

Exercise walk-through

16.4

Sexual reproduction in humans

IGCSE Biology

Human reproductive systems

male

testes make **sperm** ;
sperm ducts → **ure-**
thra → penis

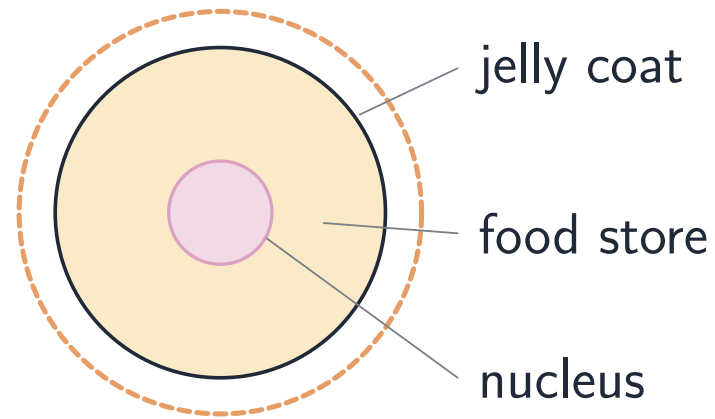
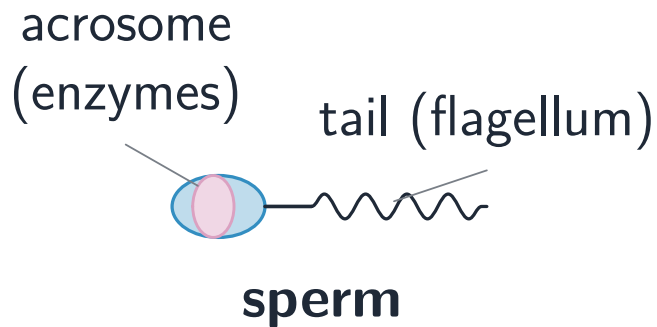
female

ovaries make **eggs** ;
oviduct → **uterus**

Gametes: sperm and egg

- **sperm** – small, many, swims (**flagellum**)
- **egg cell** – large, few (about one a month), stores food

Fertilisation = the two nuclei fusing. Sperm are made in **millions** and eggs in **ones**, which is the difference every comparison question turns on.



Two cells built for opposite jobs

The sperm

Small and mobile: a tail, many **mitochondria** for energy, and **enzymes** in the **acrosome** to break into the egg.

The egg

Large and still: a store of food, and a **jelly coat** that changes after fertilisation to keep other sperm out.

Haploid and diploid

Gamete nuclei are **haploid** – one set of **chromosomes**; the zygote's nucleus is **diploid**, with two.

After fertilisation

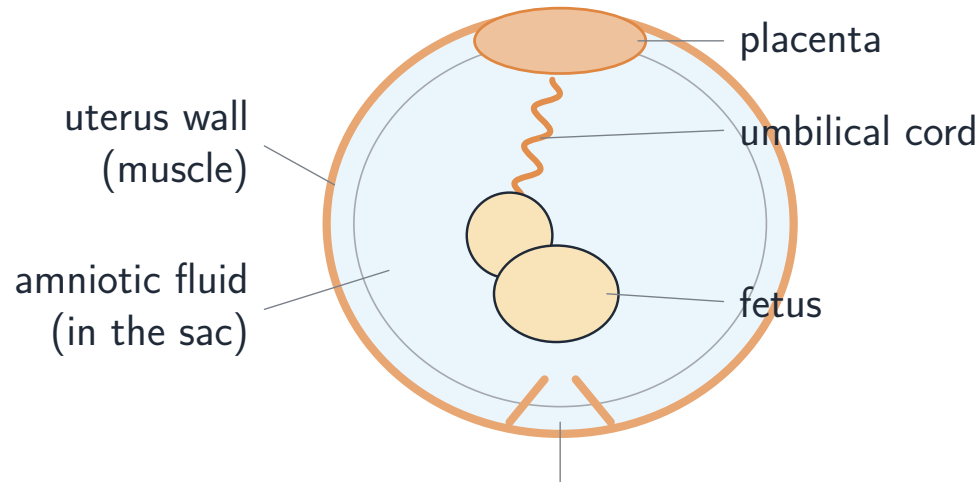
The zygote divides into an **embryo**, a ball of cells that **implants** into the lining of the uterus.

Each adaptation answers a job: the sperm must travel and enter, the egg must feed the embryo and admit only one sperm.

Pregnancy and the fetus

The **fetus** grows in the uterus:

- **placenta** – exchanges food, gases & waste
- **umbilical cord** – joins fetus to placenta
- **amniotic sac** – fluid cushions it



Puberty and the menstrual cycle

At **puberty**, sex hormones bring **secondary sexual characteristics**.

The ~28-day cycle: lining thickens → **ovulation** (day 14)
→ a period if no pregnancy.

A woman has a regular 28-day cycle and her period starts on the 1st. Around which date is she most likely to conceive?

- Day 1 is the day the period starts, not the day it ends.
- Ovulation is about **day 14**, so count 14 days on from the 1st.
- That points to about the **14th**, and the days either side are the most fertile.

Exercises 2.1-2.3

2.1 State where fertilisation occurs in a human.

[1]

2.2 State the role of the amniotic fluid.

[1]

2.3 Name two structures that adapt a sperm cell to its function, and give the use of each.

[4]

Exercises 2.1-2.3

2.1 State where fertilisation occurs in a human.

[1]

2.1

- fertilisation occurs in the **oviduct**

2.2 State the role of the amniotic fluid.

[1]

2.2

- amniotic fluid **cushions** / **protects** the fetus

2.3 Name two structures that adapt a sperm cell to its function, and give the use of each.

[4]

2.3

- any **two**, each with its use: **flagellum** to swim / **mitochondria** for energy / **acrosome** enzymes to digest the egg membrane

Exercises 2.4·2.5

2.4 State two substances that pass from the fetus's blood to the mother's. [2]

2.5 Explain why the mother's and the fetus's blood must not mix. [2]

Exercises 2.4·2.5

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2.4

- from fetus to mother: **carbon dioxide** and **urea**

2.5 Explain why the mother's and the fetus's blood must not mix. [2]

2.5

- the mother's blood pressure is **much higher** and would damage the fetus's vessels
- the **blood groups** may differ, so the bloods could react

Exercise 3.1

3.1 The egg cell, compared with a sperm cell, is:

[1]

☐

A smaller and able to swim

B larger and stores food

C present in millions

D has a flagellum

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3.1 B

- the egg is **larger and stores food**
- A, C and D describe the sperm

Exercise 3.2 (a)

3.2 The placenta supports the developing fetus.

(a) State two substances that pass from the mother's blood to the fetus.

[2]

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(a)

- any **two** of: **oxygen** / **glucose** / dissolved nutrients

Exercise 3.2 (b)

3.2 The placenta supports the developing fetus.

(b) State one feature of the sperm cell and how it helps.

[2]

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(b) State one feature of the sperm cell and how it helps.

[2]

(b)

- e.g. a **flagellum** lets the sperm **swim to the egg**

Exercise 3.3 (a)

3.3 The diagram of a pregnant uterus shows the placenta, the umbilical cord and the amniotic sac.

(a) Complete the table by naming the structure that carries out each function. [3]

Function	Structure
exchanges substances between mother and fetus	
carries blood between the fetus and the placenta	
cushions the fetus and supports its weight	

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(a)

- **placenta; umbilical cord; amniotic fluid** in the amniotic sac

Exercise 3.3 (b)

3.3 The diagram of a pregnant uterus shows the placenta, the umbilical cord and the amniotic sac.

(b) Describe how oxygen passes from the mother's blood to the fetus's blood. [3]

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- mother's blood has a **higher oxygen concentration**
- oxygen **diffuses** down the gradient across the placenta
- villi give a **large surface area**, so diffusion is fast enough

Exercise 3.3 (c)

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(c) Explain two ways in which the sperm cell is adapted for reaching and entering the egg. [4]

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- any **two** of: **flagellum** to swim / **mitochondria** for energy / **acrosome** enzymes to digest the egg membrane

Exercise 3.3 (d)

3.3 The diagram of a pregnant uterus shows the placenta, the umbilical cord and the amniotic sac.

(d) State where fertilisation takes place, and describe what happens to the zygote in the days that follow. [3]

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(d)

- fertilisation in the **oviduct**
- the zygote divides by **mitosis** as it travels to the uterus
- the ball of cells **implants** in the uterus lining

Exercise 3.3 (e)

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(e)

- carbon monoxide binds to haemoglobin (or nicotine narrows vessels), so **less oxygen** reaches the fetus
- the fetus grows more slowly and has a **lower birth mass**