Hormones in human reproduction

4.5.3.3 · Biology · revision notes

The hormones of puberty and the menstrual cycle: what FSH, LH, oestrogen and progesterone each do and, at Higher tier, how they control each other. Expect graph questions on hormone levels across the cycle and a 6-mark explanation of the hormone interactions.

Key facts

- Oestrogen: ovaries; main female reproductive hormone
- Ovulation = release of an egg, about every 28 days
- LH (pituitary): egg released
- Grade 7+ only Oestrogen: inhibits FSH, stimulates LH
- Testosterone: testes; stimulates sperm production
- FSH (pituitary): egg matures
- Oestrogen and progesterone: build up and maintain the uterus lining
- Grade 7+ only Progesterone: inhibits FSH and LH

Notes

Puberty

- During **puberty**, reproductive hormones cause **secondary sex characteristics** to develop.
- **Oestrogen** is the main female reproductive hormone, produced in the **ovaries**. At puberty, eggs begin to mature and one is released about every **28 days**. This is **ovulation**.
- **Testosterone** is the main male reproductive hormone, produced by the **testes**. It stimulates **sperm production**.

Hormones of the menstrual cycle

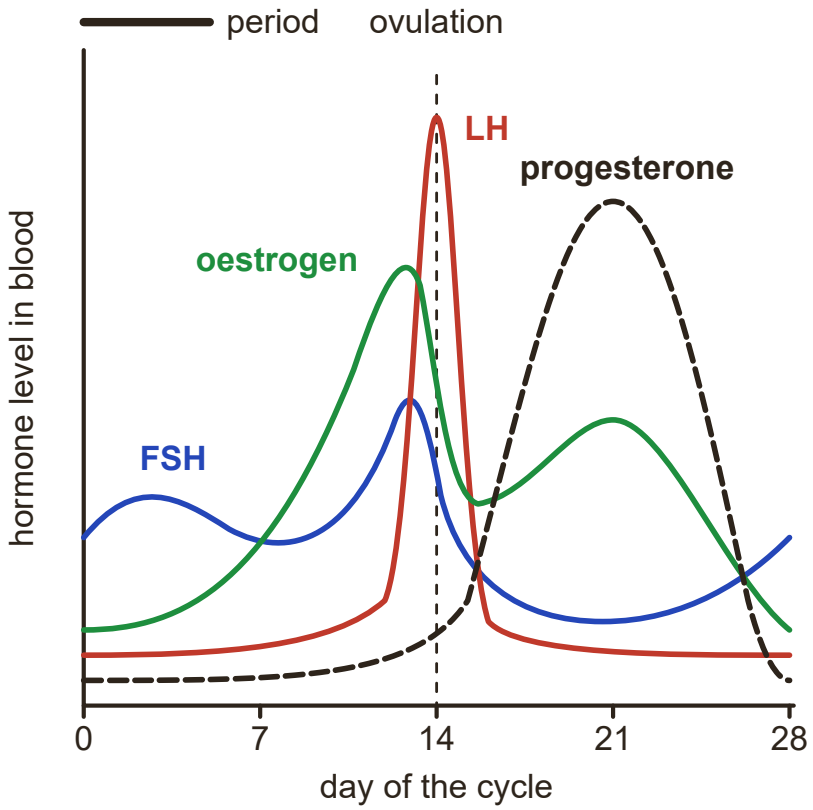
- **FSH** (follicle stimulating hormone, from the pituitary gland) causes an **egg to mature** in the ovary.
- **LH** (luteinising hormone, from the pituitary gland) stimulates the **release of the egg** (ovulation).
- **Oestrogen** (from the ovaries) makes the lining of the uterus build up.
- **Progesterone** (from the ovary, after ovulation) maintains the lining of the uterus.

How the hormones interact Grade 7+ only

- FSH also stimulates the ovaries to produce **oestrogen**.
- Rising oestrogen **inhibits FSH** release and **stimulates LH** release.
- A surge in LH at about **day 14** triggers ovulation.
- After ovulation, progesterone **inhibits both FSH and LH** and keeps the lining in place.
- If the egg is not fertilised, progesterone falls, the lining breaks down (a period), and FSH is no longer inhibited, so another egg starts to mature.

The cycle in days

- Days 1 to about 5: the uterus lining breaks down and is lost (menstruation).
- About days 5 to 14: the lining builds up again while an egg matures.
- About day 14: ovulation. Days 14 to 28: the lining is maintained, ready for a fertilised egg to implant.



Hormone levels in a 28-day cycle: the LH surge triggers ovulation at about day 14.

How to answer each type of question

Name the hormone

1 mark each | **Grade 4**

1. Match the effect to the hormone: mature (FSH), release (LH), build up (oestrogen), maintain (progesterone).
2. Give the name or the correct abbreviation.

Example. Name the hormone that:
(a) causes an egg to mature in the ovary
(b) stimulates the release of an egg
(c) stimulates sperm production.

Model answer.

(a) FSH (1)
(b) LH (1)
(c) Testosterone (1)

Interpret hormone levels during the cycle

2 to 4 marks | **Grade 6**

1. Find the day of each hormone's peak.
2. LH peak → ovulation. High progesterone → lining maintained.
3. Give a reason linked to what the hormone does.

Example. In one woman's cycle, the concentration of LH in her blood is low for most of the cycle but rises sharply to a peak on day 13, then falls.
(a) Predict the day on which ovulation is most likely to happen. Give a reason.
(b) Her progesterone concentration is highest between days 18 and 24. Explain why this is important if an egg is fertilised.

Model answer.

(a) Day 13 or 14 (1), because LH stimulates the release of an egg / the LH peak triggers ovulation (1)

(b) Progesterone maintains the uterus lining (1), so an embryo can implant and the pregnancy can continue (1)

6-mark: explain how the hormones control the cycle

6 marks | **Grade 7**

1. Go through the hormones in the order they act: FSH, oestrogen, LH, progesterone.
2. For each, give where it is made, what it does, and its effect on the other hormones.
3. Finish with what happens if the egg is not fertilised.

Example. Explain how FSH, LH, oestrogen and progesterone interact to control the menstrual cycle.

Model answer.

Indicative content: FSH is released by the pituitary gland; FSH causes an egg to mature in the ovary; FSH stimulates the ovary to release oestrogen; oestrogen makes the uterus lining build up; oestrogen inhibits FSH release and stimulates LH release; LH from the pituitary triggers ovulation at about day 14; after ovulation the ovary releases progesterone; progesterone maintains the uterus lining and inhibits FSH and LH; if the egg is not fertilised, progesterone falls, the lining breaks down and FSH is released again.
Level 3 (5 to 6 marks): the role of each hormone and the links between them, in a logical sequence.
Level 2 (3 to 4 marks): the roles of most hormones with at least one interaction.
Level 1 (1 to 2 marks): simple roles, e.g. 'LH releases an egg'.

Don’t lose marks

- ✗ Saying LH makes the egg mature. FSH matures it; LH releases it.
- ✗ Saying FSH and LH come from the ovaries. They come from the pituitary gland.
- ✗ Mixing up 'inhibits' and 'stimulates' in the hormone interactions.

✕ Saying the cycle is exactly 28 days for everyone. It is about 28 days and varies.

More tips

Memory tricks

- Order in which they act: FSH, Oestrogen, LH, Progesterone. 'Follow Our Lovely Plan.'
- FSH = Follicle Stimulating: gets the egg ready. LH = the Launch hormone: releases it.
- PROgesterone is PRO-pregnancy: it keeps the lining ready.
- Oestrogen switches FSH off and LH on; progesterone switches both off.

Exam technique

- For graph questions, match peaks to events: LH peak → ovulation; high progesterone → lining maintained.
- In the 6-mark answer, give each hormone's source, its effect, and its effect on the other hormones.
- Use the words 'inhibits' and 'stimulates': they are what examiners look for.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Name the main male and female hormones**
Testosterone from the testes; oestrogen from the ovaries.

Grade 4 — **Define ovulation**
The release of a mature egg from an ovary, about every 28 days.

Grade 5 — **State the roles of the four cycle hormones**
FSH matures an egg, LH triggers its release, and oestrogen and progesterone maintain the uterus lining.

Grade 6 — **Interpret hormone graphs of the menstrual cycle**
Match each hormone's peak to events such as ovulation and the build-up of the uterus lining.

Grade 7 — **Explain how the four hormones interact**
E.g. oestrogen inhibits FSH and stimulates LH; progesterone inhibits FSH and LH.

Grade 8 — **Explain why the cycle restarts without pregnancy**
Progesterone falls, the lining breaks down, and FSH is no longer inhibited, so another egg matures.

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