DP Biology – D3.1 Plant Systems

Reproduction in plants

- What does sexual or asexual reproduction show about change and continuity?
- How must organisms change in order to reproduce?

Plant statements D3.1.8–12, SL and HL. Textbook pp. 702–708.
Image: honey bee on a flower. Virtual gamma, CC BY-SA 3.0.



Objectives for each class

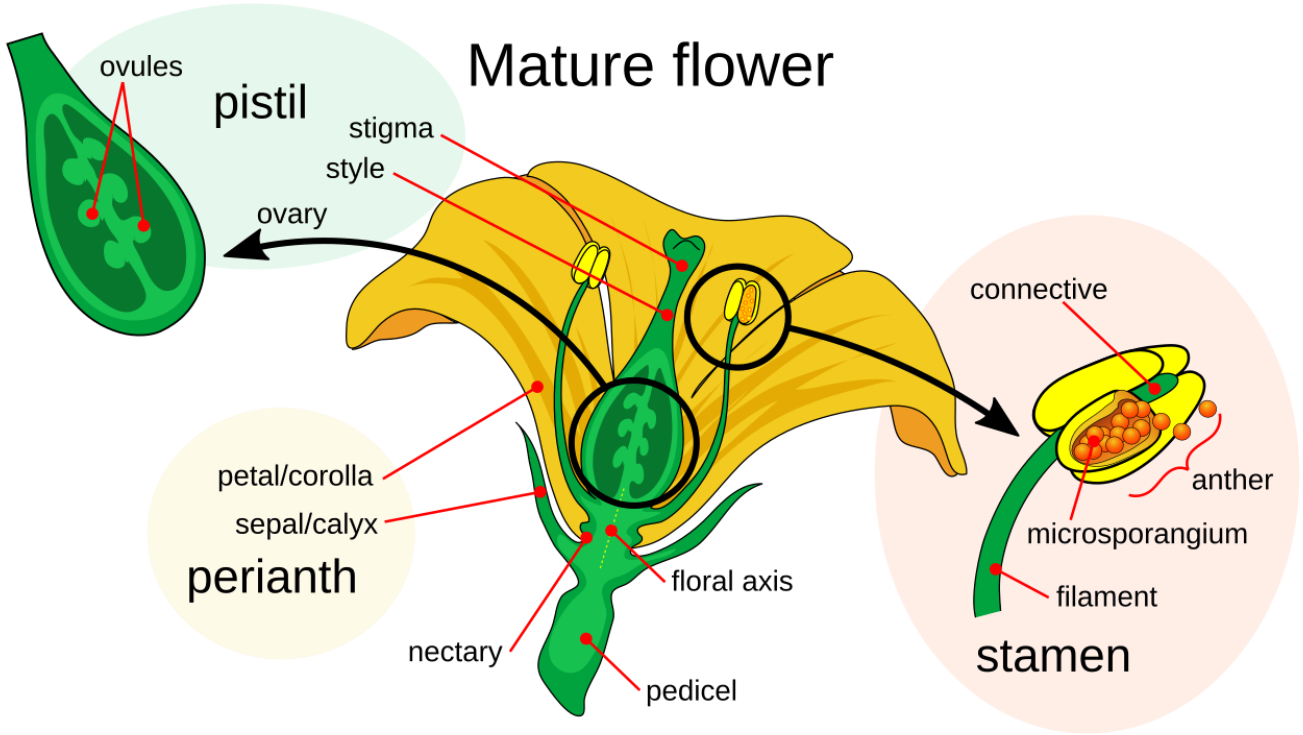
Class	Statements	By the end of the class, you can...
1	D3.1.8–9	Outline sexual reproduction in flowering plants, and draw an annotated insect-pollinated flower
2	D3.1.10–12	Explain how cross-pollination is promoted, and how seeds disperse and germinate

Overview of this chapter

Part	Statements	What it covers
From pollen to embryo	D3.1.8	Gametes, pollination and fertilization
The flower	D3.1.9	Structures of an insect-pollinated flower
Cross-pollination	D3.1.10	How plants avoid pollinating themselves
Self-incompatibility	D3.1.11	A genetic block to inbreeding
Seeds	D3.1.12	Dispersal, germination and food reserves

An insect-pollinated flower

D3.1.9



A mature flower. Mariana Ruiz, LadyofHats, public domain.

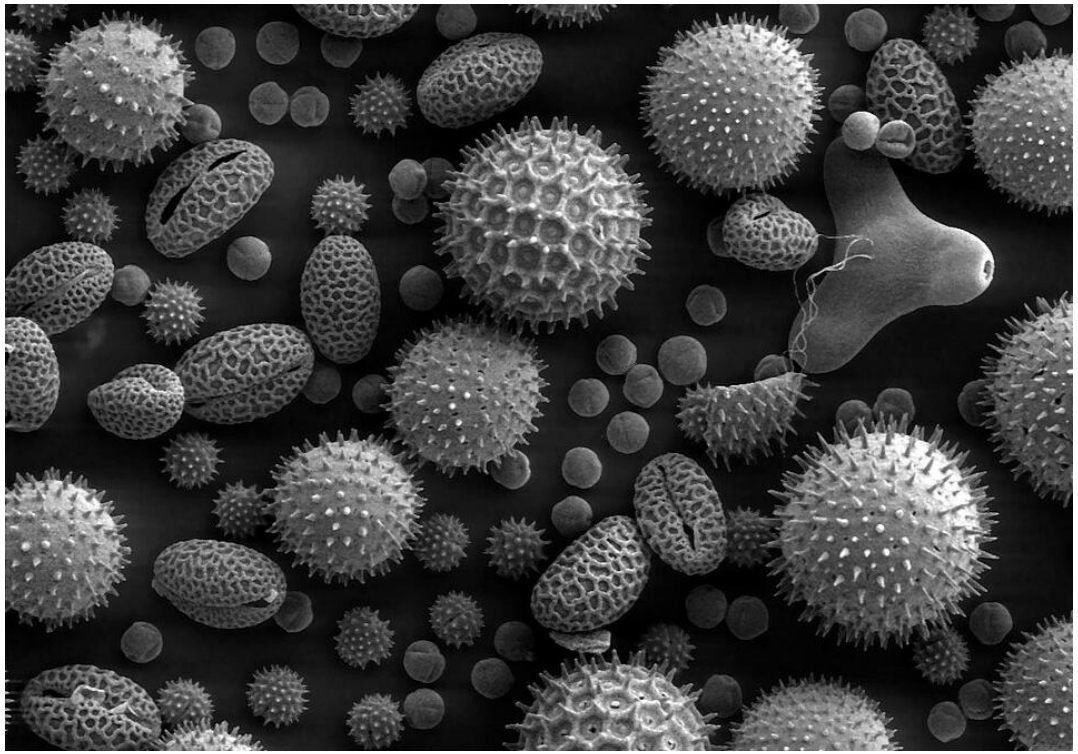
Part	Function
Sepal	Protects the bud
Petal	Colourful, attracts pollinators
Anther	Makes pollen
Filament	Holds up the anther
Stigma	Pollen lands here
Style	Holds up the stigma; path for pollen tube
Ovary	Contains ovules
Nectary	Secretes nectar as a reward

Exam note

Be ready to draw this and annotate structures with their functions. Stamen = anther + filament. Carpel = stigma + style + ovary.

Where the gametes are made

D3.1.8



Pollen grains from several species, coloured electron micrograph. Dartmouth College, public domain.

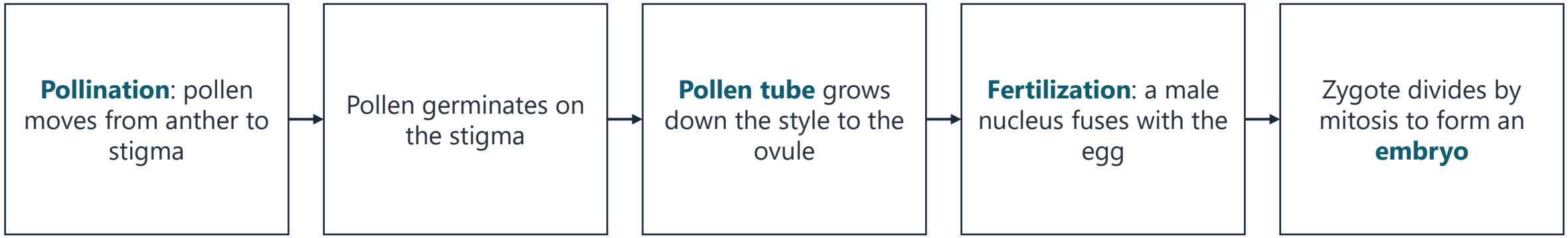
- Many flowers are **hermaphrodite**, with both male and female parts
- Male gametes develop inside **pollen grains**, made in the anthers
- The female gamete, the egg, develops inside an **ovule**, within the ovary
- Meiosis comes before gamete formation, so gametes are haploid

Key idea

Reproduction in flowering plants is sexual, even when a plant is hermaphrodite and even if it fertilizes itself, because gametes still fuse.

From pollination to embryo

D3.1.8



- The pollen tube carries two male nuclei
- One fuses with the egg to form the zygote; the other triggers formation of the food store
- The ovule becomes the seed, and the ovary becomes the fruit

Common mistake

Pollination and fertilization are different events. Also, pollination delivers pollen to the stigma, not the ovary: the pollen tube delivers the male nuclei down the style.

Self-pollination and cross-pollination

D3.1.10

	Self-pollination	Cross-pollination
Pollen comes from	The same plant	Another plant of the same species
Result	Inbreeding	Outbreeding
Advantage	Preserves genomes suited to a stable environment	More variation, so better able to adapt
Disadvantage	Less diversity; harmful recessive alleles can come together	Pollen must find a stigma, which is partly chance

Key idea

Animals, usually attracted by colour, scent or nectar, carry pollen between plants. In return, they feed. Wind can also carry pollen.

How plants promote cross-pollination

D3.1.10

Method	Example
Stigma and anthers mature at different times	Pecan trees
Stigma and anthers at different heights	Stigma above the anthers
Separate male and female flowers on one plant	Birch trees
Separate male and female plants	Holly



Holly: berries form only on female plants. James E. Petts, CC BY-SA 2.0.

Question

A gardener plants one holly bush and it never produces berries. Explain why, and suggest what the gardener should do.

Self-incompatibility

D3.1.11

- Self-pollination leads to **inbreeding**, which reduces genetic diversity and vigour
- Many species have a genetic mechanism to recognise and reject their own pollen
- If pollen carries a self-incompatibility allele also found in the style, the pollen tube stops growing
- So the gametes that fuse come from different plants

Plant receiving pollen	Pollen allele	Result
S1 S2	S1 or S2	Tube stops: incompatible
S1 S2	S3	Tube grows: compatible

Link

This is a good example of change and continuity: a mechanism that keeps variation in the population generation after generation.

Seed dispersal

D3.1.12





Dandelion seeds, carried by wind (CC BY-SA 3.0); coconut, carried by water (Kulmalukko, CC BY 3.0).

Method	Example
Wind	Dandelion: parachute of fine hairs
Water	Coconut: floats
Animal	Fleshy fruit eaten, seeds pass through
Explosive	Pod bursts as it dries

Common mistake

Do not confuse pollination with seed dispersal. Pollination moves pollen to a stigma before fertilization. Dispersal moves seeds away from the parent after fertilization, which reduces competition for space, light, nutrients and water.

Inside a seed

D3.1.12



Germinating beans. Doronenko, CC BY-SA 3.0.

Part	Function
Testa	Protective seed coat
Cotyledons	Store food for the embryo
Embryo root	Becomes the first root
Embryo shoot	Becomes the stem and leaves
Micropyle	Gap where water enters

Key idea

A dry seed is dormant. Water makes up only 10–15% of its mass, so its metabolism is very slow until conditions are right.

What germination needs

D3.1.12

Condition	Why
Water	Rehydrates the cells so that the embryo becomes metabolically active
Oxygen	For aerobic cell respiration, which supplies ATP
Suitable temperature	Close to the optimum for the enzymes involved



Seedlings. Arn, CC BY-SA 4.0.

Activity

Design an experiment to test one condition. Think about how many seeds to use in each dish, what to control, and how you will allow for seeds that are naturally dormant or dead.

Mobilizing the food reserves

D3.1.12



- Protein reserves are also broken down, to amino acids
- These sugars and amino acids are carried to the growing points of the stem and root
- The seedling uses these reserves until its leaves can photosynthesize

Exam note

Be ready to explain why a seed loses dry mass during germination: respiration of stored food releases carbon dioxide, and photosynthesis has not yet begun.

Check that you can explain

1. The parts of a flower and their functions
2. The steps from pollination to embryo
3. The difference between pollination and fertilization
4. Why cross-pollination is an advantage
5. Three ways to promote cross-pollination
6. How self-incompatibility works
7. The difference between pollination and dispersal
8. What germination needs, and how food is mobilized

Exit activity: 5 minutes

On your own and without notes. Hand this in as you leave.

1. Distinguish between pollination and seed dispersal.
2. Give one way in which a hermaphrodite flower can avoid self-pollination.
3. Explain why oxygen is needed for germination.

Image credits

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