

# Reproduction

## IGCSE Biology 0610 · Topic 16 revision notes

Everything from the 8 lessons of this topic on a few pages: the key idea of each lesson, the diagram to remember, the points to learn and the traps examiners set. Read it, cover it, test yourself.

1. Asexual reproduction

2. Sexual reproduction

3. Flowers and pollination

4. Fertilisation and germination

5. Human reproductive systems and gametes

6. Pregnancy and the placenta

7. Sex hormones and the menstrual cycle

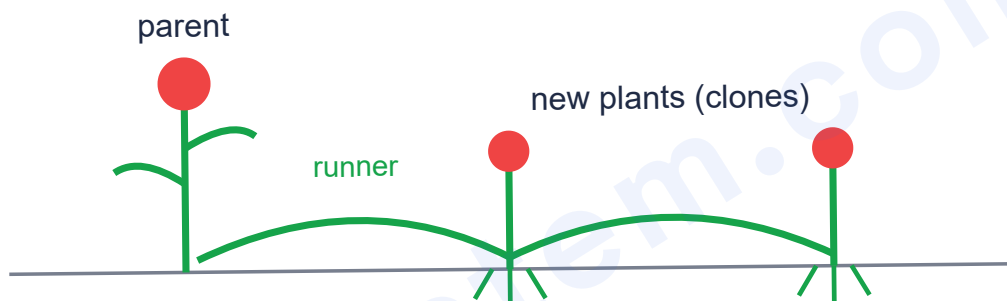
8. Sexually transmitted infections

# 1 Asexual reproduction

## Syllabus 16.1

Asexual reproduction is a **process resulting in the production of genetically identical offspring from one parent**. There are no gametes and no fertilisation, so the offspring (clones) have the same genes as the parent and as each other. Extended: it is fast and needs only one parent, but the lack of variation means a whole population can be wiped out by one change, such as a new disease.

strawberry plant reproducing by runners



one parent, no gametes, no fertilisation  
offspring genetically identical to the parent

Fig. 1: new strawberry plants grow along runners; they are clones of the parent

## One parent, no gametes.

- ✓ **Definition:** genetically identical offspring from one parent.
- ✓ **Spot it:** one parent, new individual grows from part of it, no gametes, no fertilisation.
- ✓ **Advantages (Extended):** fast, one parent, good features kept, uniform crop.
- ✓ **Disadvantages (Extended):** no variation, so disease or change can kill all; competition with parent.

## Watch out!

Asexual offspring are not just similar to the parent: they are *genetically identical*. If you see variation between asexual offspring, it must be caused by the environment, not by their genes.

Do not just write "it is quicker" or "there is no variation". Say *why* it matters: for example, no variation means no individual is likely to be resistant, so the whole population or crop could be lost.

## 2 Sexual reproduction

### Syllabus 16.2

Sexual reproduction is a process involving the fusion of the nuclei of two gametes to form a zygote and the production of offspring that are genetically different from each other. Fertilisation is the fusion of the nuclei of gametes. Extended: the nuclei of gametes are **haploid** (one set of chromosomes) and the nucleus of a zygote is **diploid** (two sets).

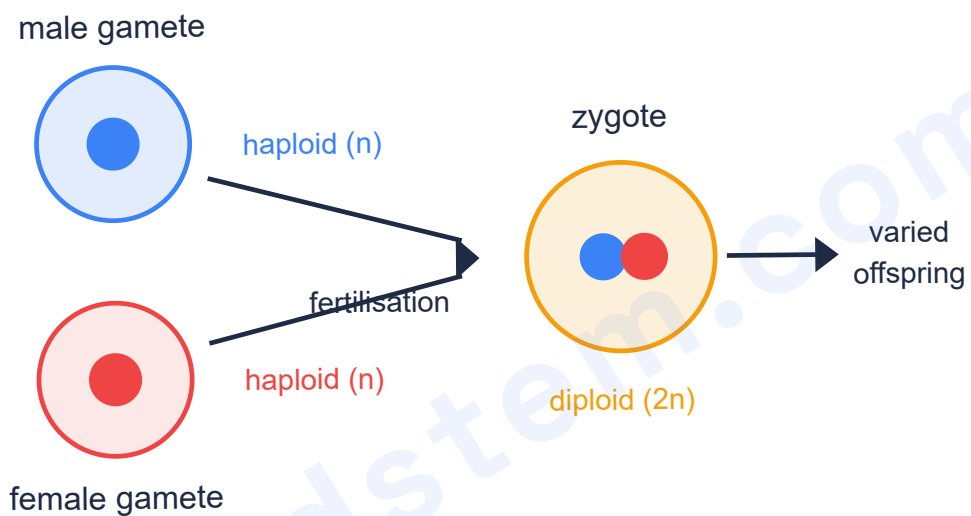


Fig. 1: two haploid gamete nuclei fuse at fertilisation to give a diploid zygote

### Fusion of nuclei, variation.

- ✓ **Sexual reproduction:** fusion of the nuclei of two gametes to form a zygote; offspring genetically different.
- ✓ **Fertilisation:** fusion of the nuclei of gametes.
- ✓ **Extended:** gamete nuclei haploid (one set), zygote nucleus diploid (two sets).
- ✓ **Discuss questions:** give advantages and disadvantages, for the wild and for crops.

### Watch out!

Fertilisation is the fusion of the nuclei, not just the sperm touching or entering the egg. Write "the nucleus of the sperm fuses with the nucleus of the egg".

Variation is an advantage for the population, not a guarantee for each individual. Write that some individuals are likely to survive a change, so the species is less likely to die out.

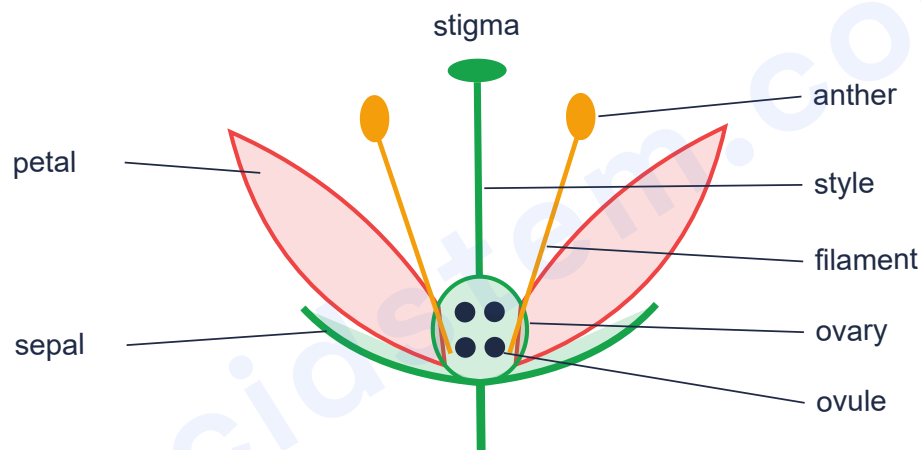
### 3 Flowers and pollination

#### Syllabus 16.3

**Pollination is the transfer of pollen grains from an anther to a stigma.** Insect-pollinated flowers have large, coloured, scented petals and nectar, with anthers and a sticky stigma inside the flower; wind-pollinated flowers have small or no petals, anthers hanging outside on long filaments and large feathery stigmas. Extended: self-pollination moves pollen to a stigma on the same plant; cross-pollination moves it to a flower on a different plant of the same species.

stamen = anther + filament

carpel = stigma + style + ovary



half-flower of an insect-pollinated flower

Fig. 1: half-flower showing the stamens (male) and carpel (female) of an insect-pollinated flower

## Structure fits the pollinator.

- ✓ **Stamen** = anther + filament; **carpel** = stigma + style + ovary (with ovules).
- ✓ **Pollination:** pollen grains from an anther to a stigma.
- ✓ **Insect:** showy petals, scent, nectar, sticky stigma inside, larger sticky pollen.  
**Wind:** dangling anthers, feathery stigmas, small light pollen.
- ✓ **Extended:** self = same flower or same plant; cross = different plant, same species.

## Watch out!

The stamen is the anther and filament together; the carpel is the stigma, style and ovary together. Do not label the whole carpel as the "ovary" or the anther as the "stamen".

A wind-pollinated flower has large feathery stigmas but small pollen grains. Students often swap these. A large surface catches pollen; small light grains travel far.

Two flowers on the same plant count as self-pollination, even though pollen has moved between flowers. Cross-pollination needs a different plant of the same species.

## 4 Fertilisation and germination

### Syllabus 16.3

**Fertilisation occurs when a pollen nucleus fuses with a nucleus in an ovule.** Extended: after pollination a pollen tube grows out of the pollen grain, down through the style to an ovule, and enters it through the micropyle, carrying the pollen nucleus. Seeds need **water, oxygen and a suitable temperature** to germinate.

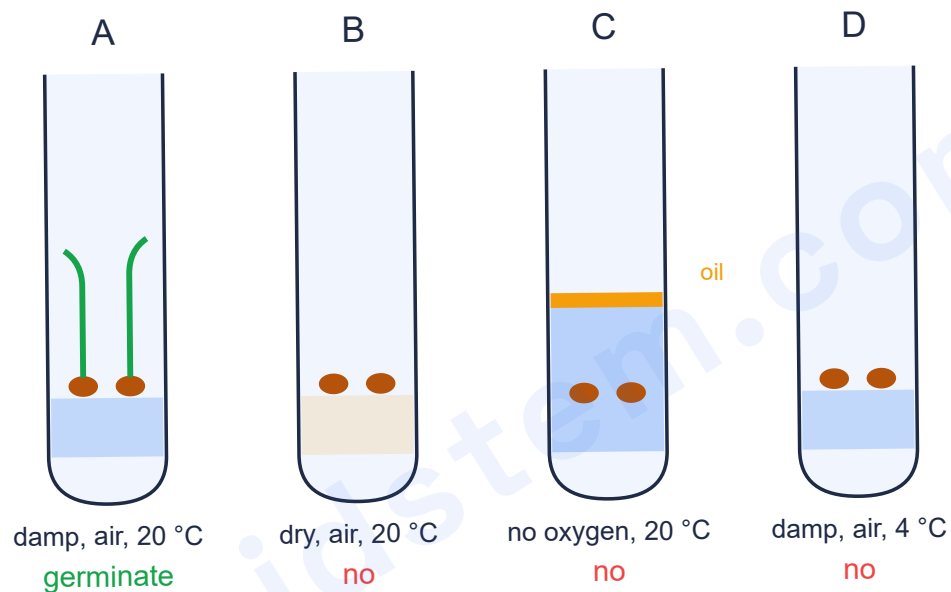


Fig. 1: germination experiment; only tube A has water, oxygen and a suitable temperature

## *Pollinate, grow, fuse, germinate.*

- ✓ **Fertilisation:** a pollen nucleus fuses with a nucleus in an ovule.
- ✓ **Extended:** pollen tube grows down the style, enters the ovule through the micropyle.
- ✓ **Germination needs** water, oxygen and a suitable temperature; not light.
- ✓ **Experiments:** remove one condition per tube; keep a control with all three.

## *Watch out!*

Pollination and fertilisation are different events. Pollination is pollen landing on the stigma; fertilisation happens later, inside the ovule, when the nuclei fuse. A pollen grain does not travel down the style: its tube grows down, carrying the nucleus.

Light is not one of the conditions needed for germination: the seed uses its food store, not photosynthesis. Do not add light, carbon dioxide or soil to your list.

## 5 Human reproductive systems and gametes

### Syllabus 16.4

Fertilisation is the **fusion of the nuclei from a male gamete (sperm) and a female gamete (egg cell)**; in humans it happens in the oviduct. Sperm are small, numerous and swim using a flagellum; egg cells are large, few and cannot move by themselves. In early development **the zygote forms an embryo, which is a ball of cells that implants into the lining of the uterus**.

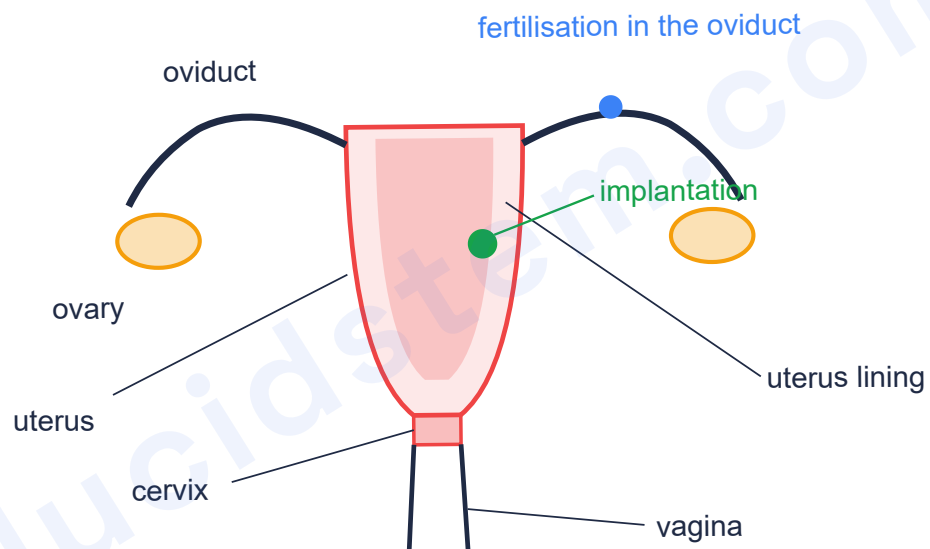


Fig. 1: female reproductive system (diagrammatic), showing where fertilisation and implantation happen

### *Name it, give its job.*

- ✓ **Male:** testes, scrotum, sperm ducts, prostate gland, urethra, penis.
- ✓ **Female:** ovaries, oviducts (fertilisation), uterus (implantation), cervix, vagina.
- ✓ **Sperm:** flagellum, mitochondria, acrosome enzymes. **Egg:** energy stores, jelly coat that changes.
- ✓ **Compare gametes** on size, structure, motility and numbers.

### *Watch out!*

The *sperm duct* carries sperm; the *urethra* carries semen and urine out of the body. The *oviduct* (not the uterus) is where fertilisation normally happens. The bladder in the model is not part of the reproductive system.

Mitochondria give the sperm energy for swimming; they do not make it swim. The flagellum is what moves. Say "release energy by respiration", never "produce energy".

The embryo does not implant in the oviduct or the ovary. It implants in the lining of the uterus.

## 6 Pregnancy and the placenta

### Syllabus 16.4

The **placenta** is attached to the wall of the uterus and the **umbilical cord** joins it to the fetus; the **amniotic sac** encloses the fetus in **amniotic fluid**, which protects it. Extended: in the placenta the blood of the mother and the blood of the fetus come very close but do not mix; dissolved nutrients and oxygen diffuse to the fetus and carbon dioxide and urea diffuse to the mother. Some pathogens and toxins can also cross the placenta and affect the fetus.

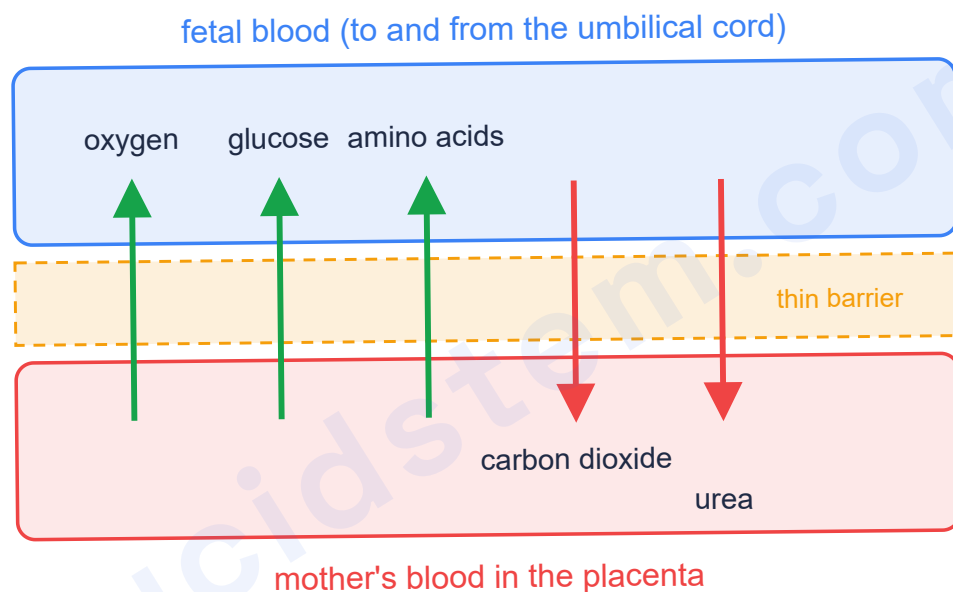


Fig. 1: exchange across the placenta; the two bloods are separated by a thin barrier

### *Close, but never mixed.*

- ✓ **Placenta:** exchange between mother's and fetus's blood; attached to the uterus wall.
- ✓ **Umbilical cord:** fetus's blood vessels to and from the placenta.
- ✓ **Amniotic sac and fluid:** enclose, support and protect the fetus.
- ✓ **Extended:**  $O_2$ , glucose, amino acids to the fetus;  $CO_2$ , urea to the mother; some pathogens and toxins cross too.

### *Watch out!*

The umbilical cord carries the fetus's blood, not the mother's. The mother's blood stays in her own vessels in the placenta.

Do not write that the mother's blood flows into the fetus.

Substances diffuse across the placenta; the two bloods never mix.

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## 7 Sex hormones and the menstrual cycle

### Syllabus 16.5

**Testosterone** (from the testes) and **oestrogen** (from the ovaries) cause the development of secondary sexual characteristics at puberty. In the **menstrual cycle**, of about 28 days, the uterus lining breaks down (menstruation), then repairs and thickens while an egg matures in a follicle; the egg is released at ovulation, about day 14, and the lining is kept thick ready for an embryo. Extended: FSH and LH come from the pituitary gland; oestrogen is made by the ovary (follicle), progesterone by the corpus luteum and, in pregnancy, by the placenta.

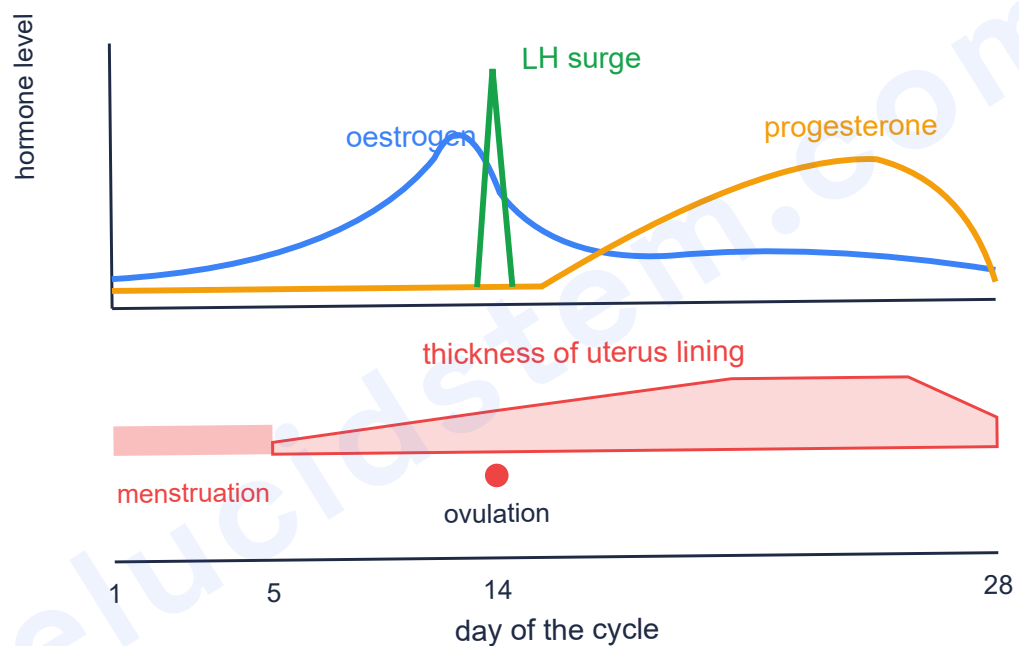


Fig. 1: hormone levels (simplified) and the thickness of the uterus lining through one 28-day cycle

## *Gland, hormone, target.*

- ✓ **Puberty:** testosterone (testes), oestrogen (ovaries) cause secondary sexual characteristics.
- ✓ **Cycle:** menstruation days 1 to 5, lining thickens, ovulation about day 14, lining kept thick.
- ✓ **Extended:** FSH and LH from the pituitary; oestrogen from the follicle; progesterone from the corpus luteum, then the placenta.
- ✓ **Extended:** FSH develops follicle; LH triggers ovulation; oestrogen builds the lining; progesterone keeps it.

## *Watch out!*

Secondary sexual characteristics develop at puberty. They are not the reproductive organs themselves, which are present from birth (primary sexual characteristics).

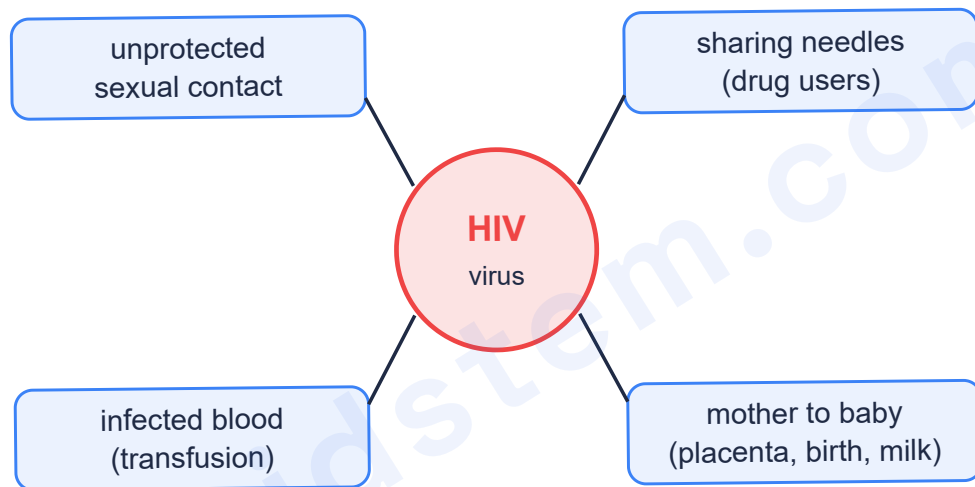
FSH and LH come from the pituitary gland, not the ovary.

Oestrogen and progesterone come from the ovary (follicle and corpus luteum), and later in pregnancy from the placenta.

## 8 Sexually transmitted infections

### Syllabus 16.6

A **sexually transmitted infection (STI)** is an infection that is transmitted through **sexual contact**. The **human immunodeficiency virus (HIV)** is a pathogen that causes an STI, and HIV infection may lead to **AIDS**. HIV is passed on in body fluids: by unprotected sexual contact, sharing needles, infected blood and from mother to baby. The spread of STIs is controlled by using condoms, limiting sexual partners, testing and treatment, and education.



infects lymphocytes; may lead to AIDS

Fig. 1: the four ways HIV is transmitted

### Route, then barrier.

- ✓ **STI:** an infection transmitted through sexual contact.
- ✓ **HIV** is a virus that causes an STI; infection may lead to AIDS.
- ✓ **Routes:** unprotected sex, shared needles, infected blood, mother to baby.
- ✓ **Control:** condoms, fewer partners, testing and treatment, clean needles, screening blood, education.

### Watch out!

HIV is the virus; AIDS is the condition that may develop later when the immune system fails. Write "HIV infection may lead to AIDS", not "HIV is AIDS".

Antibiotics do not kill viruses, so they cannot cure HIV. Treatment with antiviral drugs controls HIV but does not remove it from the body.