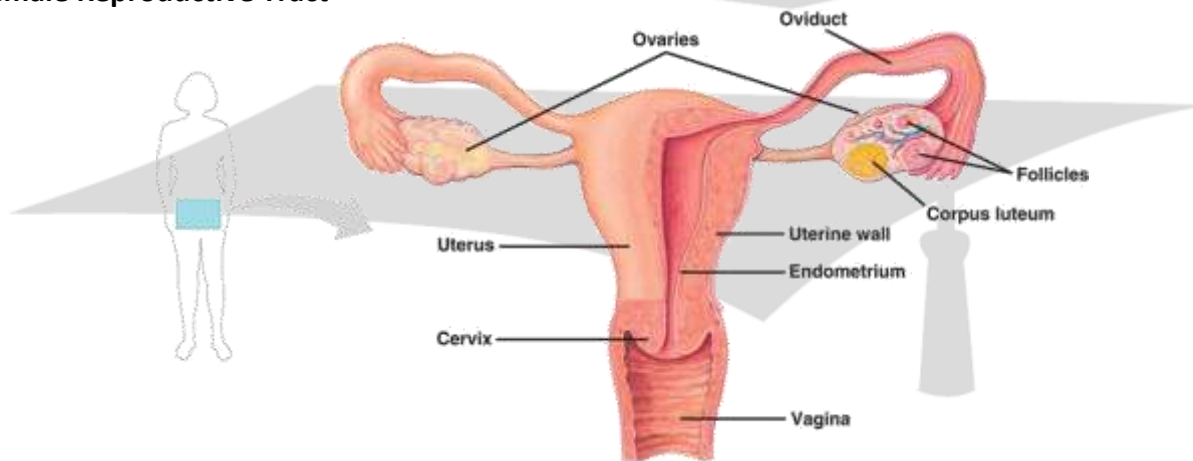
- Internal fertilisation occurs inside the body of the female in animals.
 - It is most common in terrestrial organisms, like mammals and reptiles.

Anatomy

- The female sex organs are specialised to produce eggs and to nurture a developing embryo.

Structure	Function
Vulva	Aids in reproductive functions through lubrication and provides an entry to the vagina
Vagina	Passageway for the entrance of the penis during sexual intercourse, and for the birth of the child during childbirth
Cervix	A very narrow passage which separates the vagina and the uterus
Uterus	Site of implantation of the zygote, and development of the embryo/foetus
Oviduct	Site of fertilisation of egg and sperm
Infundibulum	Contains finger-like structures which sweep the eggs from the ovary into the oviduct
Ovary	Produces eggs and various hormones related to reproduction

Female Reproductive Tract



Internal Fertilisation

- In an aquatic environment, internal fertilisation is not a necessary adaptation for most aquatic species. Nonetheless, it is still successful.
