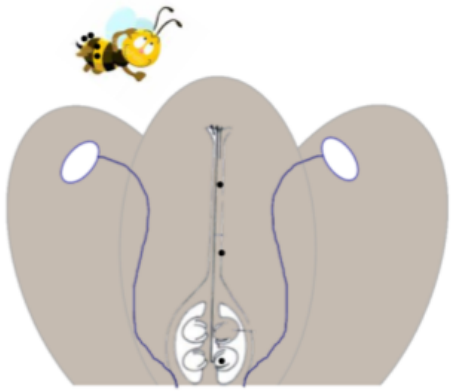


Reproduction in Angiospermophytes

Stephen Taylor

Bandung International School

The Flower is the reproductive unit of an angiospermophyte

Is this flower a monocot or a dicot? How do you know?

Label the parts:

Petal

Stigma

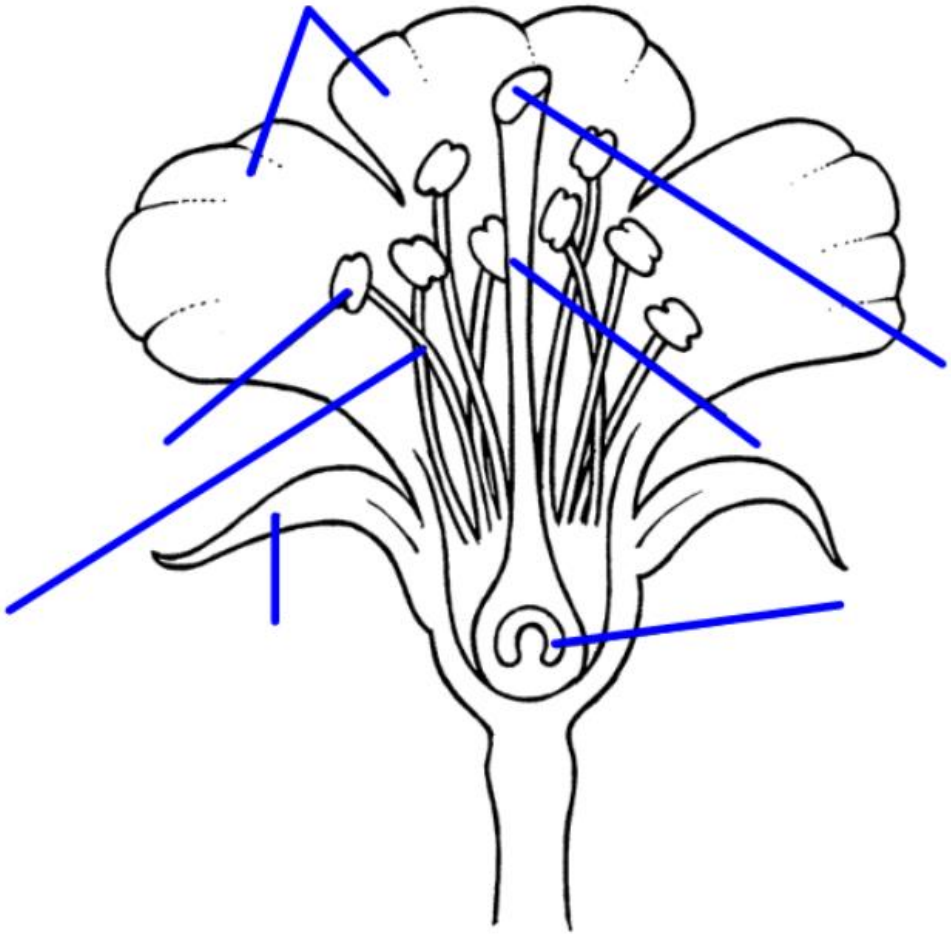
Style

Anther

Filament

Sepals

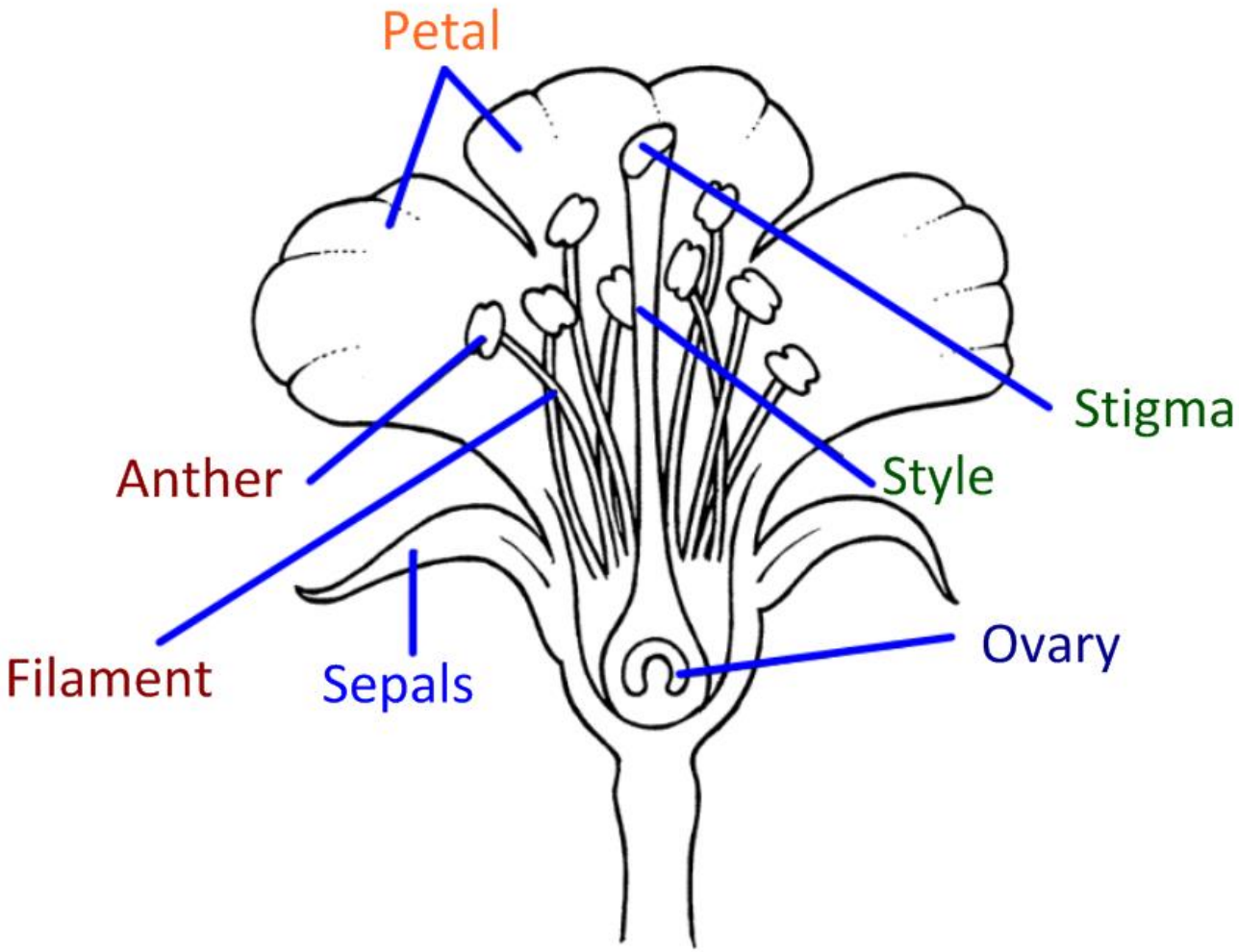
Ovary



http://www.learner.org/jnorth/images/graphics/t/flower_parts.gif

The Flower is the reproductive unit of an angiospermophyte

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



http://www.learner.org/jnorth/images/graphics/t/flower_parts.gif

Add the functions:

attracts pollinators (insects/ small birds)

pollen landing site

pollen tube grows down style from stigma to ovary

contains ovules

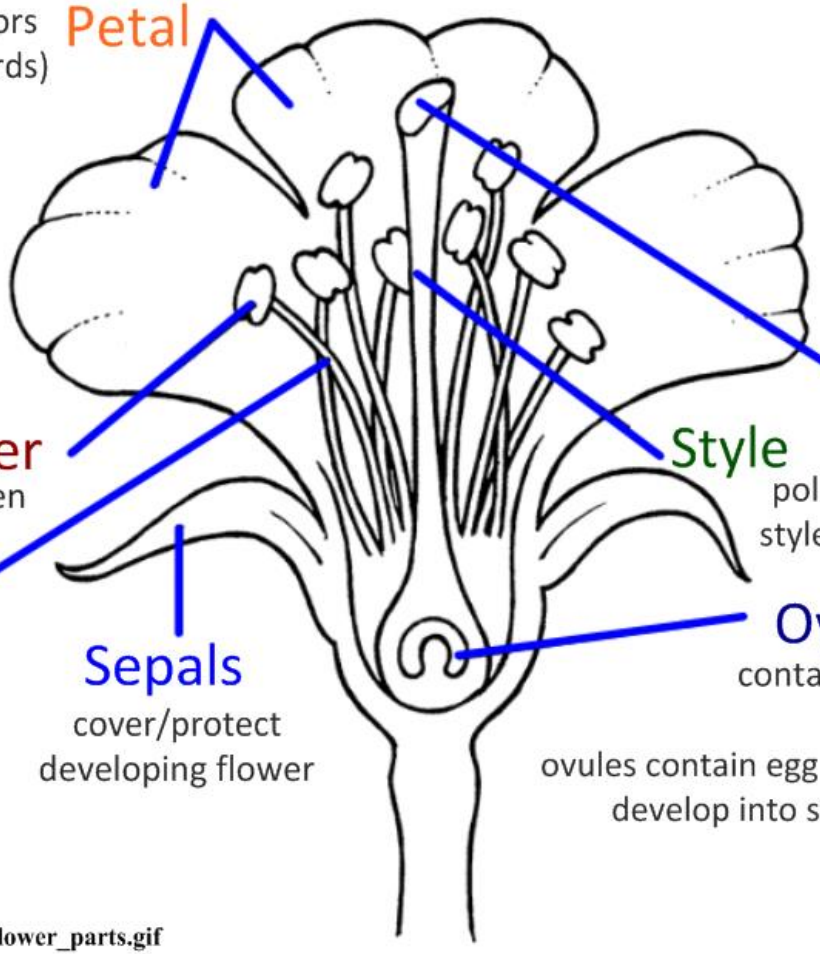
cover/protect developing flower

supports anther

contains pollen

The Flower is the reproductive unit of an angiospermophyte

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



Petal
attracts pollinators (insects/ small birds)

Stigma
pollen landing site

Style
pollen tube grows down style from stigma to ovary

Anther
contains pollen

stamen ♂

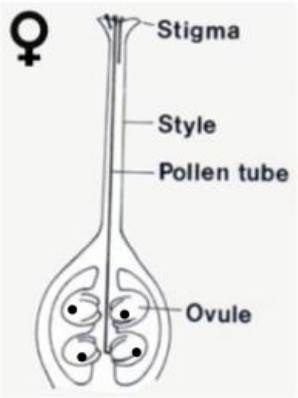
Filament
supports anther

Sepals
cover/protect developing flower

Ovary
contains ovules

ovules contain egg nuclei and develop into seeds when fertilised

http://www.learner.org/jnorth/images/graphics/t/flower_parts.gif

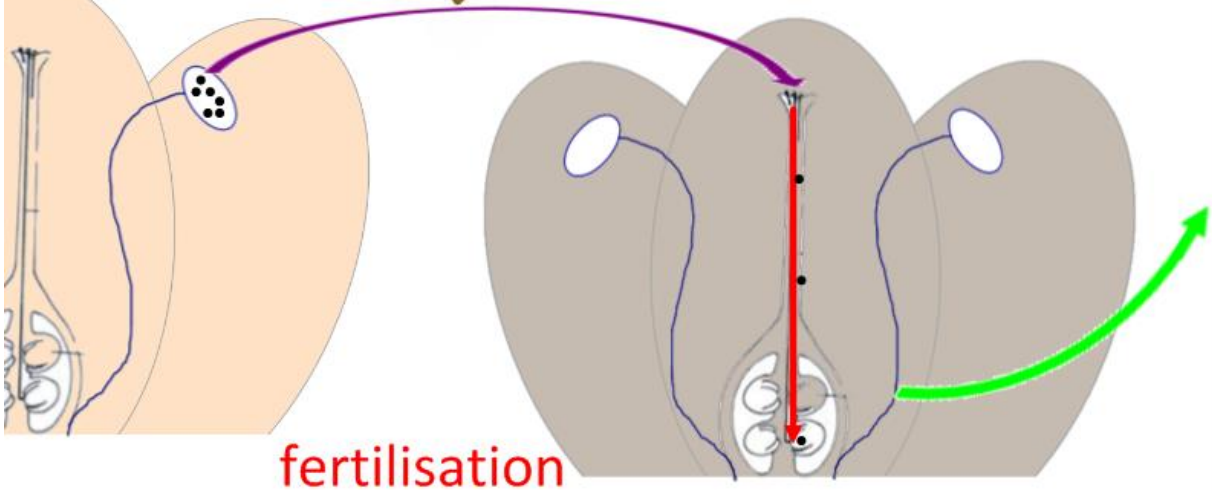


http://www.apsnet.org/Education/IllustratedGlossary/PhotosN-R/ovule.htm

The process of reproduction in angiosperms

pollination

Pollen carried from anther of one flower to stigma of another

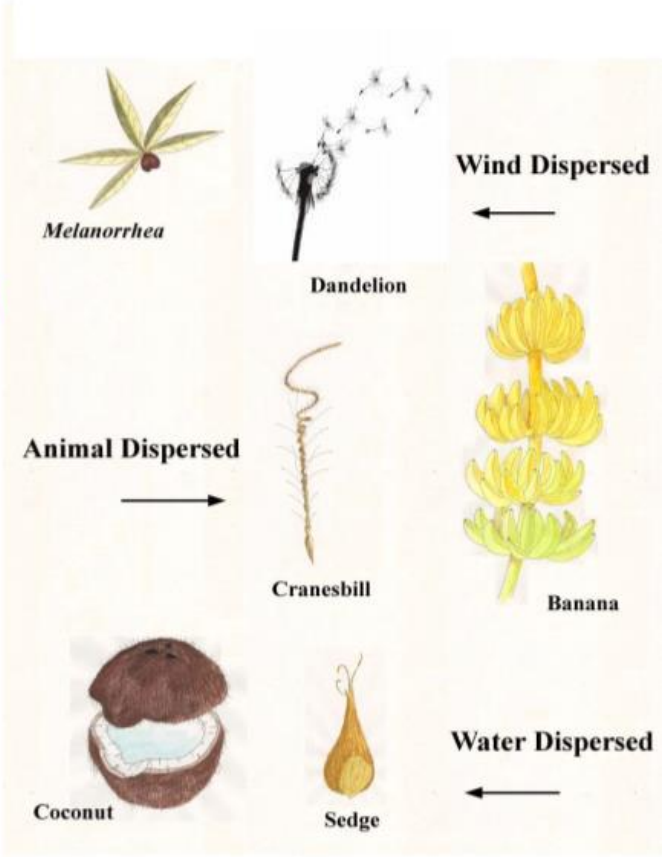


fertilisation

Pollen tube grows down from the stigma to the ovary, through the style. Pollen is delivered to the ovum and fertilisation occurs.

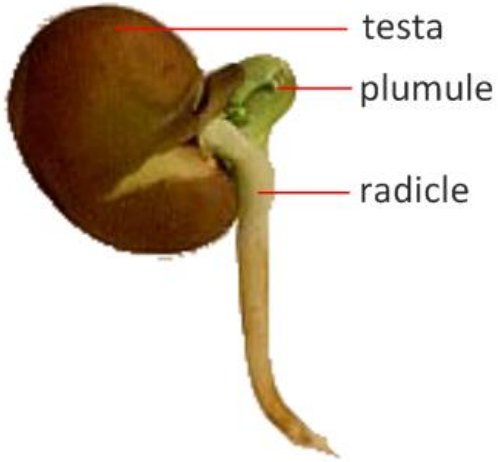
seed dispersal

Once the seed has developed in the ovule, it is ready for dispersal



Dicotyledonous seeds

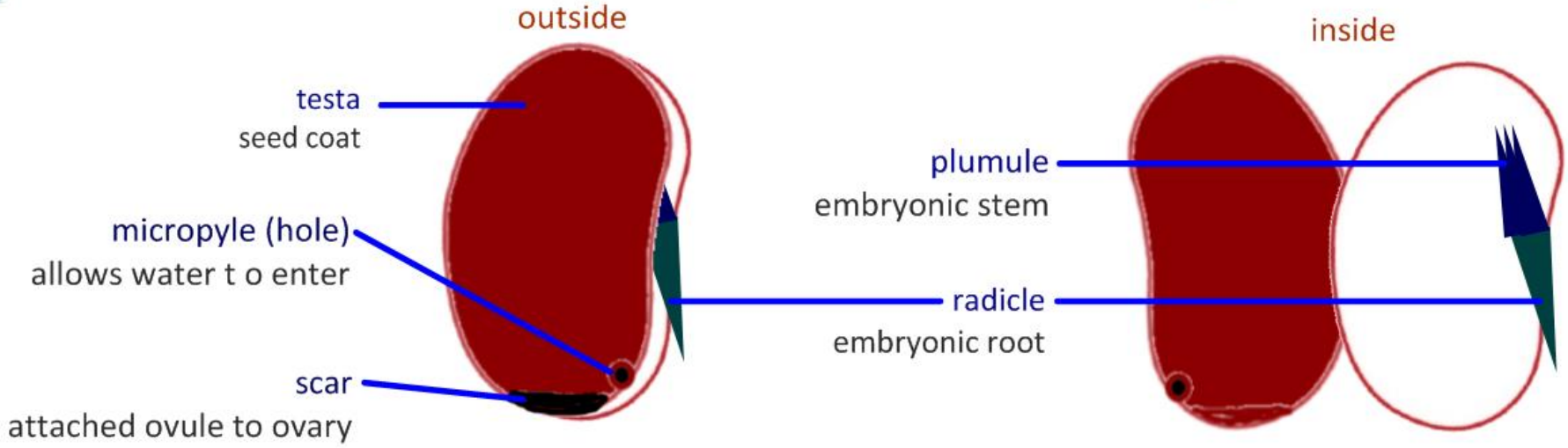
Which part of the seed lets us know that it is a dicot?



http://www.dkimages.com/discover/previews/923/5021802.JPG

e.g. green bean seed

http://www.bioscience.heacademy.ac.uk/journal/vol1/beej-1-3.aspx



Germination: development of the new plant

http://www.youtube.com/watch?v=d26AhcKeEbE

Ideal conditions for germination:

All seeds need water (taken in through the micropyle and used to activate the seed), oxygen for respiration, ideal temperatures and pH for enzyme activity.

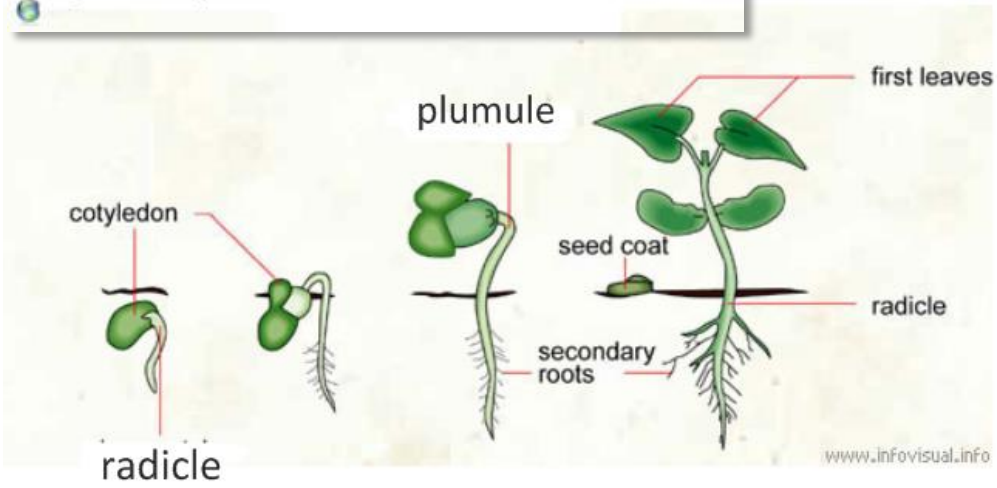
Light requirements differ between species.

Some seeds have extra, more specialised conditions:

Being digested and passed: kleingrass, digested by cattle

Removal of inhibitors by 'washing' (e.g. beans)

Fire (induced by smoke): e.g. *Cistus incanus*

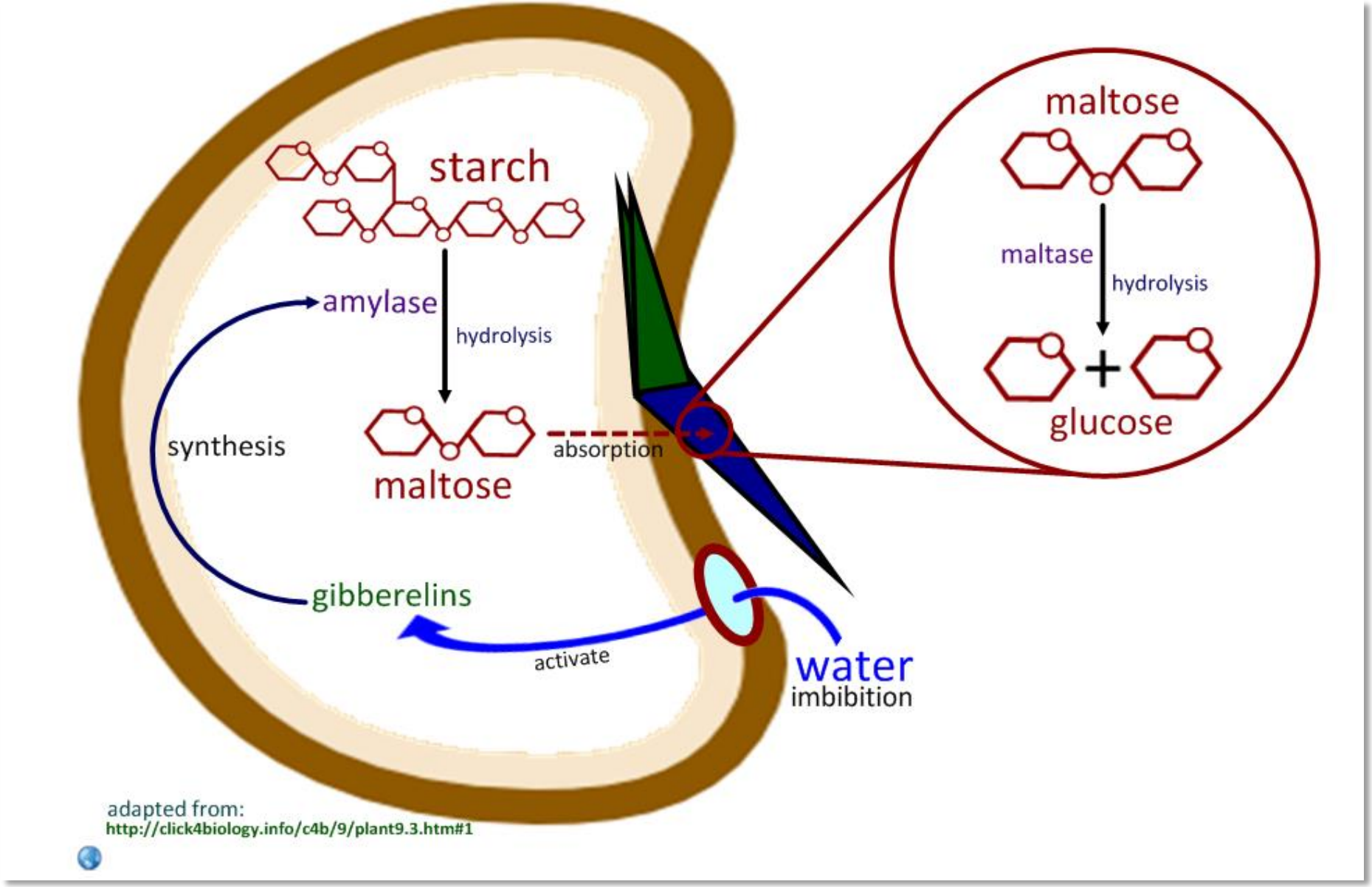


http://www.infovisual.info/01/020_en.html

Cistus incanus

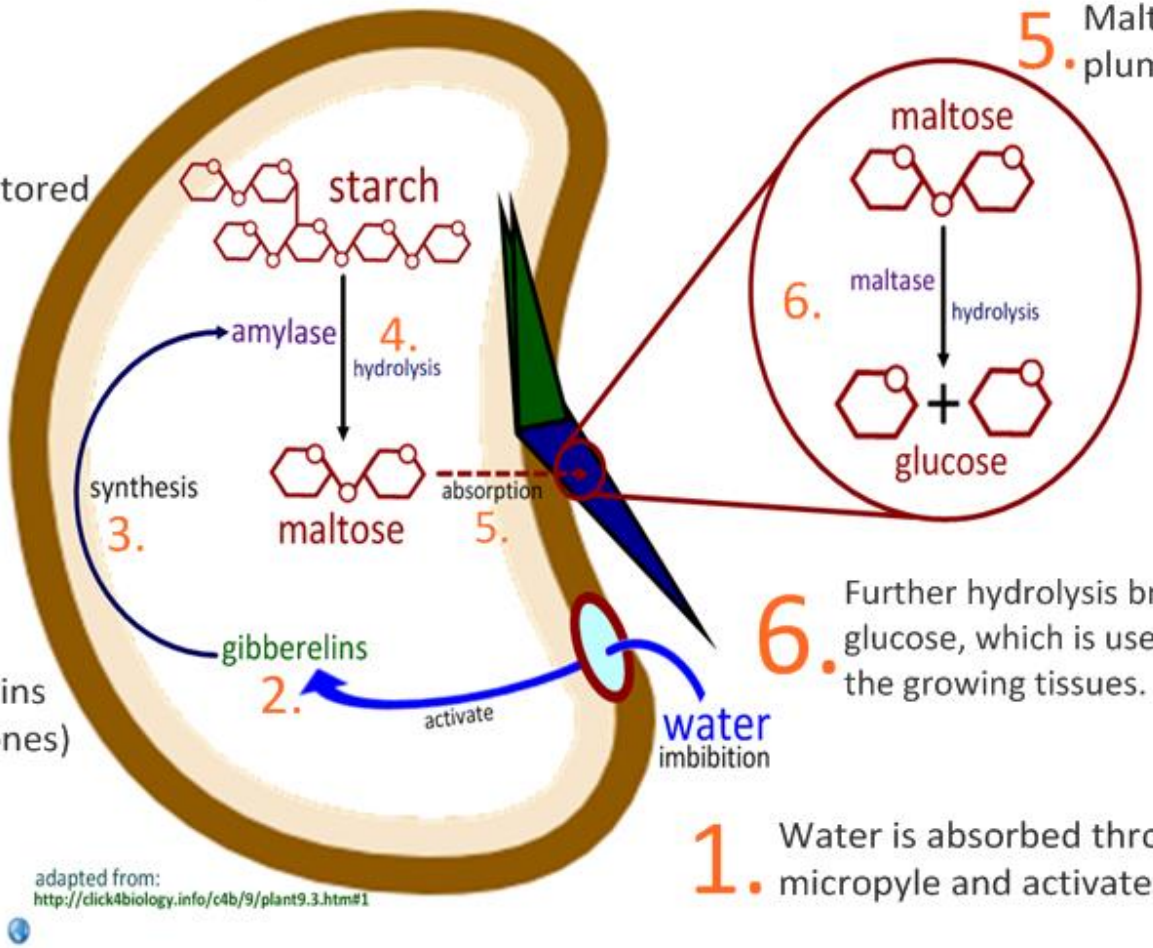
http://en.wikipedia.org/wiki/Cistaceae

Germination of starchy seeds



adapted from:
http://click4biology.info/c4b/9/plant9.3.htm#1

Germination of starchy seeds



4. Amylase hydrolyses stored starch to maltose

3. Gibberelins cause synthesis of amylase (enzyme)

2. Synthesis of gibberelins (plant growth hormones)

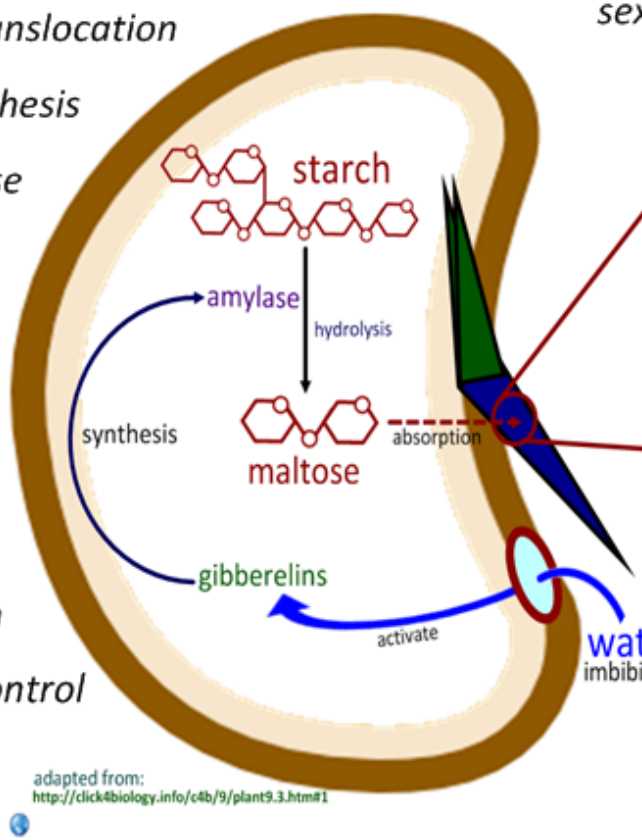
5. Maltose absorbed by plumule and radicle

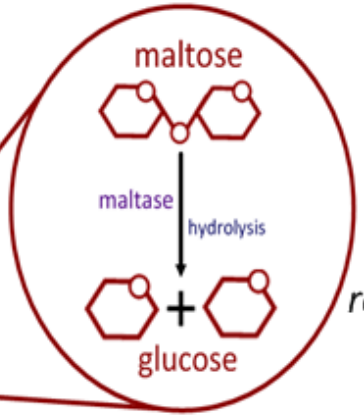
6. Further hydrolysis breaks maltose into glucose, which is used for respiration in the growing tissues.

1. Water is absorbed through the micropyle and activates cells

Bean there, done that...

How many links across the syllabus can you make with this diagram?





xylem and phloem

seed structure, monocots & dicots

sexual reproduction, diversity, genetics

active translocation

photosynthesis

starch vs cellulose

plant cell organelles

protein structure & synthesis

enzymes, rate of reaction, metabolic pathways, inhibition

hormonal control

organic molecules, hydrolysis

respiration

meristems, growth, differentiation, mitosis, membrane transport

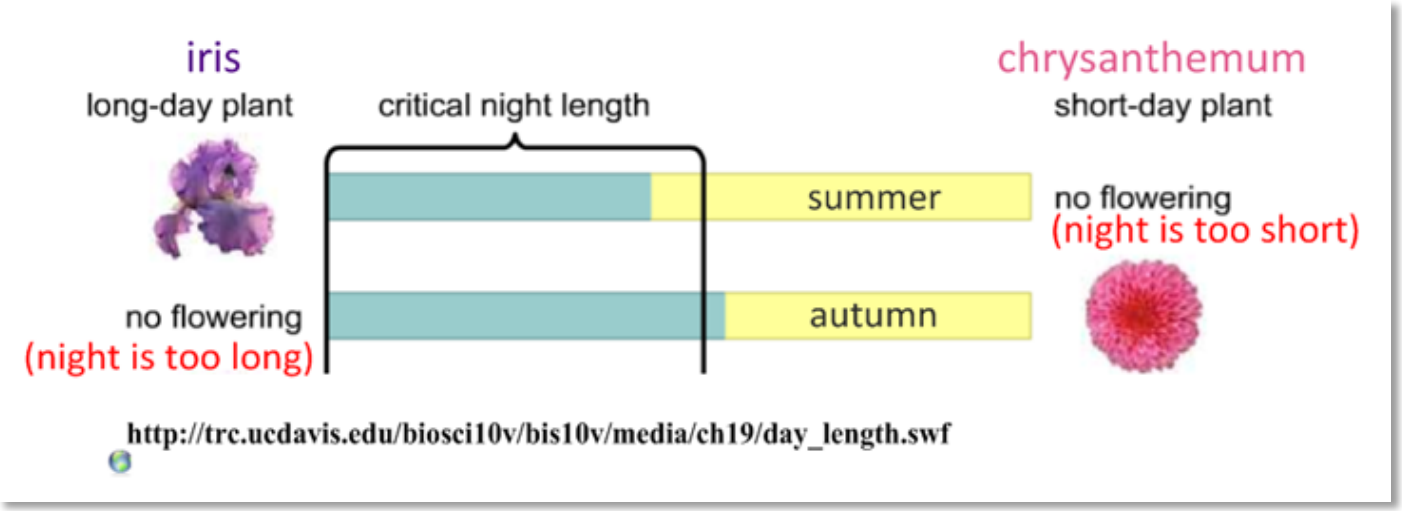
properties of water, mass flow, life cycle

adaptations of xerophytes, diffusion, membranes and transport

Control of Flowering

Why do plants only flower at certain times of the year?

The purpose of flowering is to allow for pollination, fertilisation and consequent seed dispersal. Flowers should only bloom when a suitable pollinator is abundant - these species show seasonal population shifts. Some plants (e.g. irises) bloom in long-day conditions (summer), whereas others (e.g. chyrsanthemums) bloom in short-day conditions (autumn-winter).



The control of flowering is achieved through a process called photoperiodism. The critical factor is not actually *day-length* - it is *night-length*.

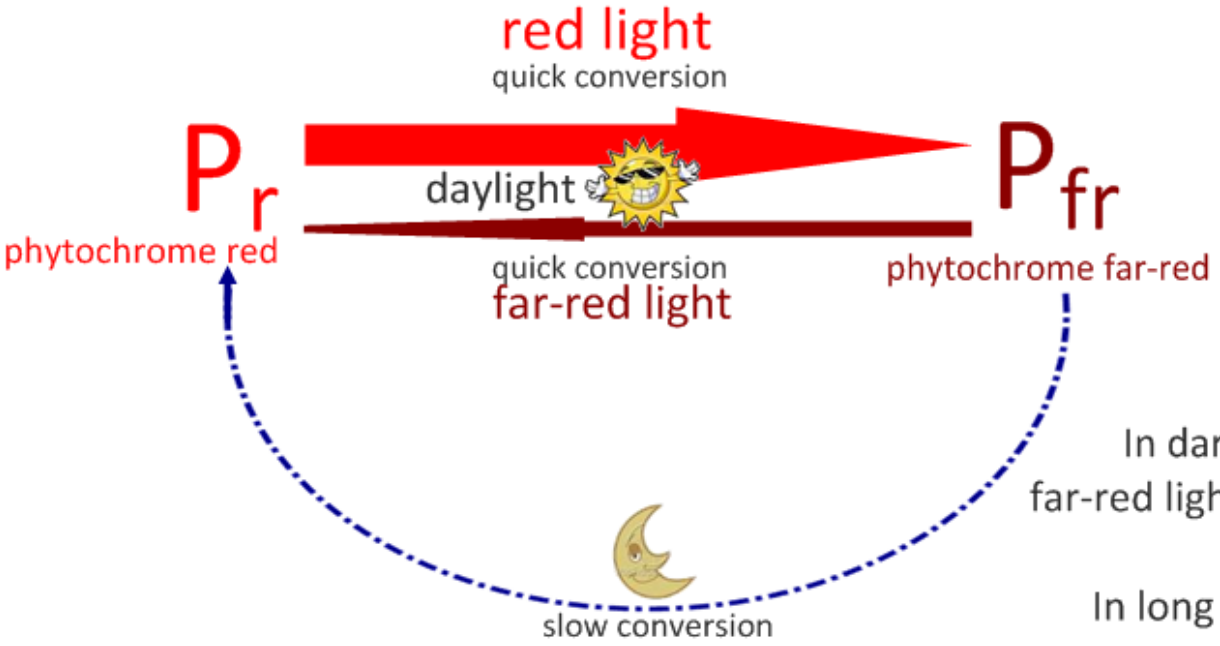
Phytochromes

Phytochromes are leaf pigments which can be used to 'measure' the length of night.

P_r phytochrome red
produced slowly in the dark

P_{fr} phytochrome far-red
produced quickly in the daylight

It is levels of P_{fr} that are used in determining the length of night - Long Day Plants (LDP's) need high levels of P_{fr} if they are to bloom; Short Day Plants (SDP's) need low levels of P_{fr}.

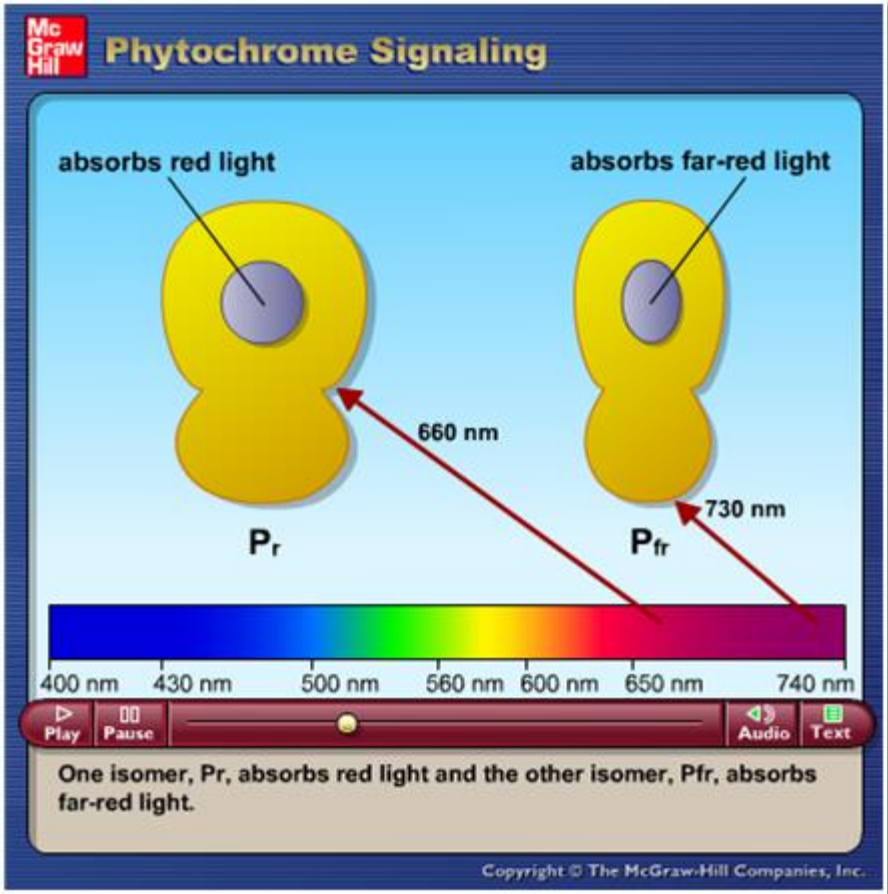


In daylight, there is a lot of red light from the sun(660nm wavelength). Some (not much) far-red light is also present (730nm).

In darkness, there is neither red light nor far-red light. P_{fr} is slowly converted back to P_r.

In long nights, lots of P_{fr} is converted to P_r.

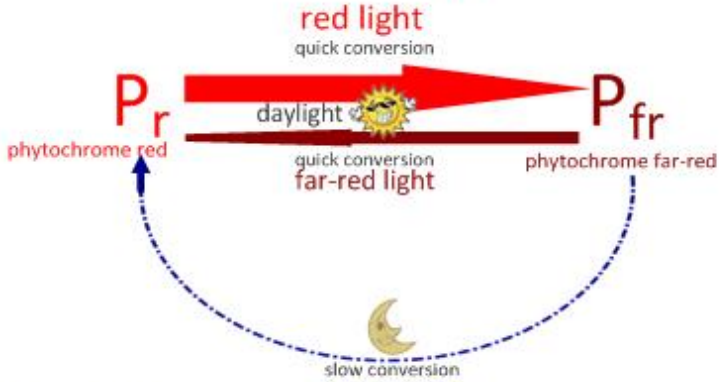
Phytochrome signalling controls plant flowering



http://glencoe.mcgraw-hill.com/sites/9834092339/student_view0/chapter41/animation_-_phytochrome_signaling.html

Phytochromes are plant pigments located in the leaf, which act as a biological clock. They measure night length in order to control flowering.

P_r is converted **quickly** to P_{fr} in daylight.
P_{fr} is converted **slowly** back to P_r in darkness.

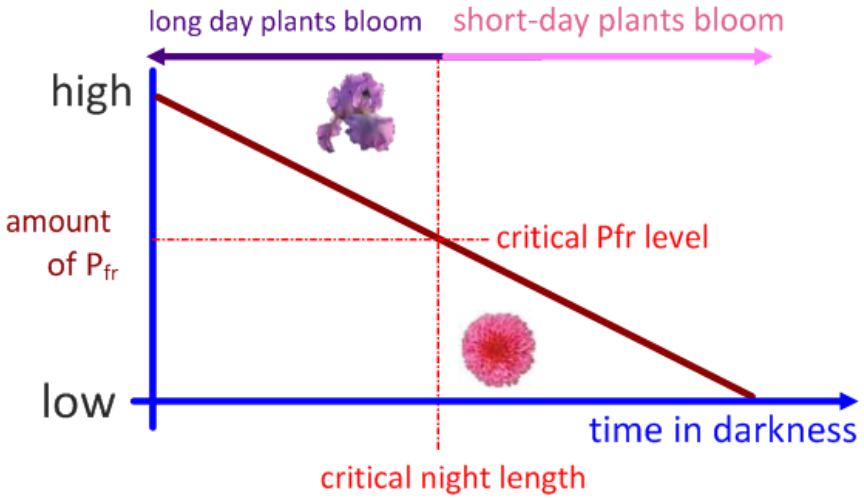


Long-day plants, e.g. iris, flower when day length reaches a critical period. This allows P_{fr} to **build up to a critical level**, stimulating release of flowering hormone.

Short-day plants, e.g. chrysanthemum, require a long period of darkness, allowing P_{fr} to **fall below a critical level** in order to flower.

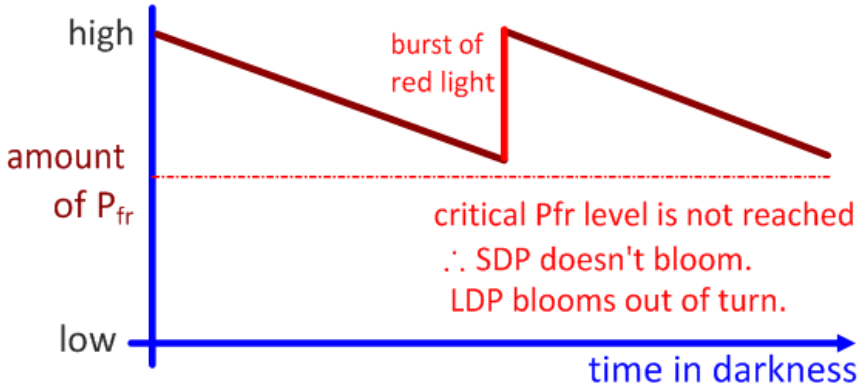
The role of phytochromes has been determined experimentally:

Normal light conditions:



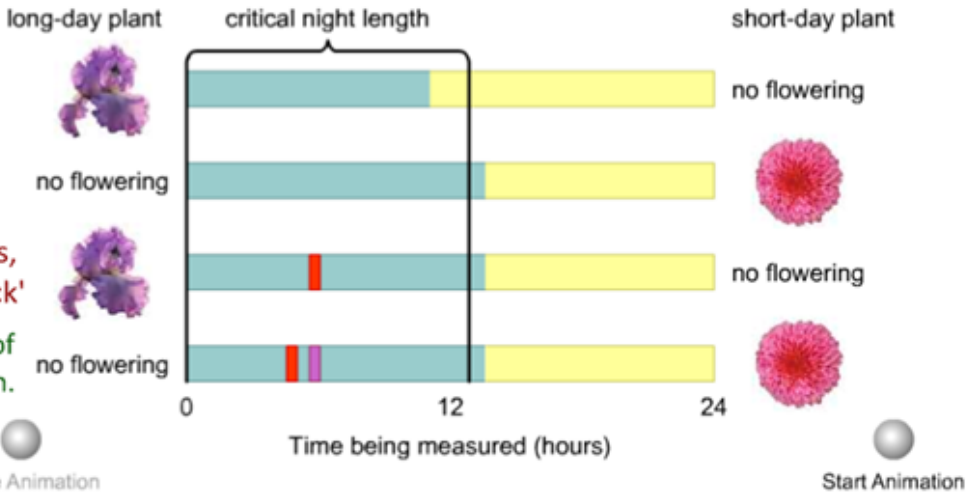
"Red Burst" experiment:

A burst of red light 'breaks' the darkness, effectively 'resetting the clock'



A burst of red light 'breaks' the darkness, effectively 'resetting the clock'

A burst of red light followed by a burst of far-red returns normal function.



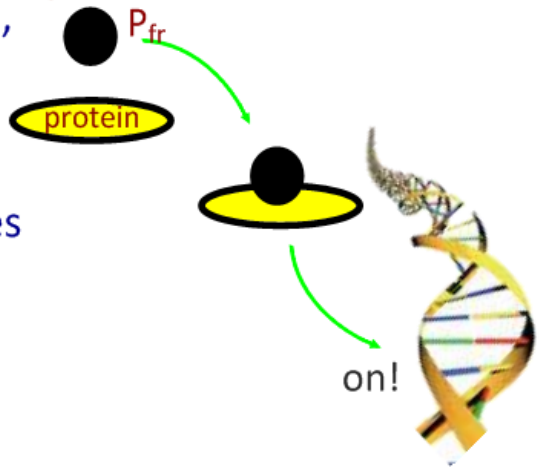
Experiments showing that short-day plants flower by measuring night length. **Click** Start Animation. The red band shows a burst of red light. The purple band shows a burst of far-red light. **http://trc.ucdavis.edu/biosci10v/bis10v/media/ch19/day_length.swf**

So, err.... how does that work again?

Long Day Plant (LDP)	Short Day Plant (SDP)
e.g iris 	e.g chrysanthemum 
blooms when	
 nights are short	nights are long 
because	
less P_{fr} is converted	more P_{fr} is converted
resulting in	
high P_{fr} levels	low P_{fr} levels

P_{fr} binds to a protein,

which acts as a transcription factor, switching on the genes for flowering.
(It is a promoter of flowering)



P_{fr} acts as an inhibitor

of flowering in low levels in SDP's

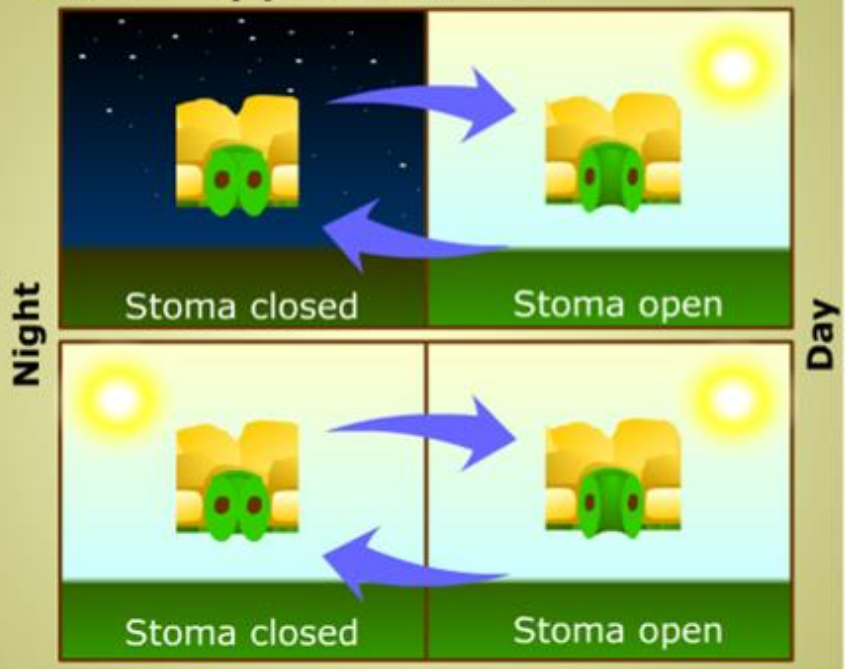
(time to revise transcription & translation!)

Circadian rhythms don't just affect flowering in plants:

Circadian rhythms in plants control many plant activities.

Circadian rhythms in plants control:

- Gene expression
- Leaf and petal movements
- Release of floral fragrances
- Stomata opening and closing
- Metabolic activities



http://www.ucopenaccess.org/courses/CPBiology/bio_5_3_2_3.swf

For more IB Biology resources:

http://sciencevideos.wordpress.com