

Sexual reproduction in humans

Revision notes · The male and female reproductive systems, sperm and egg cells, fertilisation, implantation, and the fetus, placenta and umbilical cord.

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

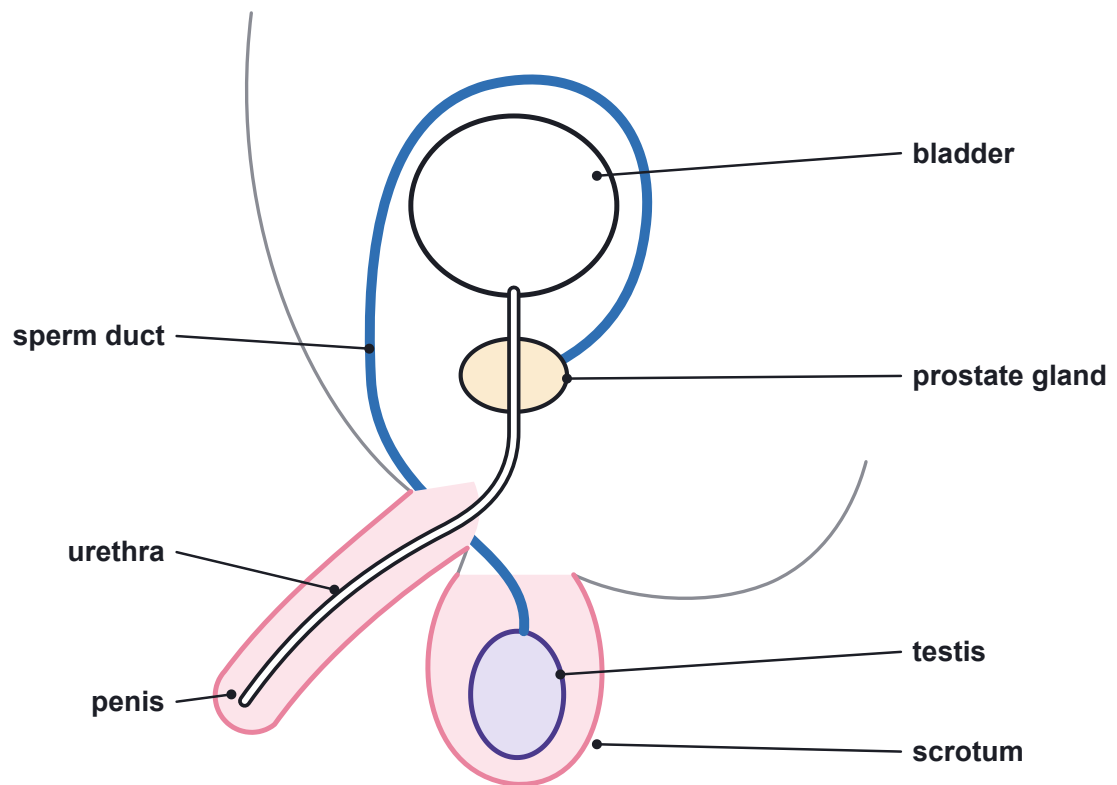
Sexual reproduction in humans Spec 16.4

The male and female reproductive systems Spec 16.4.1, 16.4.2

Humans reproduce sexually. The male system makes and delivers **sperm**. The female system makes **egg cells**, receives the sperm and carries the developing baby.

The male reproductive system

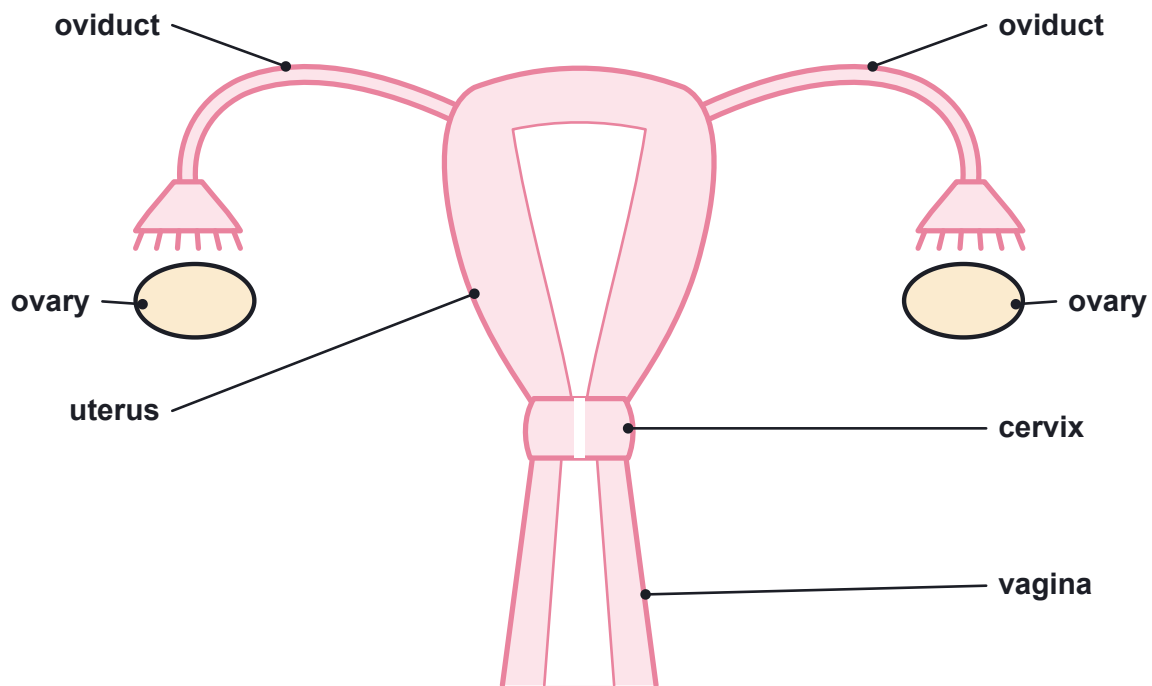
Parts of the male reproductive system	
Part	Function
Testes	Make sperm (and the hormone testosterone)
Scrotum	Bag of skin that holds the testes outside the body, where it is cooler than body temperature
Sperm ducts	Tubes that carry sperm from the testes to the urethra
Prostate gland	Adds fluid to the sperm to make semen, which helps the sperm to swim and gives them nutrients
Urethra	Tube inside the penis that carries semen (and urine) out of the body
Penis	Places sperm inside the vagina during sexual intercourse



The male reproductive system. Sperm travel from the **testis** along the **sperm duct** (blue) to the urethra.

The female reproductive system

Parts of the female reproductive system	
Part	Function
Ovaries	Make and release egg cells (and the hormones oestrogen and progesterone)
Oviducts	Tubes that carry the egg cell to the uterus. Fertilisation usually happens here
Uterus	Muscular organ with a soft lining, where the embryo implants and the fetus develops
Cervix	Ring of muscle at the opening of the uterus that keeps the fetus in during pregnancy
Vagina	Receives the penis and the sperm during sexual intercourse. The baby passes through it at birth



The female reproductive system. The funnel-shaped end of each **oviduct** lies close to an ovary.

Exam tip: Do not mix up the oviduct (carries the egg) and the sperm duct (carries sperm). Do not mix up the urethra and the ureter either. The ureter is part of the urinary system.

Gametes and fertilisation Spec 16.4.3, 16.4.4, 16.4.5, 16.4.6

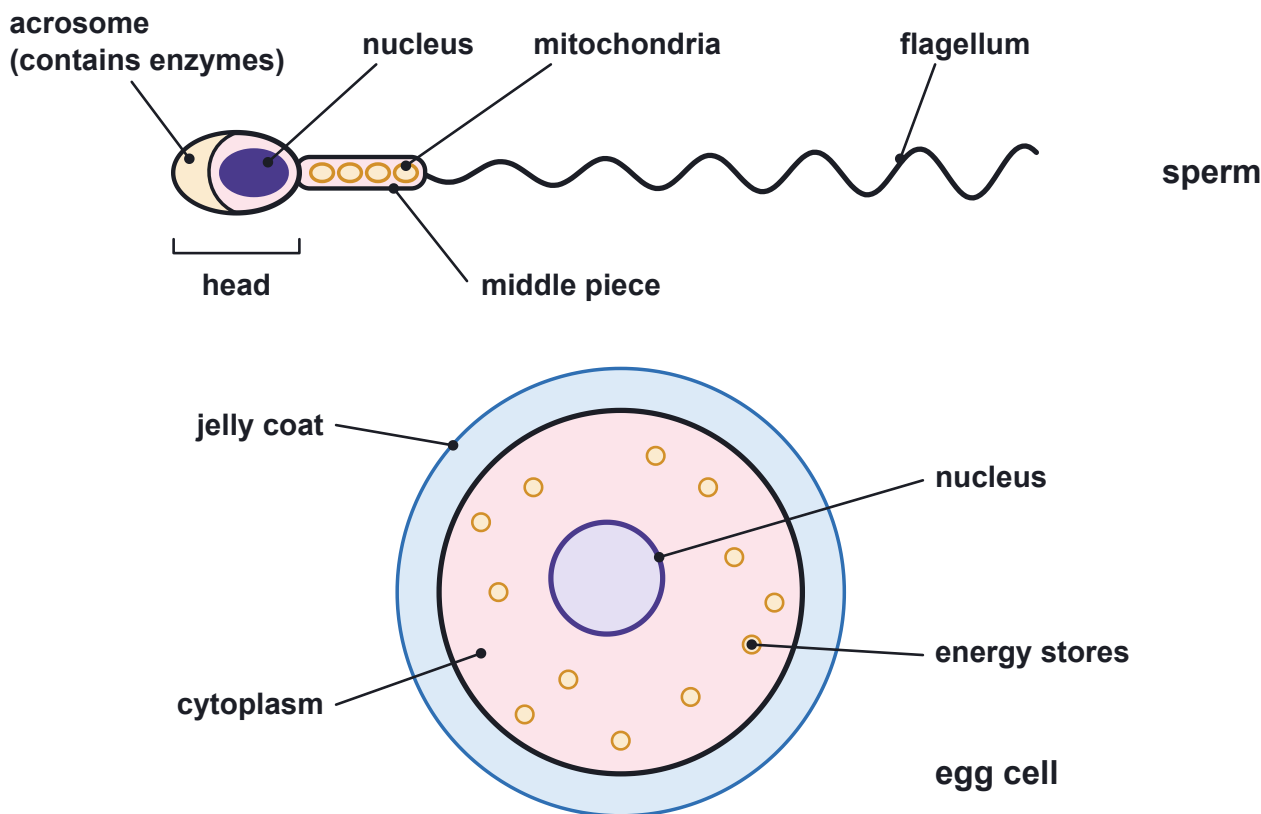
In humans, **fertilisation** is the fusion of the nuclei from a male gamete (sperm) and a female gamete (egg cell). The fertilised egg is called a **zygote**.

Adaptive features of sperm

How a sperm is adapted to its function	
Feature	How it helps
Flagellum (tail)	Whips from side to side to move the sperm towards the egg cell
Many mitochondria	Release energy by aerobic respiration for the flagellum to move
Enzymes in the acrosome	Digest a way through the jelly coat around the egg cell so the sperm nucleus can enter

Adaptive features of egg cells

How an egg cell is adapted to its function	
Feature	How it helps
Energy stores (in the cytoplasm)	Supply energy for the zygote and early embryo until it implants in the uterus
Jelly coat that changes at fertilisation	After one sperm has entered, the jelly coat changes so that no other sperm can get in. This makes sure only one sperm nucleus fuses with the egg nucleus



The sperm and the egg cell are not drawn to the same scale.

A sperm and an egg cell (not to the same scale). Note the **acrosome**, **mitochondria** and **flagellum** of the sperm, and the **energy stores** and **jelly coat** of the egg cell.

Comparing male and female gametes

Sperm compared with egg cells		
Feature	Sperm	Egg cell
Size	Very small	Much larger (one of the largest human cells)
Structure	Head with nucleus and acrosome, middle piece with mitochondria, flagellum	Nucleus, cytoplasm with energy stores, jelly coat
Motility	Can swim using the flagellum	Cannot move by itself; it is moved along the oviduct
Numbers	Millions made	Usually one released each month

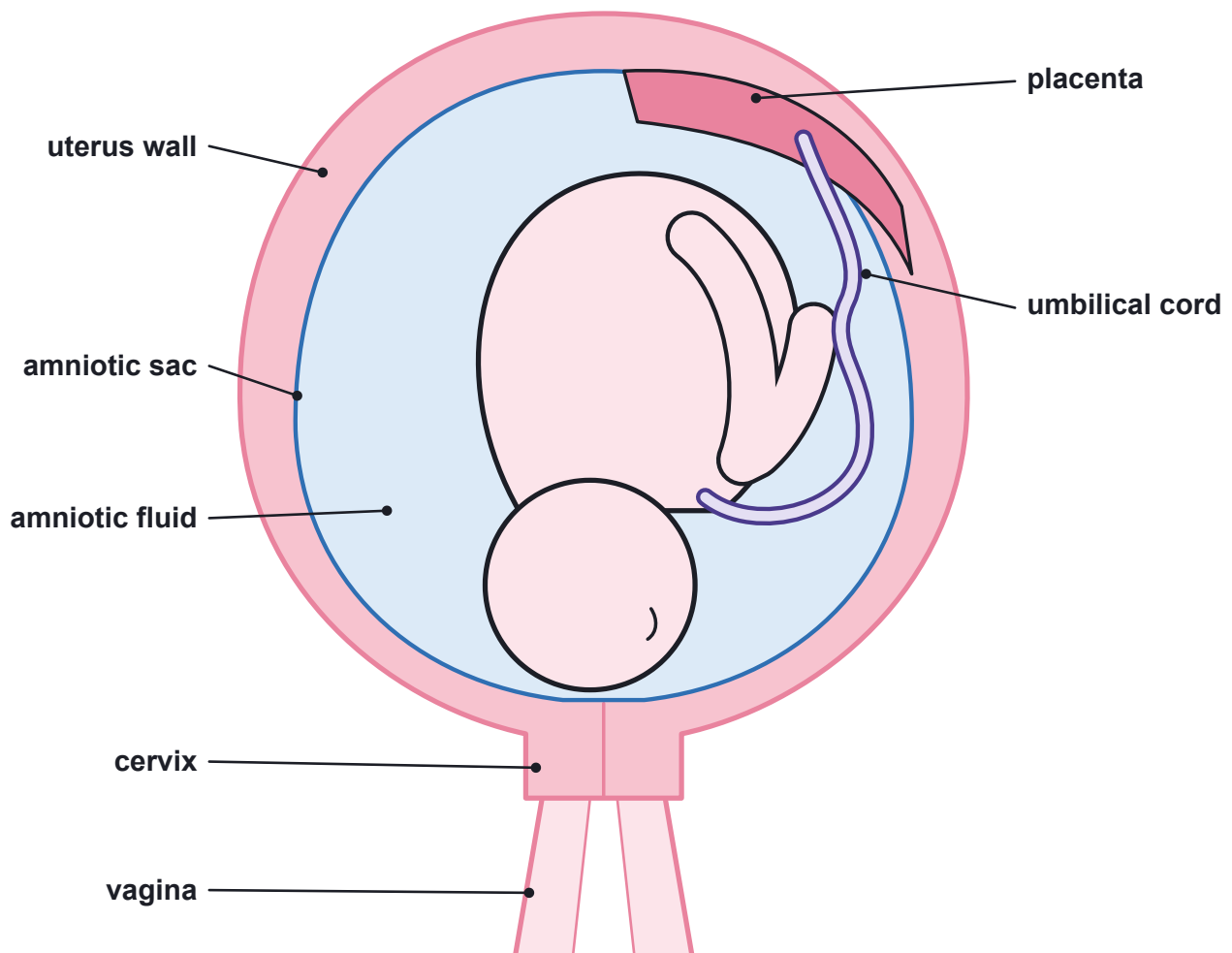
Exam tip: For 'explain the adaptive features' questions, name the feature and then say how it helps: 'mitochondria, to release energy for swimming'.

Implantation, the fetus and the placenta Spec 16.4.7, 16.4.8, 16.4.9, 16.4.10

After fertilisation, the zygote divides to form an **embryo**. The embryo is a ball of cells. It travels along the oviduct to the uterus and **implants** into the lining of the uterus. It then develops into a fetus.

Structures that protect and support the developing fetus

Structure	Function
Placenta	Disc of tissue attached to the uterus wall where substances are exchanged between the mother's blood and the fetus's blood
Umbilical cord	Connects the fetus to the placenta. It contains blood vessels that carry blood between the fetus and the placenta
Amniotic sac	Membrane that surrounds the fetus and holds the amniotic fluid
Amniotic fluid	Protects the fetus from knocks and bumps (it acts as a shock absorber)



The fetus in the uterus. The **amniotic fluid** inside the amniotic sac protects the fetus; the **umbilical cord** joins it to the placenta.

Supplement

Exchange at the placenta

Supplement

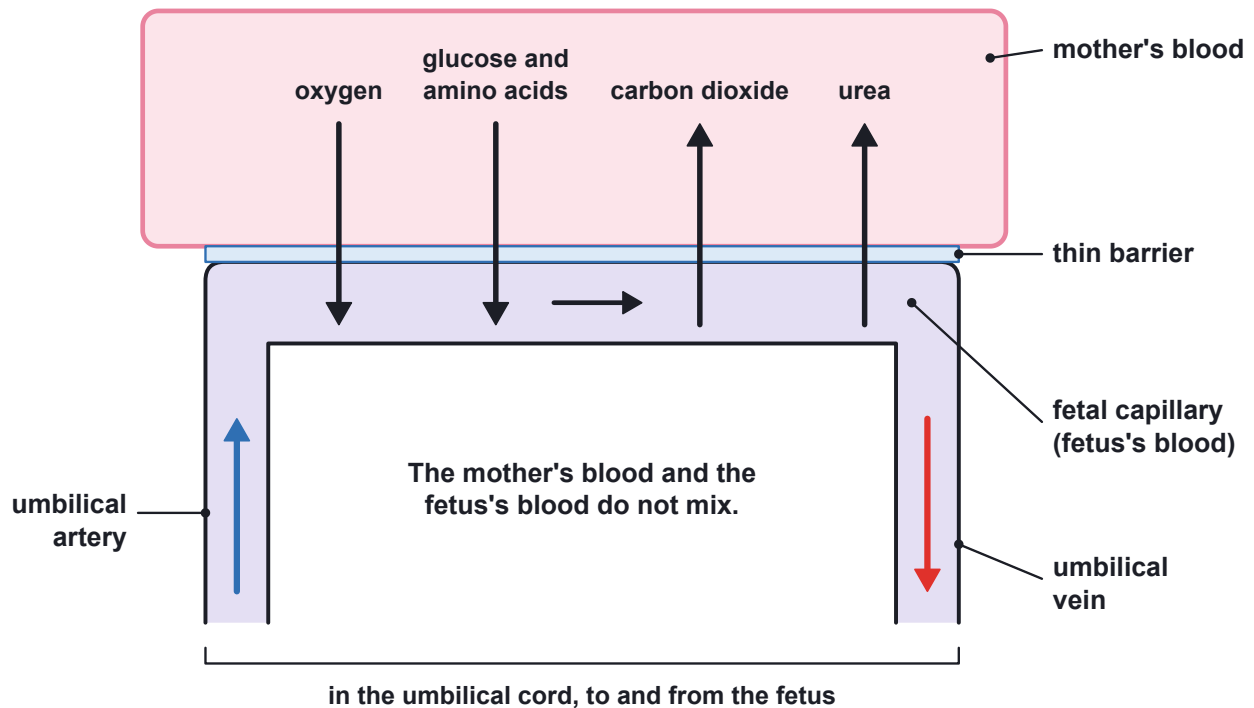
The blood of the mother and the blood of the fetus flow close together in the **placenta**, but they do not mix. Substances pass between them across a thin barrier, mainly by diffusion. The umbilical cord carries the fetus's blood to and from the placenta.

Supplement

Exchange between the mother's blood and the fetus's blood

From mother to fetus	From fetus to mother
Dissolved nutrients (for example glucose and amino acids)	Excretory products (for example urea)
Oxygen	Carbon dioxide

Supplement



Exchange at the placenta. Substances cross a **thin barrier**; the mother's blood and the fetus's blood **do not mix**.

Supplement

Some **pathogens** (for example some viruses) and **toxins** (for example some drugs and alcohol) can pass across the placenta from the mother's blood into the fetus's blood and may harm the fetus.

Supplement

Common mistake: The mother's blood does not flow into the fetus. The two bloods stay separate, and substances cross the placenta between them.

Quick check

1. Which part of the male reproductive system carries sperm from the testes to the urethra?
2. Name the part of the female system where the fetus develops.
3. What happens at fertilisation?
4. State the function of amniotic fluid.
5. **Supplement** Name two types of substance that can cross the placenta and harm a fetus.

Quick check answers

Sexual reproduction in humans

1. The sperm duct.
2. The uterus.
3. The nucleus of a sperm fuses with the nucleus of an egg cell.
4. It protects the fetus from knocks and bumps.
5. Pathogens and toxins.