IB BIOLOGY | D3.1 | SL AND HL

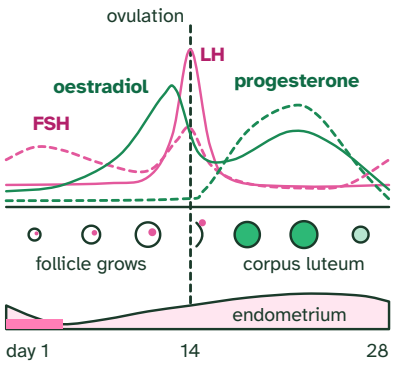
REVISION ON TWO PAGES

How new *life* begins

What to know, what to draw and what to say. Nothing else.

THE ONE IDEA

Meiosis breaks up the parents' allele combinations and fertilization makes new ones. In humans, hormones time every step.



Read it like this. Pink: pituitary hormones. Green: ovarian. Dashed: FSH and progesterone. Pink band: the period.

D3.1.5 START HERE

Two cycles, four *hormones*

- **From the pituitary:** FSH and LH. **From the ovary:** oestradiol and progesterone. The ovarian and uterine cycles together are the **menstrual cycle**.
- Oestradiol first **inhibits FSH and LH** (negative feedback); at a high level it **triggers the LH surge** (positive feedback).

DAYS 1 TO 13
Follicle
FSH grows a follicle; its oestradiol rebuilds the lining.

ABOUT DAY 14
Ovulation
The LH surge makes the follicle release its egg.

DAYS 15 TO 28
Corpus luteum
Its progesterone keeps the lining thick and inhibits FSH and LH.

NO EMBRYO
Period
Progesterone and oestradiol fall; the lining is shed.

D3.1.1 and 2

Copies or *combinations*

Asexual mitosis
Identical offspring, suited to the environment the parent is **adapted** to.

Sexual meiosis
New combinations of alleles: variation to adapt when the environment changes.

- **Meiosis breaks up the parental combinations** of alleles.
- **Fusion of gametes** (fertilization) **makes new combinations**.

D3.1.3

One travels, one *waits*

- The **male gamete travels** to the female one, so it is **small**, with almost no food.
- The egg stays put, so it can be **large**, with food reserves.
- So males make **vast numbers** of gametes; females make few and invest more in each.

10^8
sperm a day

1
egg a cycle

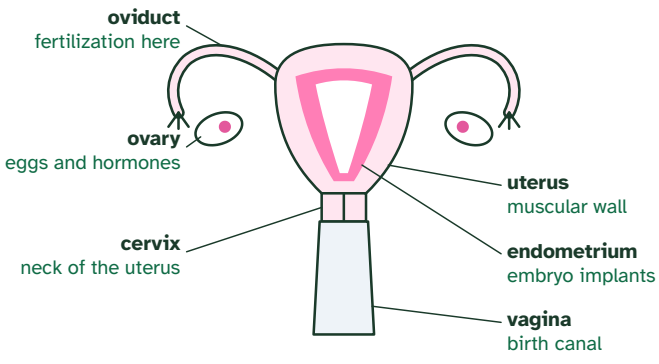
D3.1.6 and 7

Fertilization and *IVF*

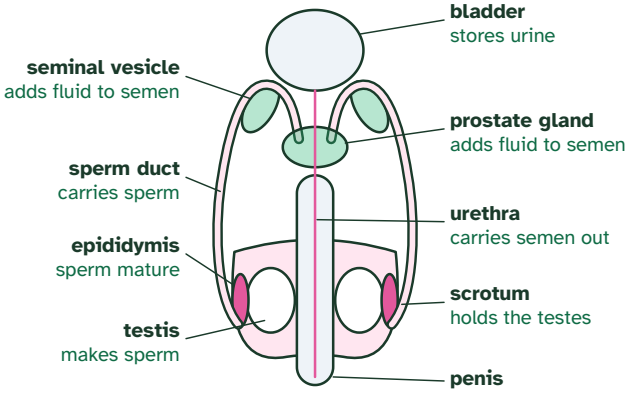
- The sperm's membrane **fuses with the egg's**; its nucleus enters, its **tail and mitochondria** are destroyed.
- Both nuclear membranes dissolve; all the chromosomes join a **joint mitosis**: two diploid nuclei.
- **IVF:** a drug **suspends** her own FSH and LH; artificial FSH doses cause **superovulation**.
- A trigger (usually hCG) matures the eggs; they are fertilized in a dish and an embryo placed in the uterus.

D3.1.4 SKILLS: NAME EACH PART AND ITS JOB

Draw and *annotate* both systems



Female-typical, from the front

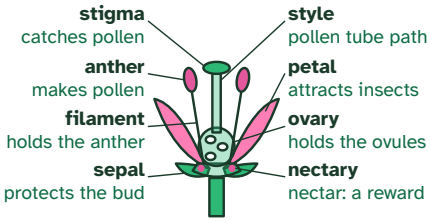


Male-typical, from the front

Flowers and seeds, then *pregnancy*

D3.1.8 to 10 OUTSIDE IN: SWEET PEAS SMELL CLEAN

From *pollen* to seed



- **Gametes:** the egg cell forms in an **ovule**; male gametes inside **pollen grains**, made in anthers.
- **Pollination**: pollen from anther to stigma. A **pollen tube** grows down the style; a male gamete fuses with the egg; the zygote grows into an **embryo**.
- It is **sexual even in a hermaphrodite** flower: male and female gametes still fuse.
- **Cross-pollination**, by animals or wind, is made likelier: pollen and stigma **ripen at different times**, or there are **separate male and female** flowers or plants.

D3.1.11

Refusing its *own* pollen

- **Selfing is inbreeding:** more offspring with two copies of an allele, so **diversity and vigour fall**.
- **Self-incompatibility**: genes stop its own pollen fertilizing it, so gametes are **from different plants**.

D3.1.12

Seeds that travel and *wake*

- **Dispersal** moves seeds from the parent, after fertilization: **less competition**. Pollination comes before.
- **Germination** needs water, oxygen and warmth ("*Wow! Oh, wow!*"). The radicle grows first.
- **Enzymes mobilise the food store** for the growing tips.

D3.1.13 to 20 HIGHER LEVEL

Puberty, gametes and *pregnancy*

STATEMENT	THE POINT	WHAT TO KNOW
Puberty D3.1.13	**GnRH starts it**	The hypothalamus releases more GnRH, so the pituitary releases more LH and FSH, so the gonads make more sex hormones: the changes of puberty.
Gametogenesis D3.1.14	**4 sperm, 1 egg**	Both: mitosis, growth, two meiotic divisions, differentiation. Sperm: four equal cells, from puberty. Egg: unequal divisions give one egg and polar bodies, from before birth.
Polyspermy D3.1.15	**One sperm only**	**Acrosome reaction** (sperm): enzymes digest a path through the zona pellucida. **Cortical reaction** (egg): enzymes change the zona, so no other sperm pass.
Blastocyst D3.1.16	**A ball, then implant**	The zygote divides by mitosis in the oviduct: a hollow ball of cells by about day 5. About a week after fertilization it implants in the endometrium.
Pregnancy test D3.1.17	**It detects hCG**	The embryo, then the placenta, secretes hCG; some reaches the urine. A free coloured monoclonal antibody binds it; a fixed one holds it at the test line.
Placenta D3.1.18	**Villi: a large area**	The two bloods never mix. To the foetus: oxygen, glucose, amino acids, antibodies; back: CO_2 and urea. So the foetus stays in the uterus to a later stage.
Pregnancy D3.1.19, birth	**Progesterone**	From the corpus luteum (kept alive by hCG), then the placenta. At birth it falls, so oxytocin rises: contractions stretch the cervix, more oxytocin: positive feedback.
HRT D3.1.20, NOS	**Correlation only**	Early studies: less coronary heart disease (CHD) with HRT. Randomized controlled trials: a small increase. HRT users had higher socioeconomic status, which itself lowers CHD risk.

WATCH OUT

Four mistakes that *cost marks*

- ✕ **Pollination is not fertilization.** It only delivers the pollen.
- ✕ **Gametes are made by meiosis, not mitosis.** The zygote has 46 chromosomes, not 23.
- ✕ **LH triggers ovulation; falling progesterone brings the period.** LH does not cause menstruation.
- ✕ **The acrosome reaction is the sperm's; the cortical reaction is the egg's.** Two events, not one.

COVER THE SHEET

Can you *answer these?*

1. Compare sexual with asexual reproduction.
2. Draw the female system and annotate four parts.
3. Explain the feedback in the menstrual cycle, and in IVF.
4. Draw and annotate an insect-pollinated flower.
5. Compare spermatogenesis with oogenesis. HL
6. Explain the hormonal control of childbirth. HL
7. Explain why early HRT studies misled. HL

IN THE EXAM

Give each hormone its source and action ("LH from the pituitary triggers ovulation") and **name the feedback**.

GO FURTHER

Animated figures, a dry lab and a marked Check are in the full guide online.