The Science of the Honeybee

Hayley Sherrard
Senior Education Manager SSERC

hayley.sherrard@sserc.scot

Aims for this workshop

- Look at the life–cycle and anatomy of the honeybee
- Find out more about the importance of bees as pollinators
- Share some ideas for activities to boost understanding of biodiversity

Why are bees important?

There are 25,000 bee species worldwide and 250 bee species in the UK – 25% of these are social bees, the rest are solitary or parasitic bees.

A foraging trip for a worker can be up to 5 miles (although it is more typically around 1 mile) - they make many trips each day. A strong colony can consist of up to 60,000 bees in the summer- so they could fly the equivalent distance from the earth to the moon each day!

Bees carry pollen from one flower to another, which is an essential part for the reproduction of some plants – including important food crops.

Three in four crops worldwide that produce fruit or seeds for human consumption or use depend partially on pollinators, including bees.

Honeybees are the only insects that produce food that humans collect to eat. It takes the equivalent of 10 million trips outside the nest to make enough honey to fill one jar!

Information from British Beekeepers Association - www.bbka.org.uk

Bumblebees

Hymenoptera

Long antennae

Two pairs of see-through wings

Round furry body, 8-30mm

Honeybees

Hymenoptera

Long antennae

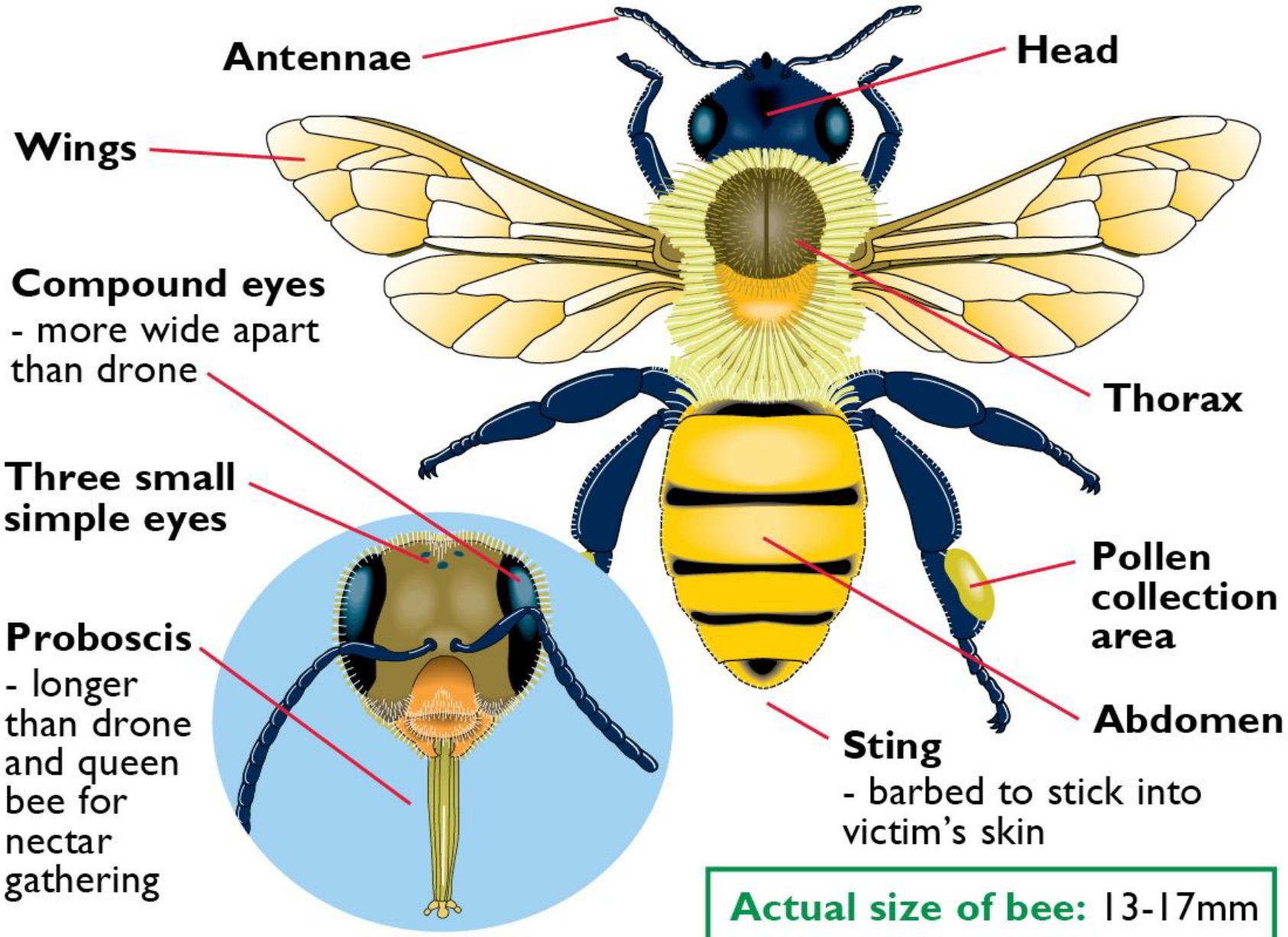
Two pairs of see-through wings

Striped ginger brown body, 5-15mm

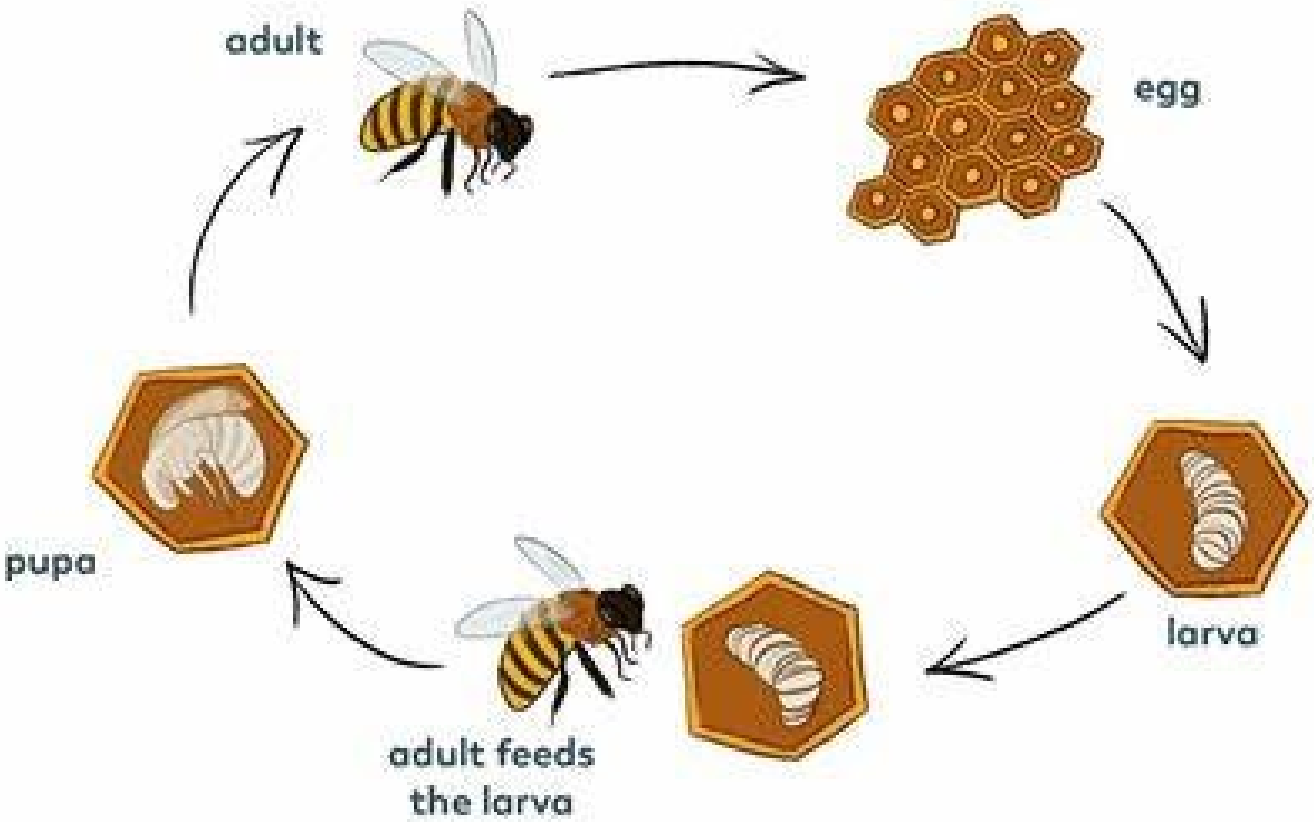
[Pollination-chart-26Feb16-low-res-web-quality_0.pdf (imperial.ac.uk)]

Worker Bee Dorsal View And Head Anatomy Diagram (anatomynote.com)

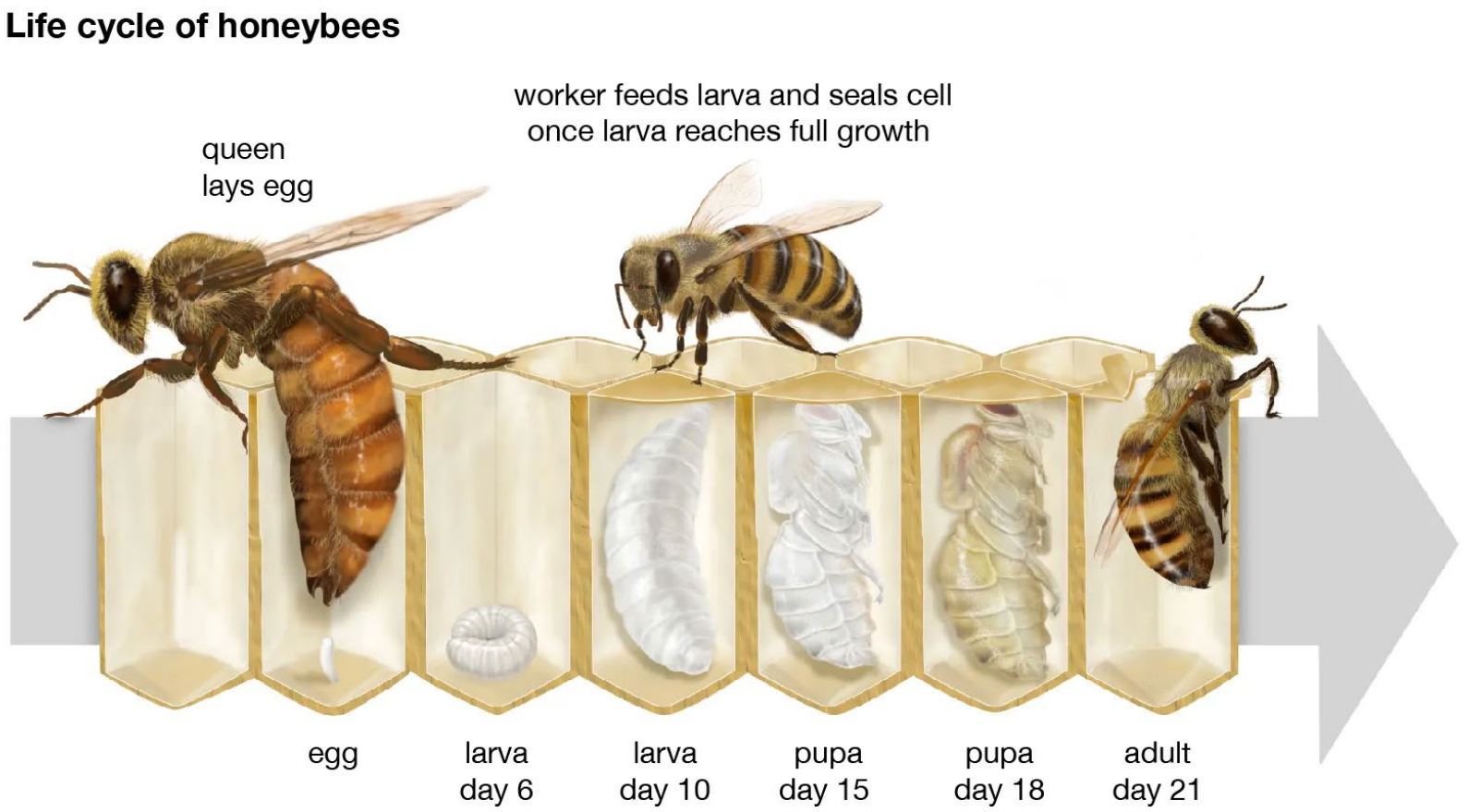
The worker bee



Life-Cycle of the honeybee



Life-Cycle of the honeybee – the worker



https://www.britannica.com/animal/honeybee

Honey Bees:

Take a look at this video showing what goes on inside a beehive….

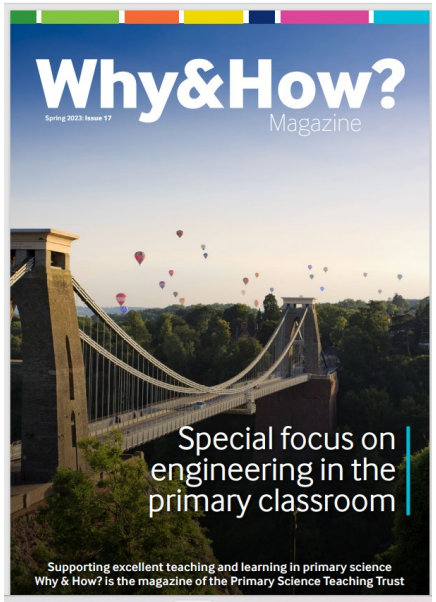
Great Science Share for Schools, Find A Scientist: Hayley Sherrard - Bing video

*the hives in the photos are small nucleus hives or “nucs” –these are used to collect swarms or to house split colonies in the summer.

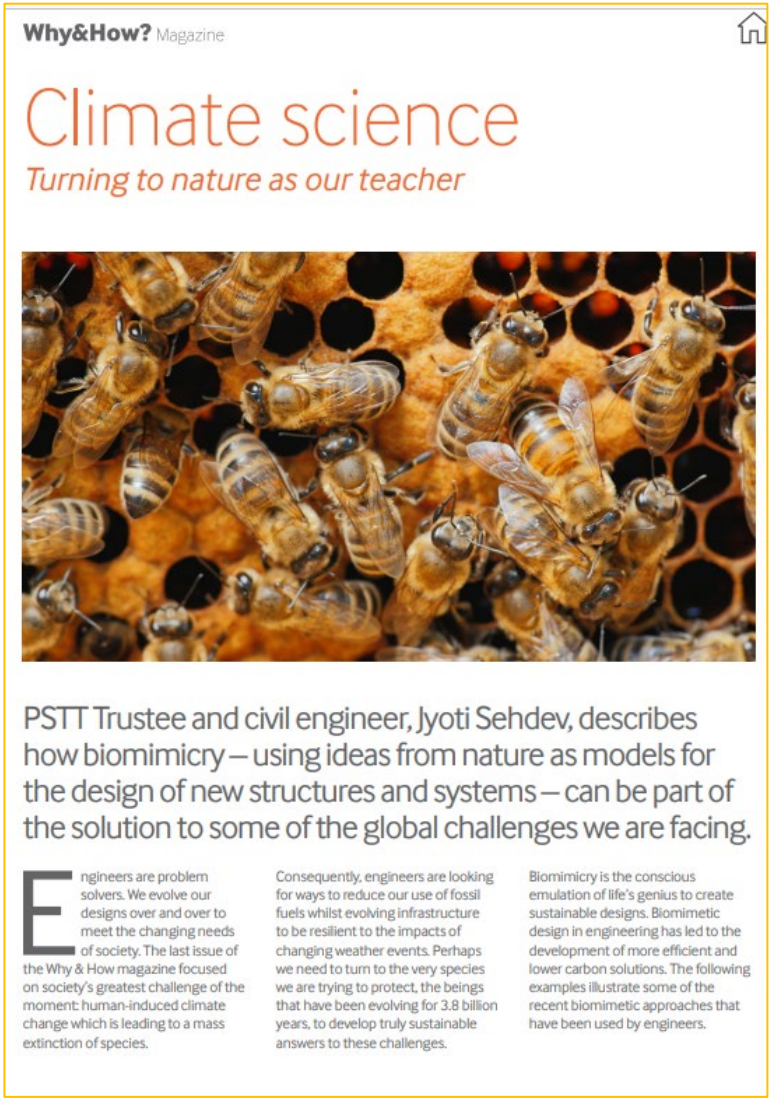
Honey, Honey!

[Honey | British Beekeepers Association (bbka.org.uk)]

Take a look at this article on biomimicry by PSTT Trustee **Jyoti Sehdev**



[Home - Primary Science Teaching Trust (pstt.org.uk)]



Why&How? Magazine

Climate science

Turning to nature as our teacher

PSTT Trustee and civil engineer, Jyoti Sehdev, describes how biomimicry – using ideas from nature as models for the design of new structures and systems – can be part of the solution to some of the global challenges we are facing.

Engineers are problem solvers. We evolve our designs over and over to meet the changing needs of society. The last issue of the Why & How magazine focused on society's greatest challenge of the moment: human-induced climate change which is leading to a mass extinction of species.

Consequently, engineers are looking for ways to reduce our use of fossil fuels whilst evolving infrastructure to be resilient to the impacts of changing weather events. Perhaps we need to turn to the very species we are trying to protect, the beings that have been evolving for 3.8 billion years, to develop truly sustainable answers to these challenges.

Biomimicry is the conscious emulation of life's genius to create sustainable designs. Biomimetic design in engineering has led to the development of more efficient and lower carbon solutions. The following examples illustrate some of the recent biomimetic approaches that have been used by engineers.

[Honeycomb Structure Is Space-Efficient and Strong — Biological Strategy — AskNature]

Links to the curriculum and beyond…

I’ve included links to Scottish CfE - where do bees and pollinators fit in to your teaching?

Curriculum for Excellence

Planet Earth: Biodiversity

I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions. **SCN 1-01a**

I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction. **SCN 2-01a**

Curriculum for Excellence

Planet Earth: Biodiversity

I have helped to grow plants and can name their basic parts. I can talk about how they grow and what I need to do to look after them. SCN 0-03a

I can help design experiments to find out what plants need in order to grow and develop. I can observe and record my findings and from what I have learned I can grow healthy plants in school. SCN 1-03a

Curriculum for Excellence

Biological systems: Inheritance

By investigating the lifecycles of plants and animals, I can recognise the different stages of their development. SCN 2-14a

Extras

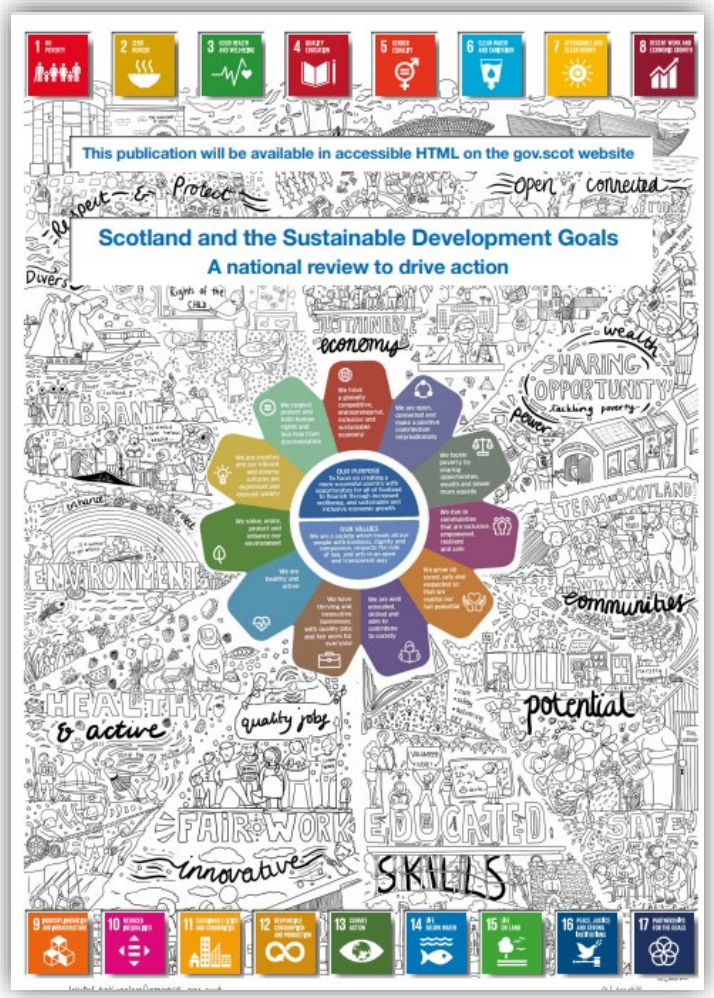
Having explored more complex number sequences, including well-known named number patterns, I can explain the rule used to generate the sequence, and apply it to extend the pattern. MTH 2-13a

Scotland - Sustainable Development Goals

15 Life on Land – Environment

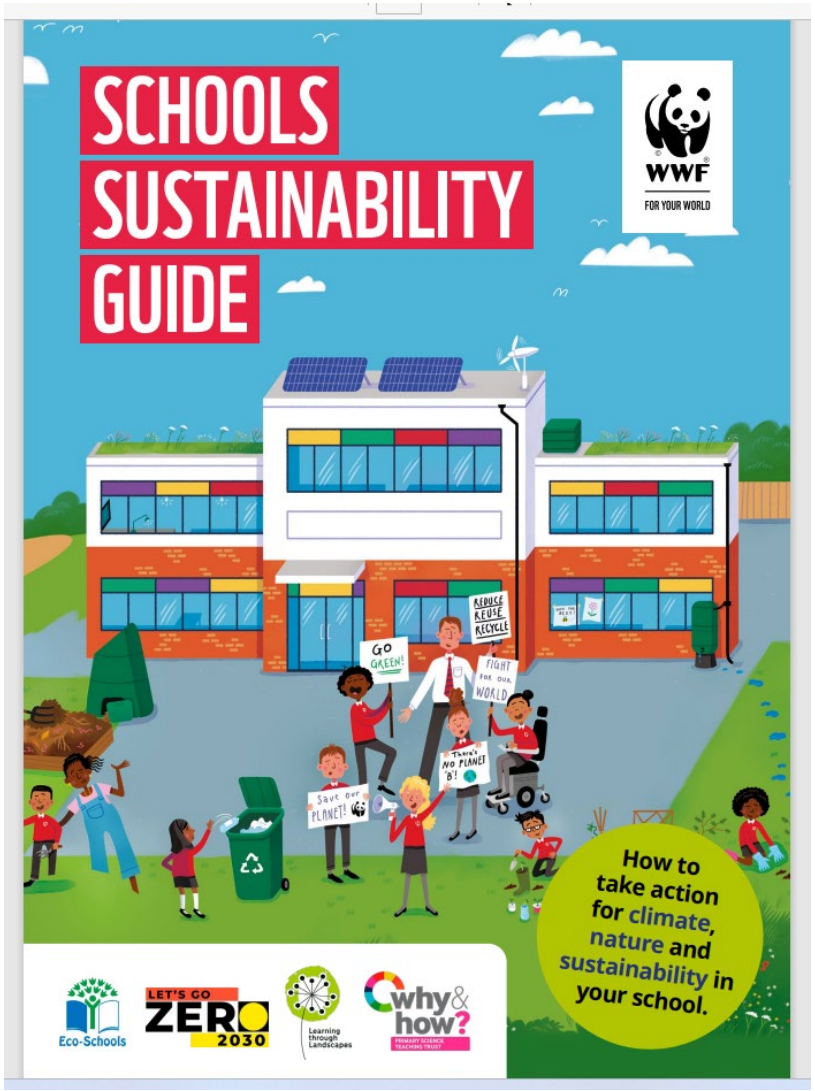
Enhancing and protecting Scotland's biodiversity and ensuring the health of its environment is critical in the fight against climate change and ensuring the environmental, social and economic benefits they bring for future generations.

Increasing understanding of how nature sustains us, and the connections between biodiversity, healthy ecosystem functioning and wider benefits to individuals and society is vital to facilitate protection of Scotland's environment.



[Scotland and the sustainable development goals: a national review to drive action - gov.scot (www.gov.scot)]


SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

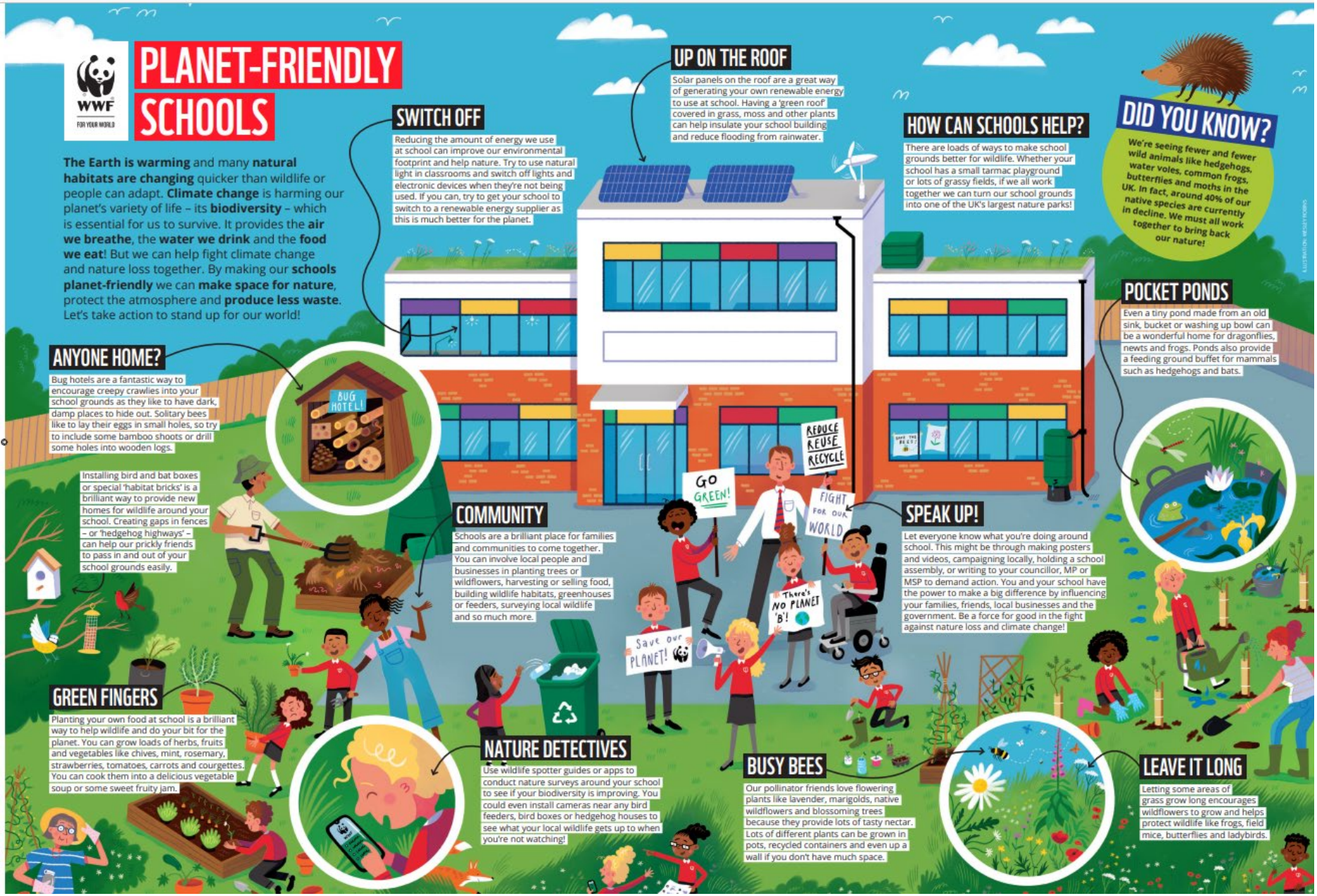


[Schools Sustainability Guide | WWF]

SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD

15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

12: Ensure sustainable consumption and production patterns.



[Schools Biodiversity Poster.pdf (wwf.org.uk)]

Habitats

SDG 15 Life on land

Making a bee line for biodiversity

What's the science?

Biodiversity is the library of life: the animals and plants that live around us. With better biodiversity, we have more species and a more stable climate. Pollinators, like bees and butterflies, help us to grow food and are a key element of biodiversity. Unfortunately, their habitats are under threat from new building developments and farmland. Creating new habitats can help to encourage more pollinators into our local area, helping biodiversity to thrive.

What are scientists doing about it?

Scientists track population trends of bees across the world. They are also researching how to reduce the use of pesticides on crops to encourage bee populations to increase. One research project found that planting a wildflower strip on farming land can increase the yield of the crops by attracting more pollinators to help the food to grow. This increases the bee population and earns the farmers more money.

How could you explore this in the classroom?

- Ask learners to consider how they could contribute to the bee line by learning about the best habitats for bees and then creating these within their school grounds.
- With help, learners could gather and record data by creating a 'library of life' of the animals and plants they see in the school. This could include making tally charts and information posters with details of the animals and their habitats.
- Learners could identify and classify the plants, researching and observing which are best for attracting bees. Discuss with them why pollinators are important and ask them whether bees fly towards the trees or the flowers. Why do they think this is?
- Take action by planting a wildflower strip and making bee hotels during DT.
- Ask learners to observe over time by reviewing the area some weeks or months later. Are there more pollinators than before?
- To link with numeracy learners could look at how bees communicate through a waggle dance and link this with positional and directional language, giving each other instructions. Within ICT learners can code Beebots to move around to find their new home.
- Contact your local beekeepers' association and have an avid apiarist speak to the learners about their passion for beekeeping.

Curriculum links

Habitats; observing over time; gathering and handling data; ICT; DT; numeracy

ROYAL SOCIETY OF CHEMISTRY

Sources The Bee Line | Bug Life; What is biodiversity and why does it matter to us? | The Guardian; What is pollination | BBC

Age range: 4–7 years

[Biodiversity and habitats | 4–7 years (rsc.org)]

Pollination

What is it? How are bees (and other animals) involved?

Pollination – what is it?

The transfer of pollen from the stamen to the stigma…

Photograph www.science 3-18.org

Animal pollination

Wind pollination

Ideas for science enquiry? Which plants require animals to pollinate them? How can you tell?

Pollination and interactions between plants and animals...

Louie Schwartzberg: The hidden beauty of pollination | TED Talk
Why we need bees | TED Talks
Jonathan Drori: Every pollen grain has a story | TED Talk

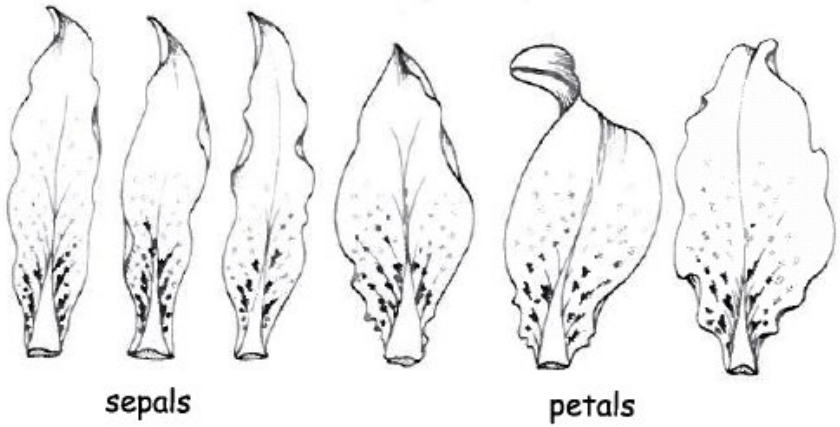
More ideas from Plants for Primary Pupils

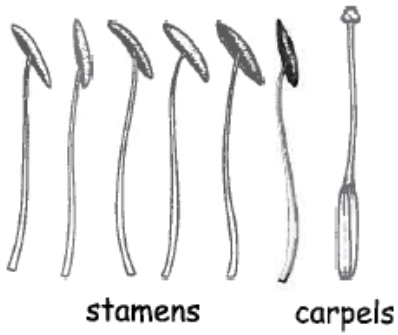
SAPS Primary Resources Homepage

Plants for Primary Pupils Booklets - Overview (saps.org.uk)

Primary Booklet 3 - Reproduction and Life Cycles - Part 2 (saps.org.uk)

A closer look at a flower!





Lay the parts of the flower onto double-sided sticky tape

Sepals

Petals

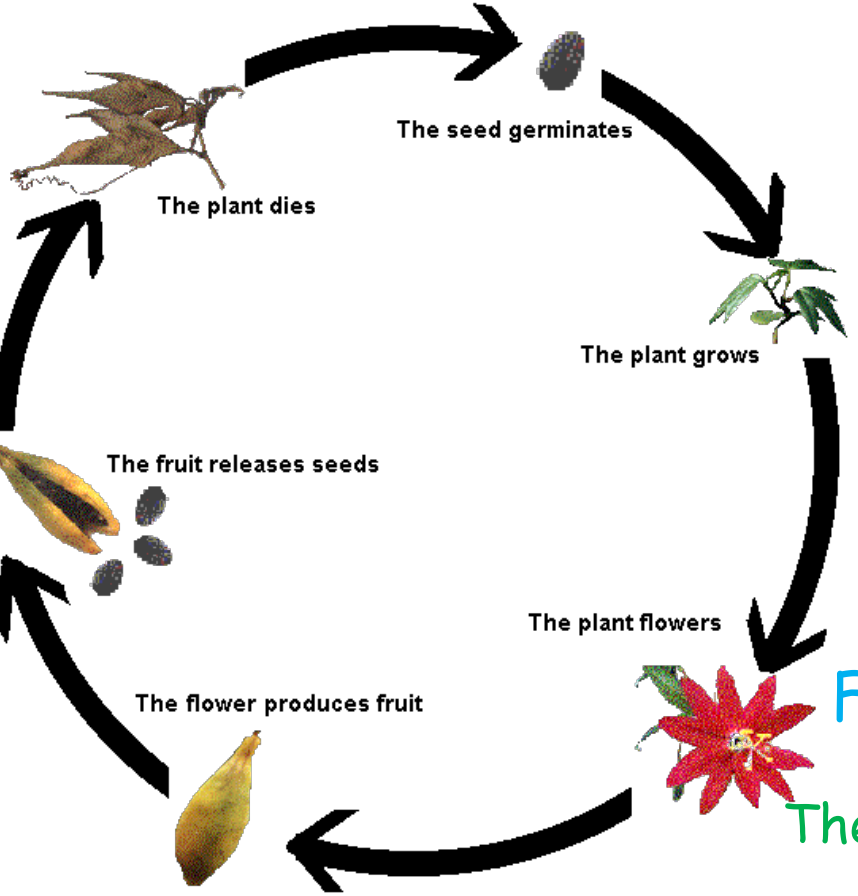
Stamens

Carpel

Lay the parts of the flower onto sticky-backed plastic.

You could place them face down and put card behind the finished display.

The Life Cycle of a Flowering Plant



Seed dispersal

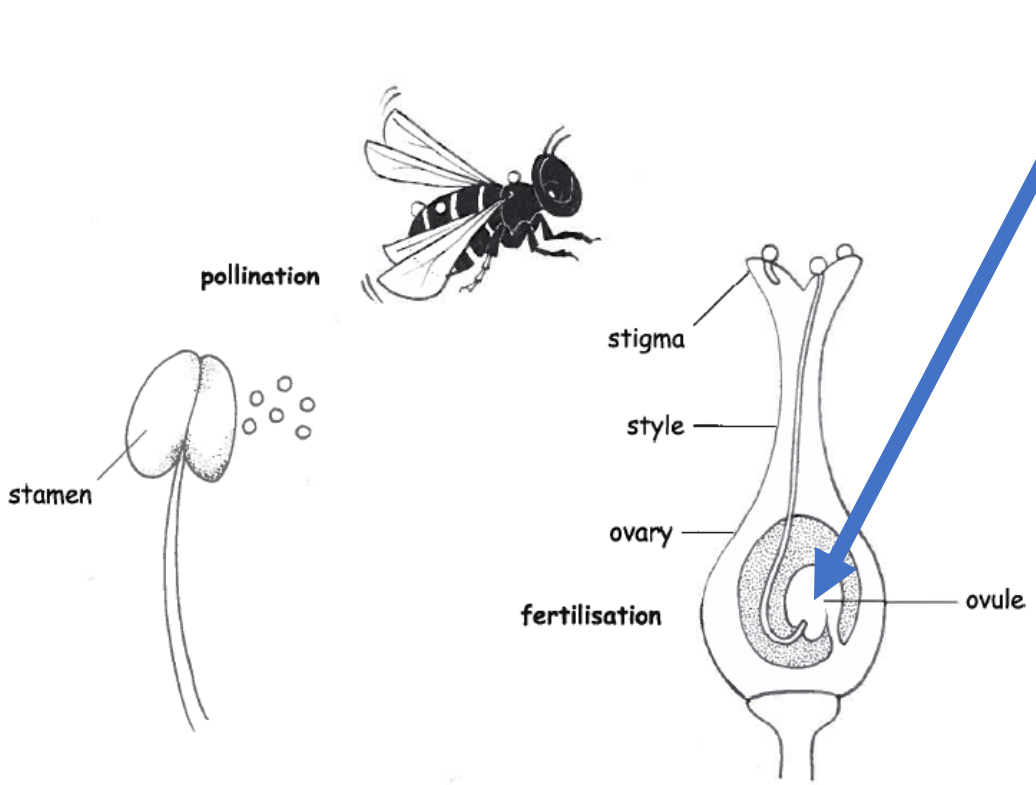
Flower structure

The plant is **pollinated**

The ovules (eggs) are **fertilised**

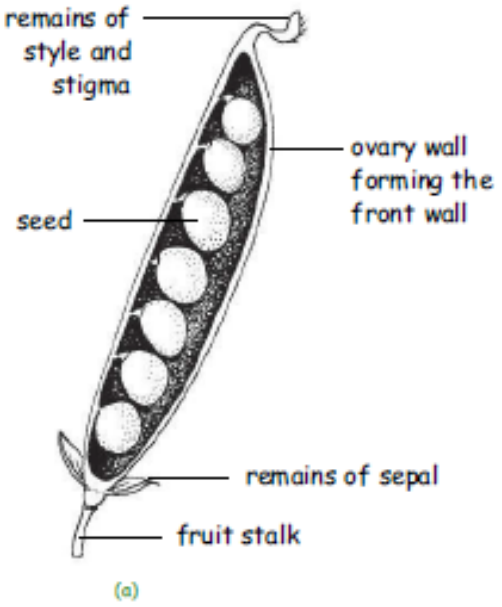
Fertilisation – What is it?

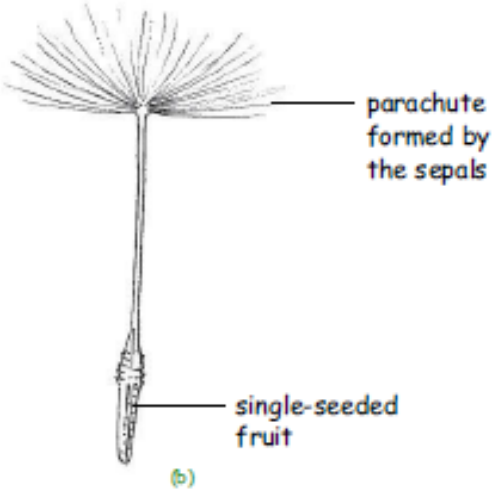
The fusion of male pollen cell with female cell

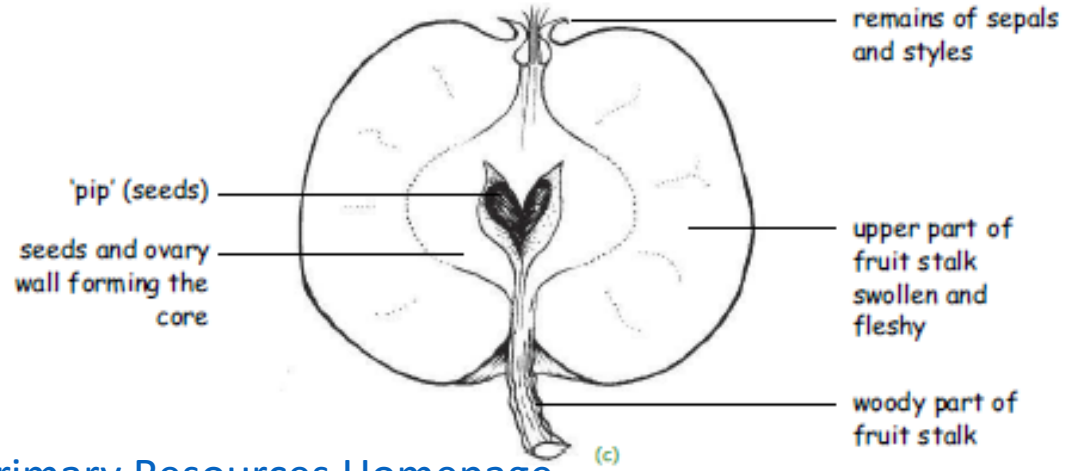


SAPS Primary Resources Homepage

Formation of the fruit

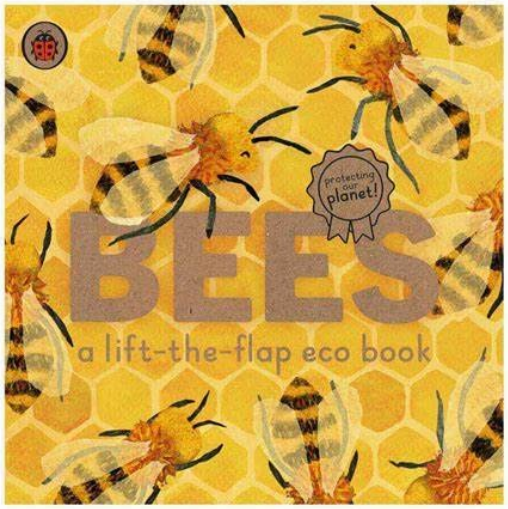




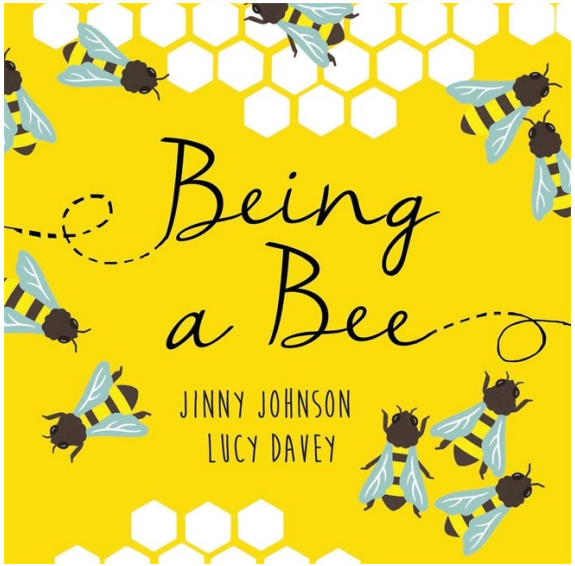


After fertilisation, the ovule develops into the seed.

Some good books on bees:



[Bees: A lift-the-flap eco book (penguin.co.uk)]



[Being a Bee by Jinny Johnson, Lucy Davey | Waterstones]

Book reading on YouTube:
https://tinyurl.com/2p9r2a53

Making seed balls to attract pollinators

You will need:
Clay powder https://tinyurl.com/FullersEarthClay
Compost/soil
Wildflower seeds https://tinyurl.com/wildflower-seeds
Gloves (optional)
Ice cream tubs/bag
Water in bottle (with nozzle attached)

Watch the video here:
Bee Bomb.mp4

Some good links and websites:

science.cleapss.org.uk/Resource-Info/PS087-Bees-and-beekeeping-in-schools.aspx

Buzz about bees! - National Geographic Kids (natgeokids.com)

Surveys - Bumblebee Conservation Trust

Polli:Nation Survey | Research groups | Imperial College London

Bee Kind: Imperial scientists' efforts to protect pollinators | Imperial News | Imperial College London

Bees in the Curriculum | British Beekeepers Association (bbka.org.uk)

CBBC - Show Me the Honey!

https://www.rspb.org.uk/fun-and-learning/for-kids/games-and-activities/activities/

https://www.wildlifetrusts.org/actions

Royal Entomological Society - Garden Entomology booklet:
Layout 1 (royensoc.co.uk)
https://www.royensoc.co.uk/wp-content/uploads/2021/12/Garden-Ent_hi-Res.pdf

19 - 25 June 2023 - Insect Week

Bee surveys - record bees and help science | Friends of the Earth