

Understandings:

1. Explain what flowering is and when it happens.

- The overview of the plant development looks like this (roughly).

Germination → Vegetative phase (growth in stem, root and leaves) → Reproductive phase

The question here is how meristems switch from producing leaves to suddenly beautiful stunning flowers? Note that flowers are reproducing compartments of angiospermophytes (flowering plants).

Well, it all has to do with what genes the meristems express. The main factor that can change the gene expressions is light period (how long the sun is up) and this is called photoperiodism! It basically means that plants respond to changes in light period. Temperature may also change gene expressions in some plants, but not always.

Since most plants are photoperiodic, we will focus on them.

Short-day plants – plants that flower when days become shorter (during autumn)

Long-day plants – plants that flower when days become longer (during summer)

But wait...is it because days get longer or night gets shorter? Some studies show that it is more related to darkness rather than light.

2. Explain how they change gene expressions.

- I mean, the idea is very simple and the steps are what we have seen before.

As usual, there must be something that sense the light periods. In other words, there must be a photoreceptor. In this case, it is called phytochrome.

There are certain things about these phytochromes we have to know. Phytochrome can come in two forms P_R and P_{FR}. The R stands for red and FR stands for far red.

So, here are the facts.

1. When there is sun present, P_R absorbs red light (600nm) to change to P_{FR}. Of course, P_{FR} absorbs far red light (730nm) to change to P_R as well, but there is not much 730nm.

Therefore generally, the movement is P_R → P_{FR}

2. Conversely, when it is dark the movement is P_{FR} → P_R. The book says that the reason is because P_{FR} is less stable but is that really the reason? I don't know.

Now, we have to distinguish how short-day plants and long-day plants function differently. Let's look at this step by step.

	Short-day plant	Long-day plant
Light	These grow when there is little light/much darkness.	These grow when there is much light/little darkness
Photoreceptor	So what does this mean? Well, it means that these flower when there is a <u>lot of P_R</u> .	In this case, it means that these plants flower when there is a <u>lot of P_{FR}</u> .
How receptors respond to P_{FR}	The receptors in these plants have an <u>inhibitory response</u> . The more P _{FR} , the less it flowers. But since we had a lot of P _R and therefore little P _{FR} , it does not inhibit flowering. Thus it flowers!	The receptors in these plants have an <u>exhibitory response</u> . The more P _{FR} , the more it flowers.

It makes sense doesn't it?

3. Explain the mutualistic relationships with pollinators in sexual reproduction.

- We know what mutualism is, right? We have seen previously how plant roots and fungus work together in ion deficient soil.

Plants give animals nectar (mainly sucrose) and animals pollinate the plant's sperm. It is interesting how specific some plants are. Some flowers open up to hummingbirds that generate a specific frequency of wind created by their wing flaps.

4. Explain how fertilization happens in plants.

- When the insects pollinate, it finds its way to another flower's style, down to the ovary. They get fertilized and form a seed.

Then, they must somehow get distributed. This is called seed dispersal. How do they do that? Well, it can be via the wind (dandelion), via fruits (apples, peaches) or some type of hooks (bur). Not bad Mr. Plant!

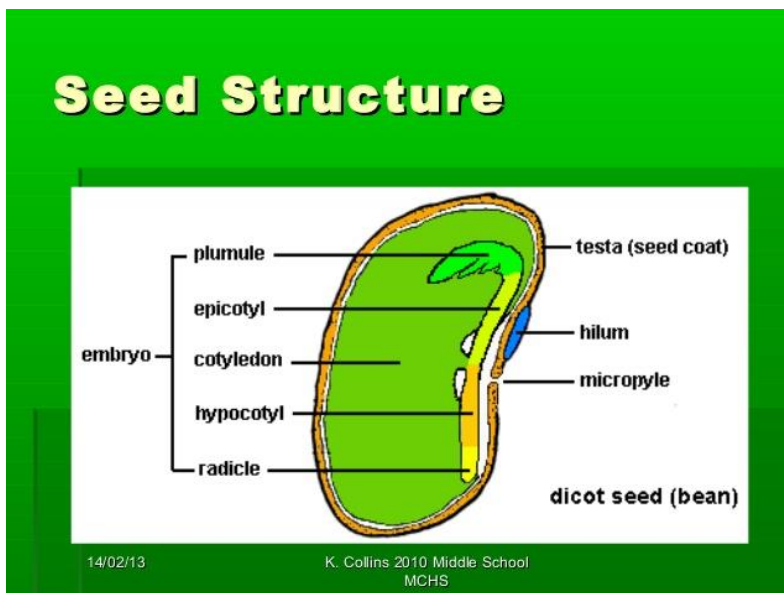
Applications and skills:

1. Explain methods that are used to induce short-day plants to flower out of season.

- Simply manipulating light periods would control the flowering time.

2. Be able to draw internal structure of seeds.

-



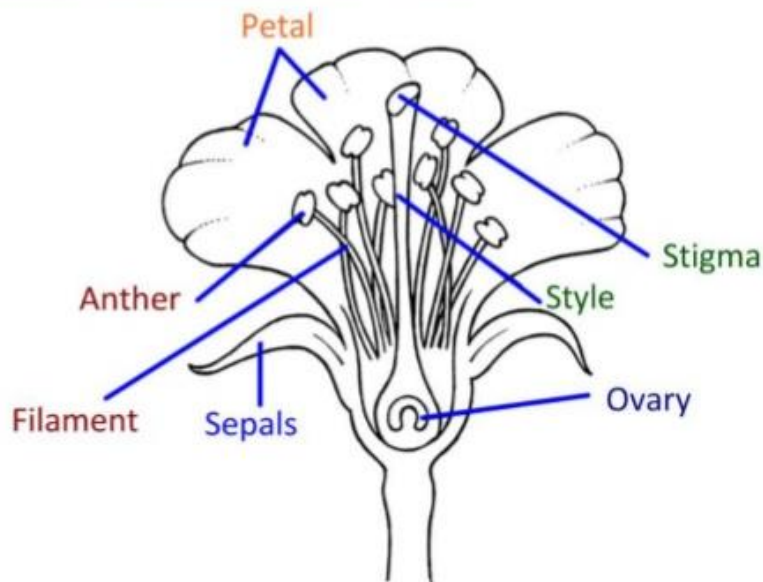
Structures we need to know are:

1. Seed coat (testa)
2. Hilum (the scar where seed was attached to the ovary)
3. Plumule (embryo shoot). In dicots, plumule would be two leaves. In monocots, plumule would be one leaf.
4. Radicle (embryo root).
5. Cotyledon (the storage of nutrients). Dicot has two, monocot has one.

3. Be able to draw half-views of animal-pollinated flowers.

The Flower is the reproductive unit of an angiospermophyte

Which parts would you consider 'male' or 'female'?



Add the functions:

- attracts pollinators (insects/ small birds)
- pollen landing site
- pollen tube grows down style from stigma to ovary
- contains ovules
- cover/protect developing flower
- supports anther
- contains pollen

Structures we have to know are:

1. Stamen = male organ = Anther + filament
2. Carpel = female organ = Stigma + ovary (that produces ovules/eggs) + style
3. Petals are to attract the insects. These are usually coloured.
4. Sepals protect the buds during development.
5. Nectaries are found on the outer wall of ovaries and produces nectar. These are placed here obviously so that animals can drop pollen into the stigma.

Extra notes

- Plants are hermaphrodite, i.e. they have both male and female organ. When you look at the position of these, stigma seems to be always above the anthers. This is to prevent self-fertilization, but what is so bad about self-fertilization?

1. Self-fertilization does not give much genetic variation. The idea of sexual reproduction is to give various offspring and those with favoured traits survive.
2. Self-pollination runs the risk of producing recessives. Like animals, breeding within close relatives will increase the chances of finding the same recessive alleles and produce a less favoured offspring. Therefore, plants want to prevent dwarf plants or any cancerous plants as well.

4. Design experiments to test hypotheses about factors affecting germination.

-

Dependent variable would be germination rate.

Independent variable would be either water, oxygen, temperature or the hormone gibberellin. If you find anything more profound, do it then!

Extra notes

- When the seed has got all the important variables – water, temperature and oxygen – it can undergo series of processes. The first thing it does is to produce a hormone gibberellin in the cotyledon. This in turn leads to production of amylase. This amylase then breaks down starch that can be used for growth. So remember:

Gibberellin → Amylase → Energy!