

Human reproduction

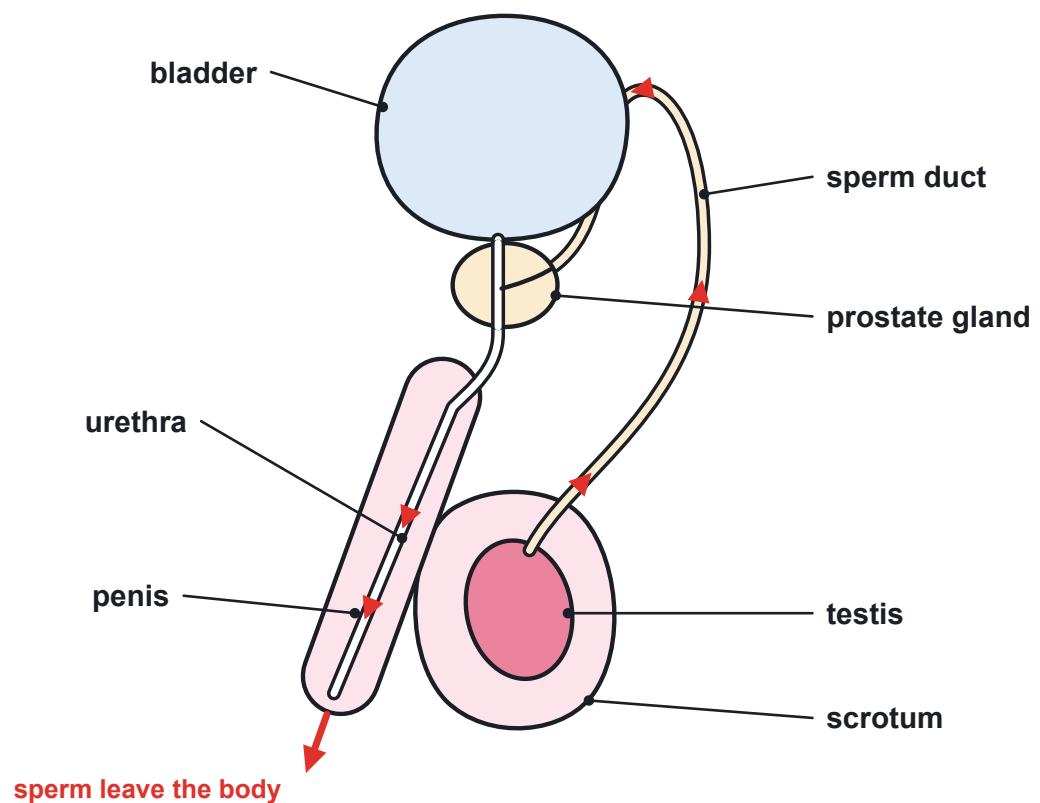
Revision notes · The male and female reproductive systems, the menstrual cycle and its hormones, the placenta, amniotic fluid and secondary sexual characteristics.

For Pearson Edexcel International GCSE Biology 4BI1 and Science (Double Award) 4SD0. **Biology only** is not in the Double Award and is only examined on Paper 2.

Human reproduction Spec 3.8–3.13

Male and female reproductive systems Spec 3.8

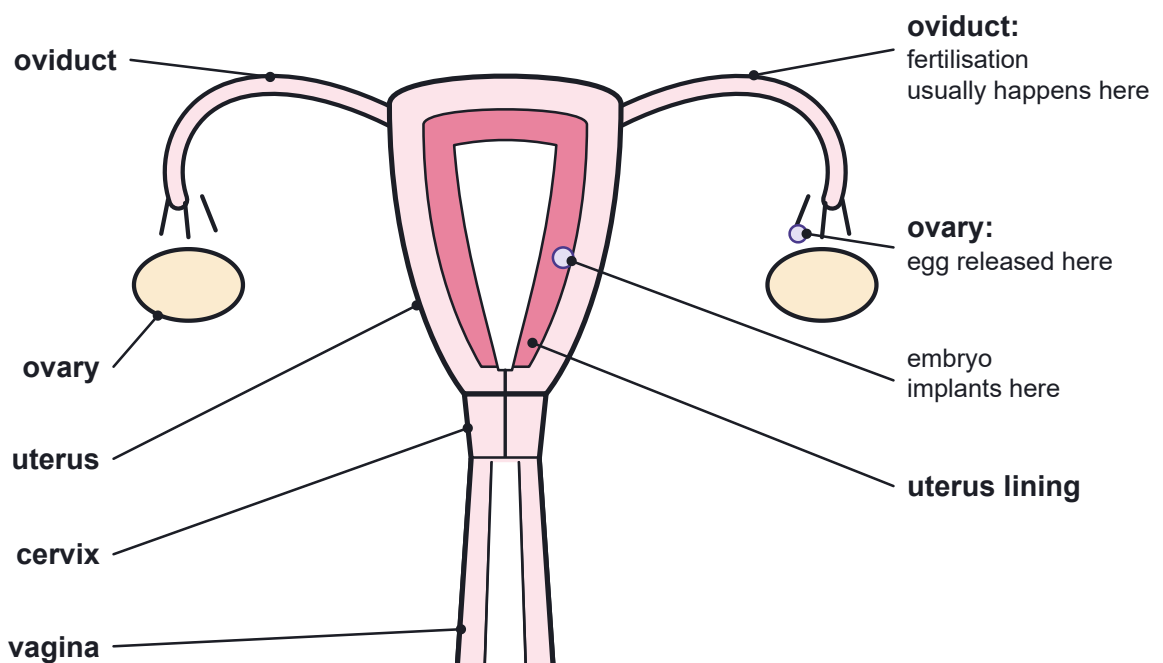
The reproductive systems are adapted for making **gametes**, bringing the gametes together for **fertilisation**, and (in females) protecting and nourishing the developing embryo. Sperm are made in the **testes** and eggs in the **ovaries**.



The male reproductive system. Sperm travel from the **testis** along the **sperm duct** to the **urethra** and out through the penis.

The male reproductive system

Part	Function
Testes	Make sperm (the male gametes) and the hormone testosterone
Scrotum	A bag of skin that holds the testes outside the body, where it is slightly cooler, which is better for sperm production
Sperm duct	A tube that carries sperm from each testis towards the urethra
Prostate gland	Adds fluid to the sperm to make semen. The fluid gives the sperm a liquid to swim in and contains nutrients
Urethra	A tube that carries semen (and urine) through the penis to the outside
Penis	Passes sperm into the vagina during sexual intercourse



The female reproductive system. **Fertilisation usually happens in the oviduct** and the embryo implants in the **uterus lining**.

The female reproductive system

Part	Function
Ovaries	Make eggs (the female gametes) and the hormones oestrogen and progesterone
Oviducts	Tubes that carry the egg from the ovary to the uterus. Fertilisation usually happens here. The lining of the oviduct has cilia that move the egg along
Uterus	A muscular organ with a soft lining. The embryo implants in the lining and the fetus develops here
Cervix	A ring of muscle at the opening of the uterus. It keeps the uterus closed during pregnancy
Vagina	Receives the penis and sperm during intercourse. It is also the birth canal

Exam tip: Learn each part as 'name, then job'. Examiners often ask where gametes are made (testes and ovaries) and where fertilisation happens (oviduct).

Oestrogen, progesterone and the menstrual cycle Spec 3.9

The **menstrual cycle** is a series of changes in a woman that repeats about every 28 days. Each cycle, an egg is released from an ovary and the lining of the uterus is prepared in case the egg is fertilised.

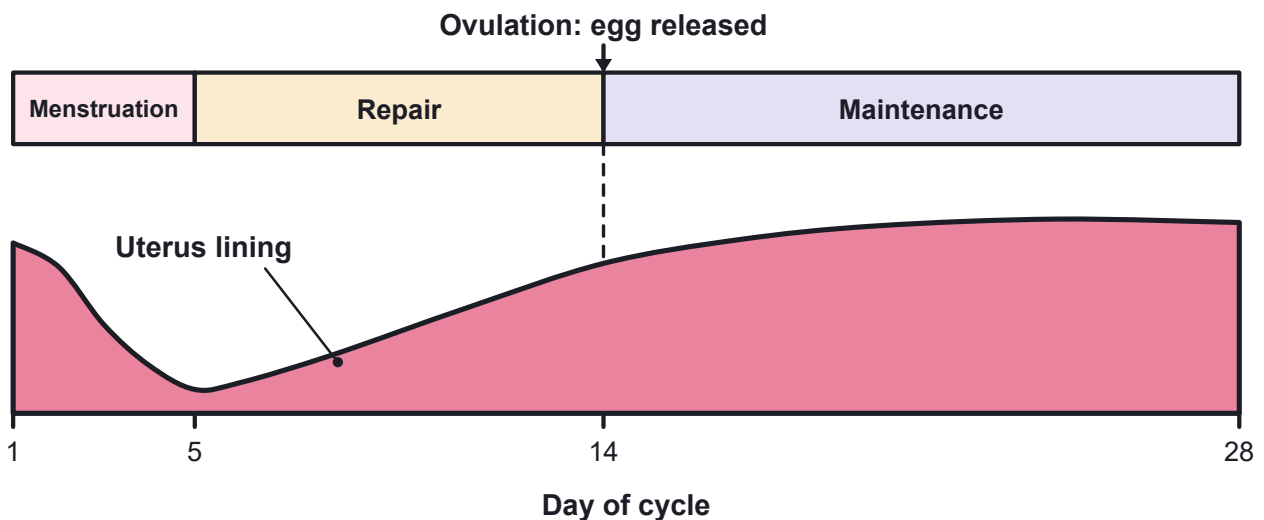
Stages of the menstrual cycle (days are approximate)		
Stage	Days	What happens
Menstruation	1 to 5	The lining of the uterus breaks down and is lost through the vagina with blood
Repair	5 to 14	The uterus lining is repaired and thickens again
Ovulation	Around 14	An egg is released from an ovary
Maintenance	14 to 28	The lining stays thick, ready for a fertilised egg. If there is no pregnancy it breaks down and the cycle starts again

The roles of two hormones

- Oestrogen** is made in the ovaries. It causes the **repair and growth** of the uterus lining.
- Progesterone** is made in the ovaries. It **maintains** the uterus lining.

If the egg is not fertilised, the level of progesterone falls. The lining is then no longer maintained, so it breaks down and menstruation begins.

Maths skill: When you read a hormone graph, say which day the change happens on and whether the level rises, falls or peaks. Use figures from the axes.



The stages of the menstrual cycle and how the thickness of the **uterus lining** changes.

FSH and LH in the menstrual cycle Spec 3.10B Biology only

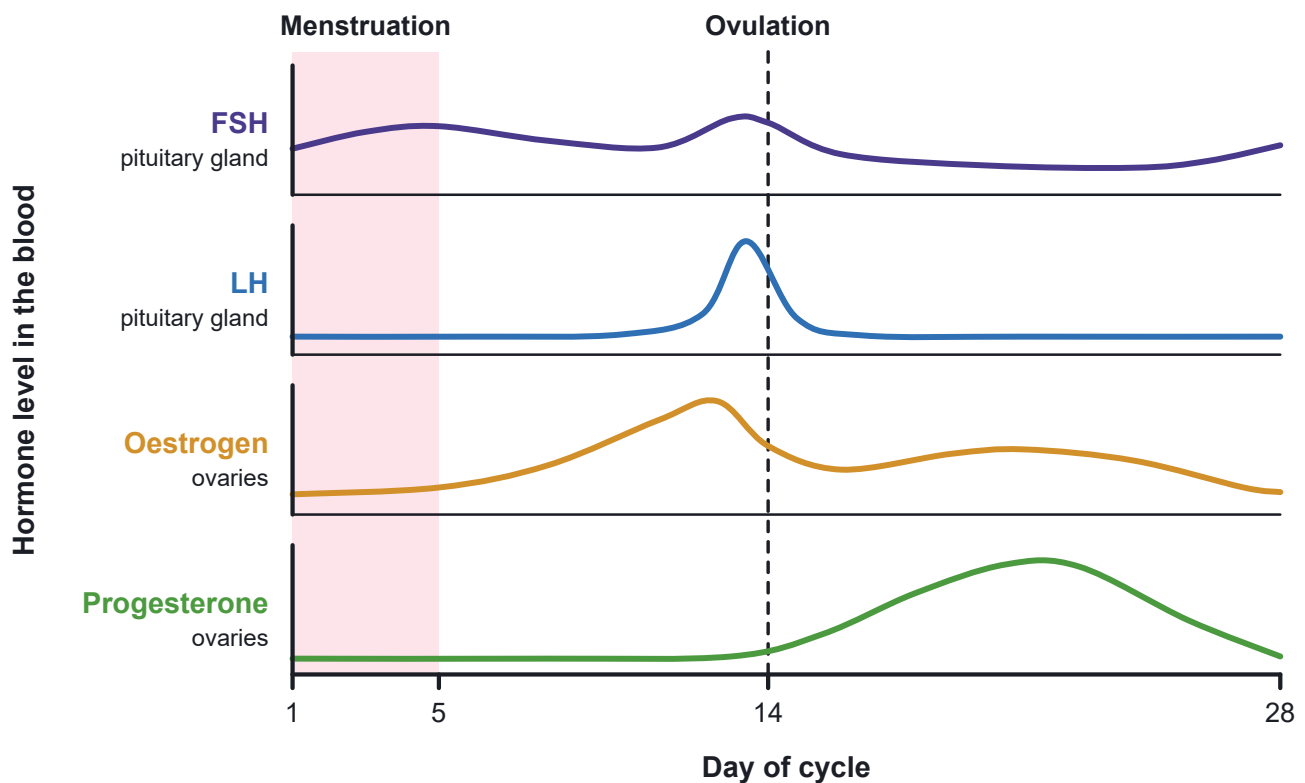
Four hormones interact to control the cycle. **FSH** and **LH** are released by the pituitary gland. **Oestrogen** and **progesterone** are made by the ovaries.

Hormones of the menstrual cycle

Hormone	Made in	What it does
FSH	Pituitary gland	Causes an egg to mature in an ovary. Stimulates the ovaries to produce oestrogen
Oestrogen	Ovaries	Repairs and builds up the uterus lining. Inhibits FSH. Stimulates the release of LH
LH	Pituitary gland	Causes ovulation
Progesterone	Ovaries	Maintains the uterus lining. Inhibits FSH and LH

1. FSH makes an egg mature and stimulates the ovaries to make oestrogen.
2. Oestrogen repairs the uterus lining. When oestrogen is high it inhibits FSH and stimulates the release of LH.
3. LH causes ovulation, around day 14.
4. After ovulation the ovary produces progesterone, which maintains the lining and inhibits FSH and LH, so no more eggs mature.
5. If there is no pregnancy, progesterone falls. The lining is no longer maintained and breaks down. This is menstruation.

Exam tip: Always say what each hormone does to the next one: stimulates or inhibits. Just writing 'oestrogen affects LH' will not score.



Levels of FSH, LH, oestrogen and progesterone. The **LH surge** triggers ovulation around day 14.

The placenta and amniotic fluid Spec 3.11, 3.12

After the embryo implants in the uterus lining, the **placenta** grows. It is a disc-shaped organ that attaches the embryo to the uterus wall. The embryo is joined to the placenta by the umbilical cord,

which contains blood vessels.

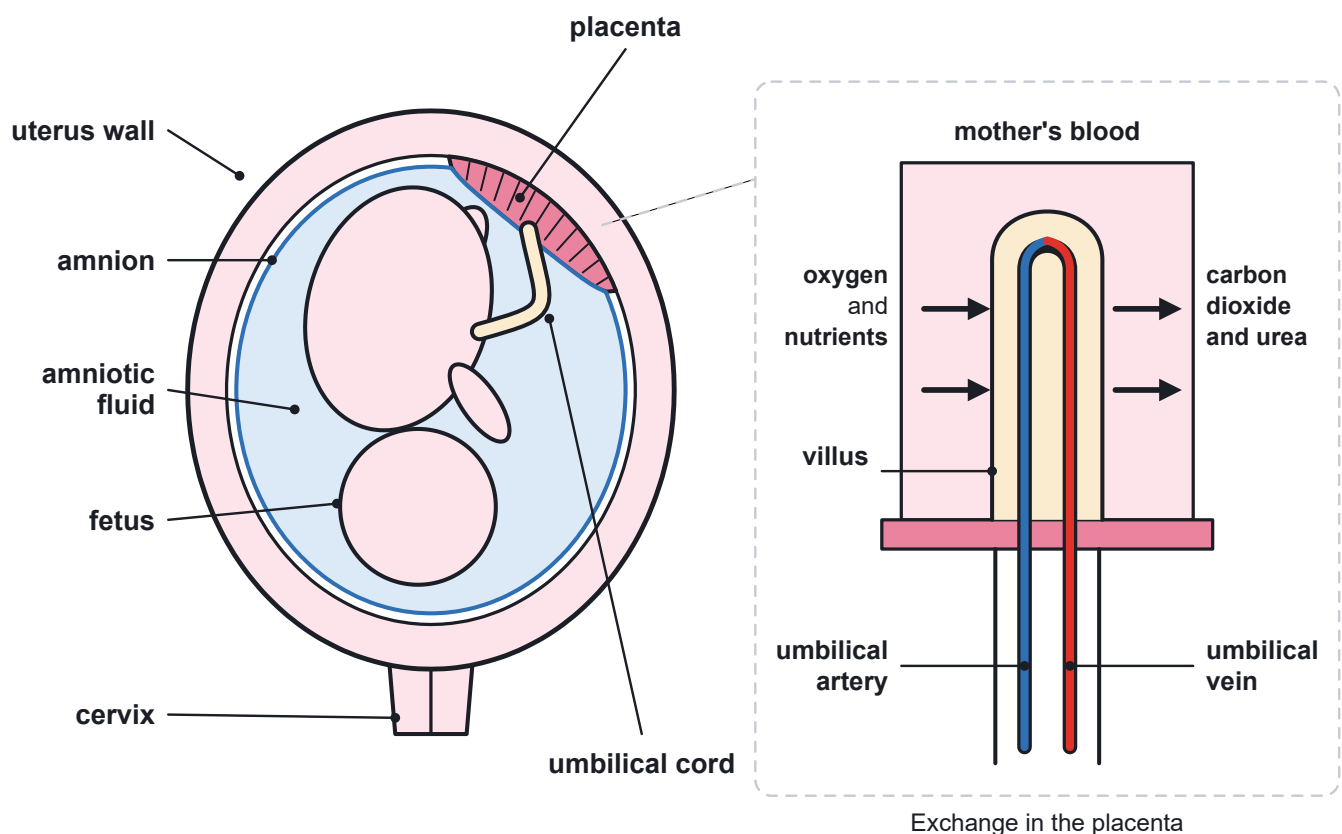
The role of the placenta

The mother's blood and the embryo's blood flow close together in the placenta, but they do not mix. Substances pass between them by **diffusion**.

- Oxygen and **nutrients** (such as glucose and amino acids) diffuse from the mother's blood into the embryo's blood. This provides the embryo with its nutrition.
- Carbon dioxide and urea diffuse from the embryo's blood into the mother's blood, to be removed.
- The placenta has many villi. These give a large surface area for exchange, so more substances can diffuse. A good blood supply and thin walls also make diffusion faster.

Amniotic fluid

The embryo develops inside a bag called the amnion. The amnion is filled with **amniotic fluid**. The fluid **protects** the developing embryo by absorbing shocks and cushioning it against knocks and bumps to the mother's abdomen.



Oxygen and nutrients **diffuse from the mother's blood** into the fetus's blood across the **placenta**; carbon dioxide and urea diffuse the other way.

Common mistake: The mother's blood and the embryo's blood do not mix. Substances move between them by diffusion across the placenta.

Puberty and secondary sexual characteristics Spec 3.13

At **puberty**, the sex hormones cause the body to develop **secondary sexual characteristics**. These are the features that develop at puberty, which are not directly part of the reproductive organs. In girls, the hormone is **oestrogen**, made by the ovaries. In boys, it is **testosterone**, made by the testes.

Secondary sexual characteristics

Hormone	Made by	Effects at puberty
Oestrogen	Ovaries	Breasts develop. Hips widen. Pubic and underarm hair grow. The menstrual cycle begins
Testosterone	Testes	Facial hair grows. The voice deepens. Muscles develop and shoulders broaden. Pubic and underarm hair grow. Sperm production begins

Exam tip: Name the hormone and the gland that makes it, then give the effect. For example: 'testosterone from the testes makes the voice deepen'.

Quick check

1. Where are sperm made?
2. What does oestrogen do in the menstrual cycle?
3. What does progesterone do in the menstrual cycle?
4. **Biology only** Which hormone causes ovulation?
5. How does amniotic fluid protect the embryo?

Quick check answers

Human reproduction

1. In the testes.
2. It repairs and builds up the lining of the uterus.
3. It maintains the lining of the uterus.
4. LH.
5. It absorbs shocks and cushions the embryo against knocks.