Year -12 Topic Notes (Biology)
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Reproduction

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

Students:

• *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

Internal fertilisation involves the fusion of male and female gametes (sex cells such as sperm cells for males and egg cells for females) within the parent's body and tends to occur between terrestrial animals. Advantages of internal fertilisation are:

- Fertilisation occurs inside the female's body and hence, the zygote is protected from the external environment of the parent
- Not restricted to terrestrial environments unlike external fertilisation which is restricted to aquatic environments only
- Has higher fertilisation success rate as the sperm cell does not need to travel by chance to fertilise an egg

External fertilisation involves the fusion of male and female gametes outside a parent's body and tends to occur between aquatic animals. Advantages of external fertilisation are:

- Greater quantity of gametes is produced → greater overall amount of offspring produced
- More mating partner options → greater genetic variation

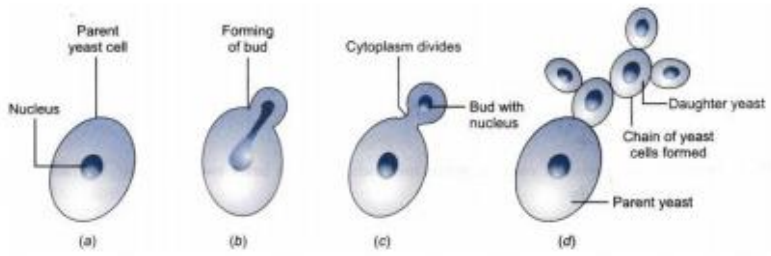
– plants: asexual and sexual reproduction

Sexual reproduction is the process of forming a new organism from the fusion of the offspring's parents' gametes. The offspring produced has the genetic material derived from its parents however, its genetic material is not identical to its parents. This process is often called meiosis and there is a fusion of gametes.

Asexual reproduction is the process of forming an offspring (usually a cell) from one parent through cell division which is often called mitosis. Hence, the offspring contains genetic material that is identical to its parent → a clone. There is no fusion of gametes.

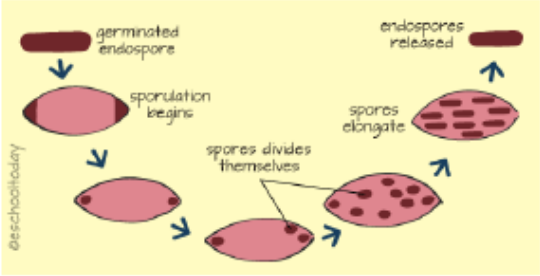
– fungi: budding, spores

Budding in fungi involves the parent cell developing a bud cell → a daughter nucleus. This usually occurs when the environment conditions are favourable for the fungi. The bud then undergoes cells division whiles still being attached to the parent cell. Before the bud separates from the parent cell, the parent's nucleus' DNA replicates and the nucleus divides equally but the cytoplasm divides unequally → the bud is smaller than the parent. The copy of the DNA moves into the daughter cell. The bud then separates from the



parent cell and grows to a sufficient size and then begins this budding process again. The bud cell is genetically identical to the parent cell.

Spores are reproductive cells produced by bacteria, fungi, algae and plants that are capable of developing into a new individual without fusion with another reproductive cell. Hence, spores are different to gametes. Spores are agents of asexual reproduction whereas gametes are agents of sexual reproduction.



– *bacteria: binary fission (ACSBL075)*

Binary fission is commonly performed by unicellular organisms such as bacteria. The process starts with the copying of genetic material of the parent cell. Each chromosome moves to either end of the cell and the cell elongates followed by cytokinesis (splitting of cell membrane and cytoplasm into 2 daughter cells). There is no splitting of the cell nucleus and the parent cell won't exist after fission as it has been converted to 2 daughter cells. The 2 cells are genetically identical to each other and to the parent.

– *protists: binary fission, budding*

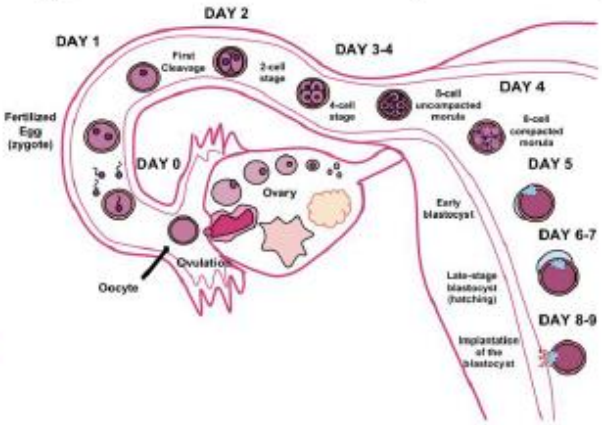
Budding is similar to that of fungi and *binary fission* in protists is similar to that of bacteria except protists contains a nucleus whereas bacteria doesn't. Hence, the chromosomes will move to each side of the nucleus before splitting of the nucleus followed by splitting of the cell membrane and cytoplasm into 2 daughter cells.

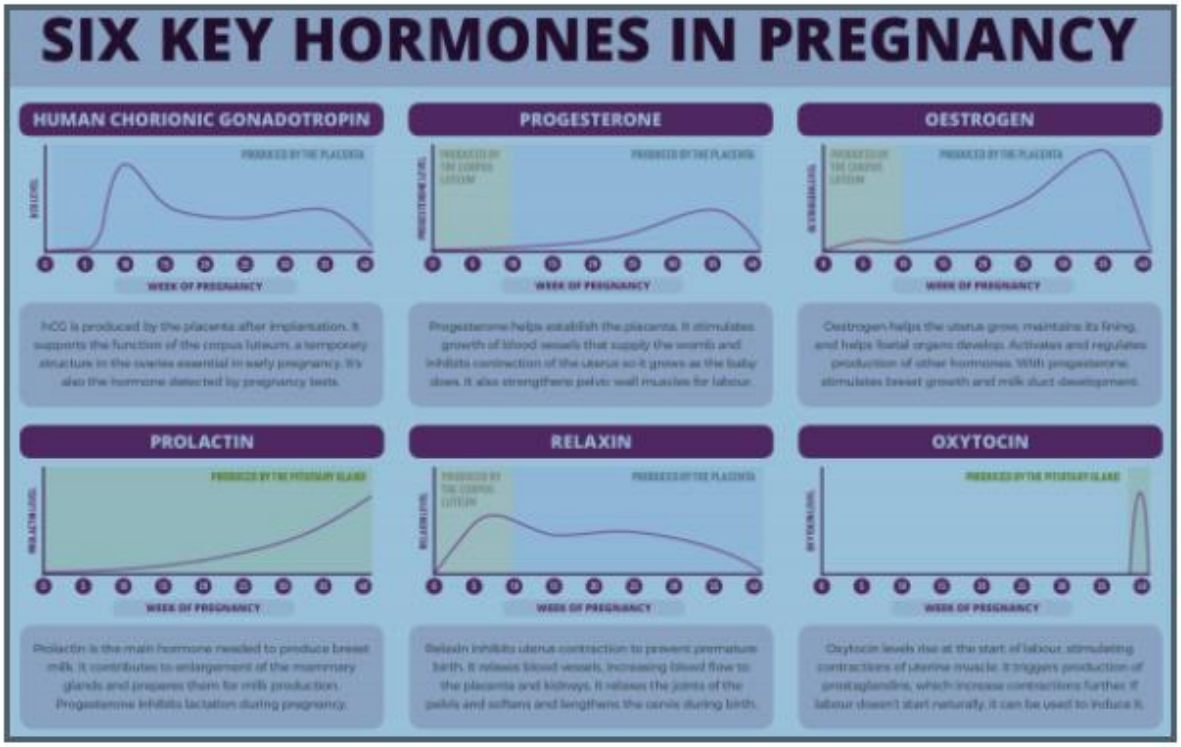
• *analyse the features of fertilisation, implantation and hormonal control of pregnancy and birth in mammals (ACSBL075)*

Fertilisation requires gametes (sperm and egg) meet and combine to form a zygote. Gametogenesis is the name of the gamete formation process. Gametogenesis can be divided into spermatogenesis (producing sperm) and oogenesis (formation of matured egg cells). The hormone testosterone is produced in cells' in the testes organ of male as part of spermatogenesis as it plays a role in producing sperm cells. The hormone oestrogen in males help with the maturing of the sperm cells in males. The fertilisation process and fusion of gametes occurs in the fallopian tube of female's body The zygote will develop into a living organism that has mixed genetic information from the parents. Zygote is the continuity of a species (relating back to inquiry question). Fertilisation involved multiple stages that MUST be fulfilled for successful fertilisation and zygote formation and thus producing a new offspring.

Three necessary stages for successful fertilisation are: Formation and maturation of gametes, Spermatozoa must journey into the oviduct, Spermatozoa must make contact and fuse with the egg cells. The gametes fuse with one purpose → to form a zygote, single cell with 46 chromosomes. During fusion, the head of the sperm cell detaches from its tail (flagellum) and the sperm-egg species journeys down the female's uterus. Also, during fusion, the sperm cell activates the egg cell resulting in cell division of the egg cell growth/development. The resulting product is called a blastocyst. Once the sperm fused with the egg, other sperms will no longer be able to fuse with the same egg. The gametes must be from the same species in other for successful fertilisation.

Implantation is the process of adhering the fertilised egg to stick to the walls of the reproductive tract, providing the most suitable environment for zygote development. It is a crucial phase for successful pregnancy. The blastocyst is implanted on the walls of the reproductive tract (uterine wall). Successful implantation means pregnancy. This implantation process onto the walls establishes blastocyst's access to nutrients to develop into an embryo (blood vessels surrounding the blastocyst carries blood which has dissolved nutrients). Embyro develops into a fetus (approx 5-11 weeks). Embryro becomes a new organism upon release from female's body.





- *evaluate the impact of scientific knowledge on the manipulation of plant and animal reproduction in agriculture (ACSBL074)*

Advancement in scientific knowledge provided humanity the knowledge that genes play an important role in the process of protein-synthesis. The protein that is formed during protein-synthesis will determine an organism's characteristics. With this knowledge, scientists use various technologies and methodologies to alter an organism's gene sequence. As a result, the modified organism's offspring would have the favourable traits that was manipulated by the scientists. The following methodologies are used to manipulate the reproduction processes of plants and animals in the agriculture industry and are all types of artificial reproduction such as artificial insemination, artificial pollination, cloning and in-vitro fertilisation.

Highlighted Text below to be completed for Home Work

Write the advantages and disadvantages of each of these methodologies and evaluate its impact on plant and animal reproduction in agriculture.

Artificial insemination

Artificial pollination

Cloning

In-vitro fertilisation