A2 Investigate the nature of reproductive processes and their role in transmitting species characteristics

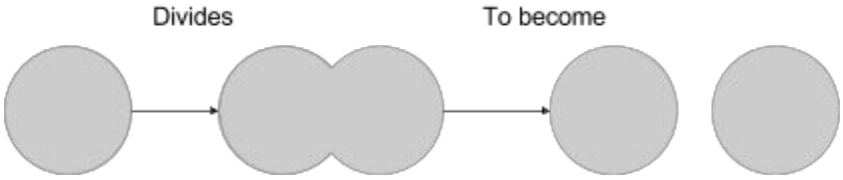
A2.1 distinguish between sexual and asexual reproduction, and identify and interpret examples of asexual and sexual reproduction in different species, by:

- ***describing mechanisms of asexual reproduction including binary fission, budding and the production of spores***
- ***describing mechanisms of sexual reproduction (e.g., cross-fertilization in seed plants, sexual reproduction in mammals)***
- ***describing examples of organisms that show both sexual and asexual reproduction (e.g., yeasts that reproduce both by budding and sexual reproduction; plants that reproduce through suckering, runners or bulbs, as well as by seed production)***
- ***describing the formation of zygote and embryo in plant and animal reproduction***

Asexual Reproduction

Asexual reproduction results in the production of offspring that are genetically identical to the parent. Asexual reproduction does not involve specific sex cells, but rather it involves all the body cells. It involves only one parent. The offspring from asexual reproduction inherits identical characteristics to the single parent, so it is identical to its parent. Different forms of Asexual reproduction are binary fission, budding, spore formation and vegetative reproduction.

During **binary fission**, one cell splits into two cells, resulting in the production of two identical individuals. Bacteria and some protists reproduce through binary fission.



During **budding**, the parent produces a small bud which detaches from the parent and develops into an identical individual. Budding takes place in yeast, hydra and corals.

Some fungi and non-flowering plants, such as ferns, produce **spores**. Each spore develops into a new individual that is identical to the parent.

Vegetative reproduction is a form of reproduction that does not involve the formation of seeds. For example, cutting of a coleus plant, runners in strawberries, tubers in potatoes, and bulbs in daffodils are various means by which vegetative reproduction can occur.

Sexual Reproduction

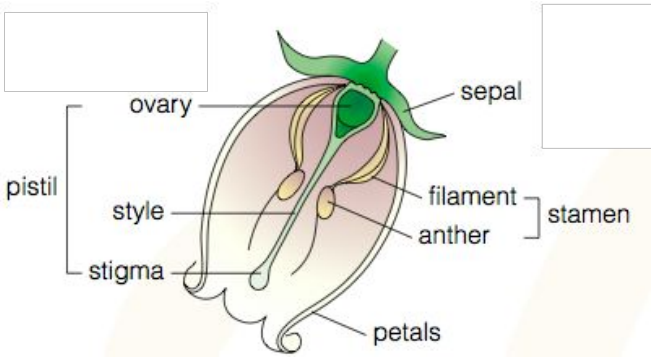
Reproduction that involves two individuals is called **sexual reproduction.** Most species of animals and flowering plants undergo sexual reproduction. The offspring of sexual reproduction show characteristics of both parents.

Sexual Reproduction in Animals

Sexual reproduction involves specialized cells known as **gametes**. Male gametes are called **sperm**, and the female gametes are known as **egg cells**. The union of sperm and egg cell occurs during **fertilization**. A **zygote** is formed as a result of fertilization. The zygote divides repeatedly to form an **embryo**. The development of an embryo may take place inside the female parent (as in mammals) or take place outside the body in an egg (as in birds and reptiles). The new individuals may resemble one parent more than the other but are not identical to either parent.

Sexual reproduction in Plants

Plants that reproduce sexually produce flowers. Some flowers are large and showy, while others are small and inconspicuous. the flower contains **stamens**, which produce **pollen grains**.



The male gametes are produced and contained in pollen grains. **Pistils**, which contain ovules, are responsible for producing the female gametes. During pollination, pollen grains from the **anther** are transferred to the **stigma** of the pistil.

The union of the male and female gametes takes place through fertilization. The resulting zygote divides to form an embryo. The embryo becomes the seed. When the conditions are favourable, the seeds germinate to produce new plants. A process called **cross-fertilization** occurs when the pollen of one plant is able to fertilize the female gametes of another plant. This often happens when the pollen is carried to another plant by wind or other animals.

Sexual and Asexual Reproduction in One Organism

Some organisms are able to reproduce both sexually and asexually. In some species of grass, roses and sunflowers, the embryo develops in the seed without a male gamete. In aphids, the female can produce other female aphids without fertilization. The young females are born instead of being hatched from eggs. Sponges also exhibit both types of reproduction.

A2.2 describe examples of variation of characteristics within a species, and identify examples of both discrete and continuous variation (e.g., hand clasping preference is an example of a discrete variation, the length of human hands varies on a continuum)

Discrete versus Continuous Variation

Discrete variation is the difference in characteristics that have defined form. An organism either has a certain characteristic or it does not. For example, a person either has green eyes or he does not. Some people can roll their tongues, while others cannot. Some people have a free earlobe; others have an attached earlobe.

Continuous variation describes the range of a heritable characteristic. Height is a good example of this. The normal human height range is well over one metre, with the petite at one end, the very tall at the other, most people falling somewhere in between.

A2.3 investigate the transmission of characteristics from parents to offspring, and identify examples of characteristics in offspring that are:

- ***the same as the characteristics of both parents***
- ***the same as the characteristics of one parent***
- ***intermediate between parent characteristics***
- ***different from both parents***

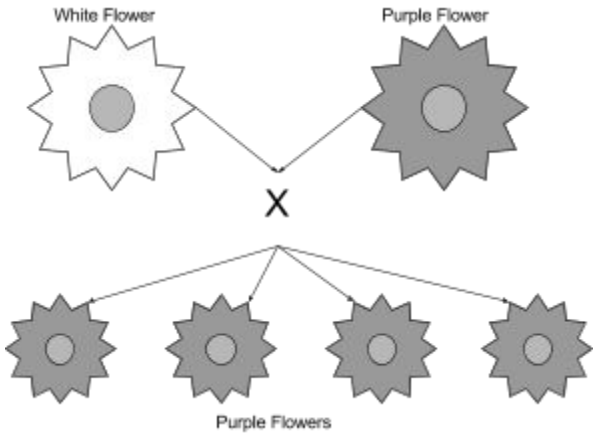
A2.5 identify examples of dominant and recessive characteristics and recognize that dominance and recessiveness provide only a partial explanation for the variation of characteristics in offspring

Transmission of Characteristics

The transmission of characteristics from parents to offspring takes place through **genes**. Genes have several possible forms. These forms are called **alleles**. This process of transmission is call **inheritance**.

An individual produced by crossing two purebred parents that differ in a trait is known as **hybrid**. After cross breeding, the trait that is able to express itself is called the **dominant trait,** and the one that does not express itself is called the **recessive trait**.

In this picture, the colour purple is the dominant trait and white is the recessive trait because all the four offspring flowers are purple.



Sometimes, the dominant and recessive traits are blended together. For example, when a purebred red-flowered snapdragon plant is crossed with a purebred white-flowered plant, the offspring have neither red no white flowers, but pink flowers. This pattern of inheritance is called **incomplete dominance**. Both the red-flower allele and the white-flower allele played a role in determining the flower colour of the offspring.

The inheritance of characteristics can be summarized as follows:

- if the offspring have the same characteristics as both parents, it is the result of pure breeding.
- If the offspring have the same characteristics as one of the parents, it is the result of cross-breeding and a dominant-recessive pattern of inheritance.
- If the offspring have intermediate characteristics of both parents, it is the result of cross-breeding and incomplete dominance.
- If the offspring differ from both parents, it is a result of a combination of several possible alleles for each trait.

A2.4 distinguish those characteristics that are heritable from those that are not heritable, and identify characteristics for which heredity and environment may both play a role (e.g., recognize that eye colour is heritable but that scars are not; recognize that a person's height and weight may be largely determined by heredity but that diet may also play a role)

Heritable and Non-heritable Characteristics

Characteristics of parents are transmitted to the next generation by the process of **heredity**. Some characteristics are inherited, while others characteristics are not. **Heritable** characteristics are passed on from one generation to another. An example of this is skin colour. **Non-heritable** characteristics, however, are acquired. They are not transferred by genes to the next generation. A father who is a very good soccer player would have to teach his children how to play the game. The children would have to learn, or acquire, the skills of playing soccer.

Sometimes, variations in individual are a result of environmental factors. If two identical twins are separated and live in areas with different climatic conditions, they may develop some variation in their skin colour. The twin who lives in a warmer climate may have darker skin. Variations caused by interactions with the environment are not heritable, rather they are acquired.