PHARMABEES

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WHAT IS SCIENCE?

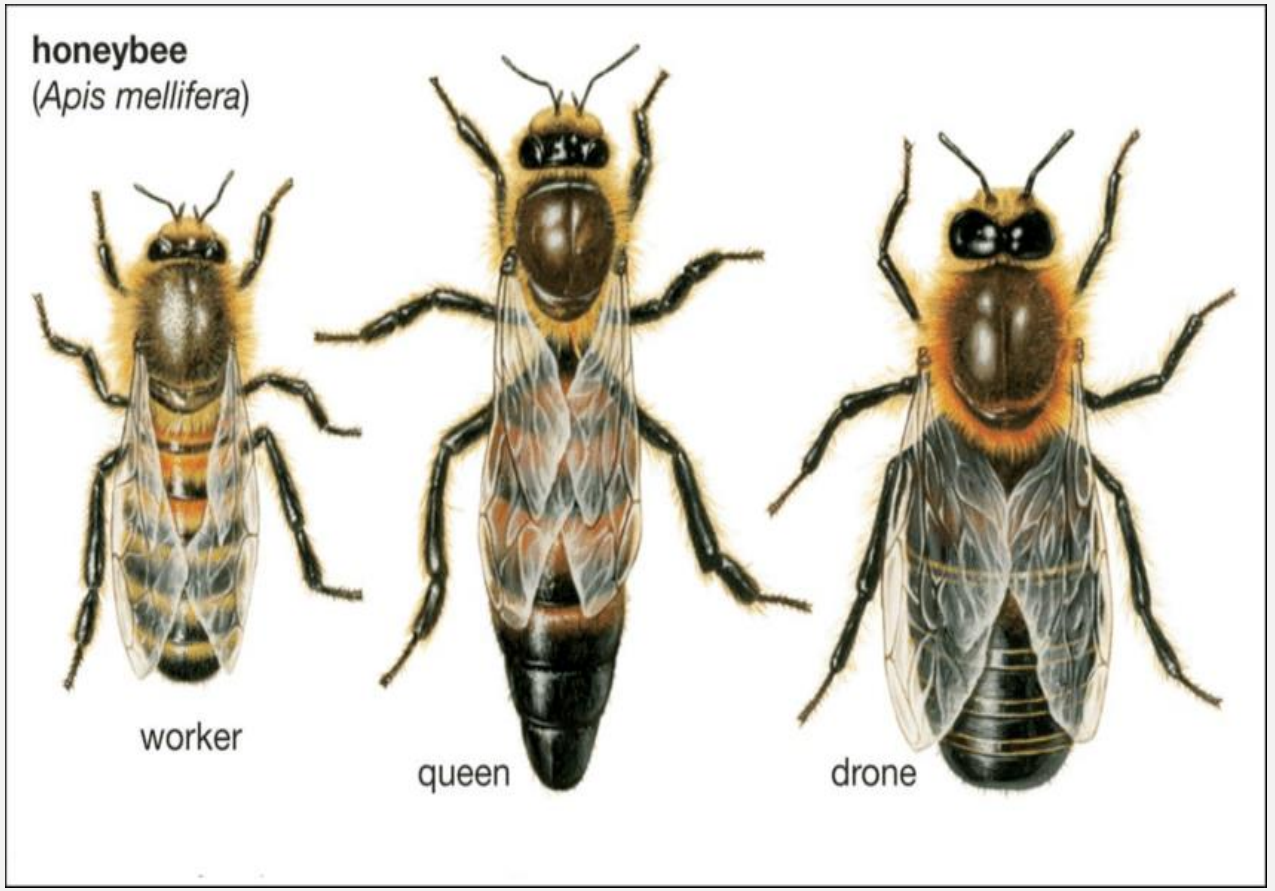
TIME FOR A VIDEO:

HTTPS://WWW.YOUTUBE.COM/WATCH?V=UMAXARBDNSM

LET'S TALK ABOUT BEES

HONEY BEES - *APIS MELLIFERA*

- Honey bees are social and make up a colony by working together
- There is a queen in every hive, drones and workers
- There are around 50,000 bees per hive
  - That's 2/3 the amount of people who can fit in Principality Stadium in Cardiff



50,000 BEES VS PEOPLE

THE QUEEN BEE

- The Queen will lay between 175,000-200,000 eggs a year at a rate of 5 - 6 a minute
- Eggs become boys or girls
- Queen **larvae** are fed royal jelly exclusively
- If two queens hatch at once, they must fight to the death

DRONES

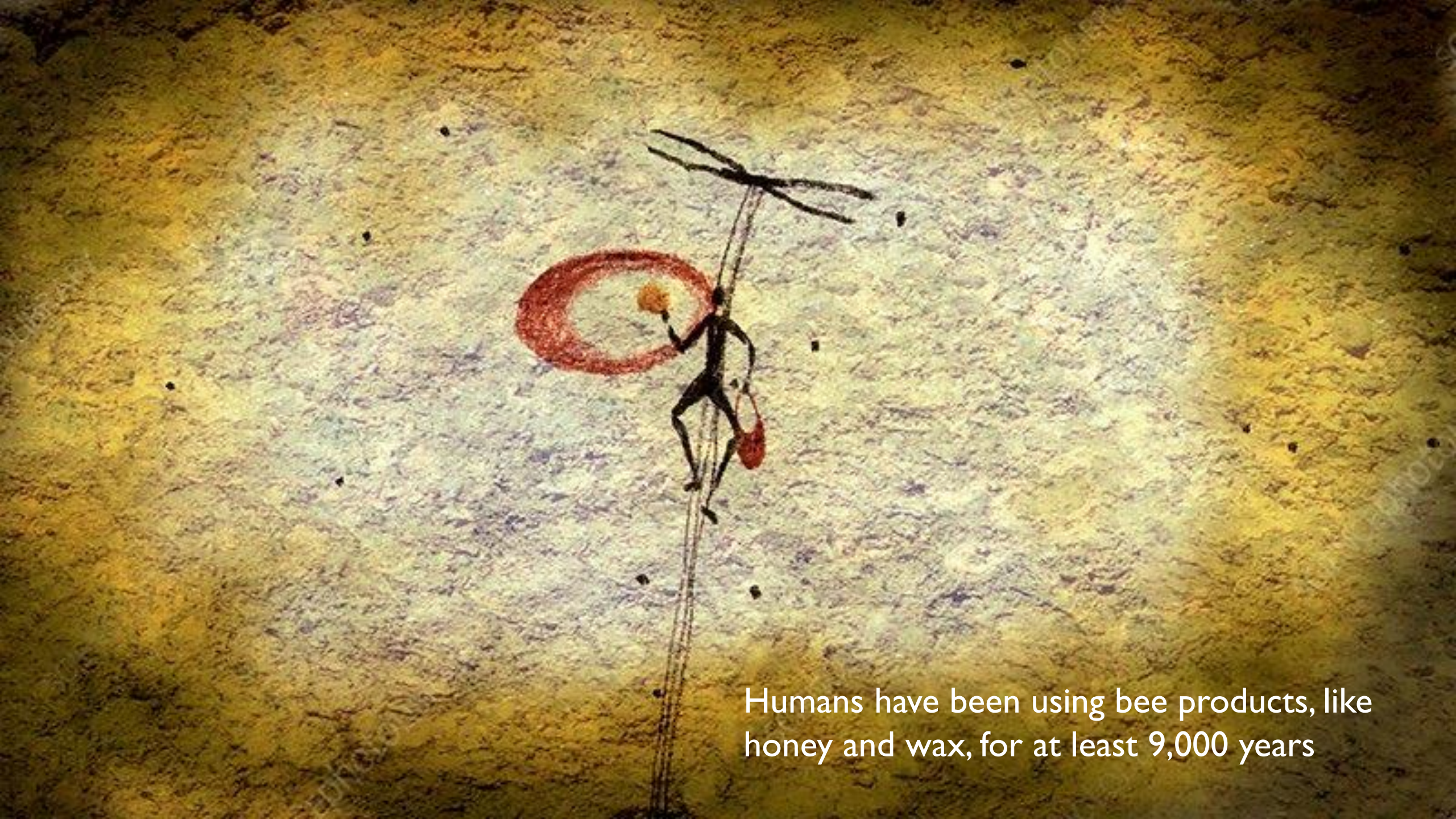
- Drones make up approximately 10% of the hive population
- They are male
- Their sole purpose is to mate with new queens, and are essential to the survival of future honey bee colonies
- Drones cannot sting
- They die straight after mating

WORKERS

- Worker bees are all female
- They make up approximately 90% of the hive population
- They do all the work and control most of what goes on inside the hive
- At around 21 days they leave the hive to collect pollen and nectar
- They can sting only once
- They live for only about six weeks because they work so hard

HOW MUCH HONEY?

- One hive makes about 14kg of honey
  - A 1 Litre bottle of coke weighs about 1 kg
- About 3.5kg of honey is eaten by bees to produce 0.5 kg of beeswax
  - 0.5 kg is about 5 apples


Humans have been using bee products, like
honey and wax, for at least 9,000 years

- The ancient Egyptians had many uses for honey including sweetener, medicines, gifts for the gods, and in embalming fluid
- Honey, dating back approximately 3,000 years, was excavated from a tomb
- That honey is the world's oldest sample – and still edible!
- Bees were important to Egyptians, they even had their own hieroglyph

HONEY IN ANCIENT EGYPT

UNBEELIVEABLE FACTS

- One bee would have to fly about 90,000 miles to make 0.5 kg of honey
  - That is about three times around the world
- A bee visits 50 to 100 flowers during a collection trip
- Worker bees can only sting once in their lives, but wasps can sting multiple times and are much more aggressive than bees
- The queen can sting as many times as she likes, workers die after they sting

UNBEELIVEABLE FACTS

- A bee can fly for up to six miles to collect pollen and nectar, and travel at 15 miles per hour
  - Usain Bolt can run 28mph
  - Most people run around 9mph, so you can't outrun a bee
- The odds are:
  - Dying from a bee sting: 1 in 6 million
  - Struck by lightning: 1 in 3,000
  - Attacked by a shark: 1 in 11.5 million

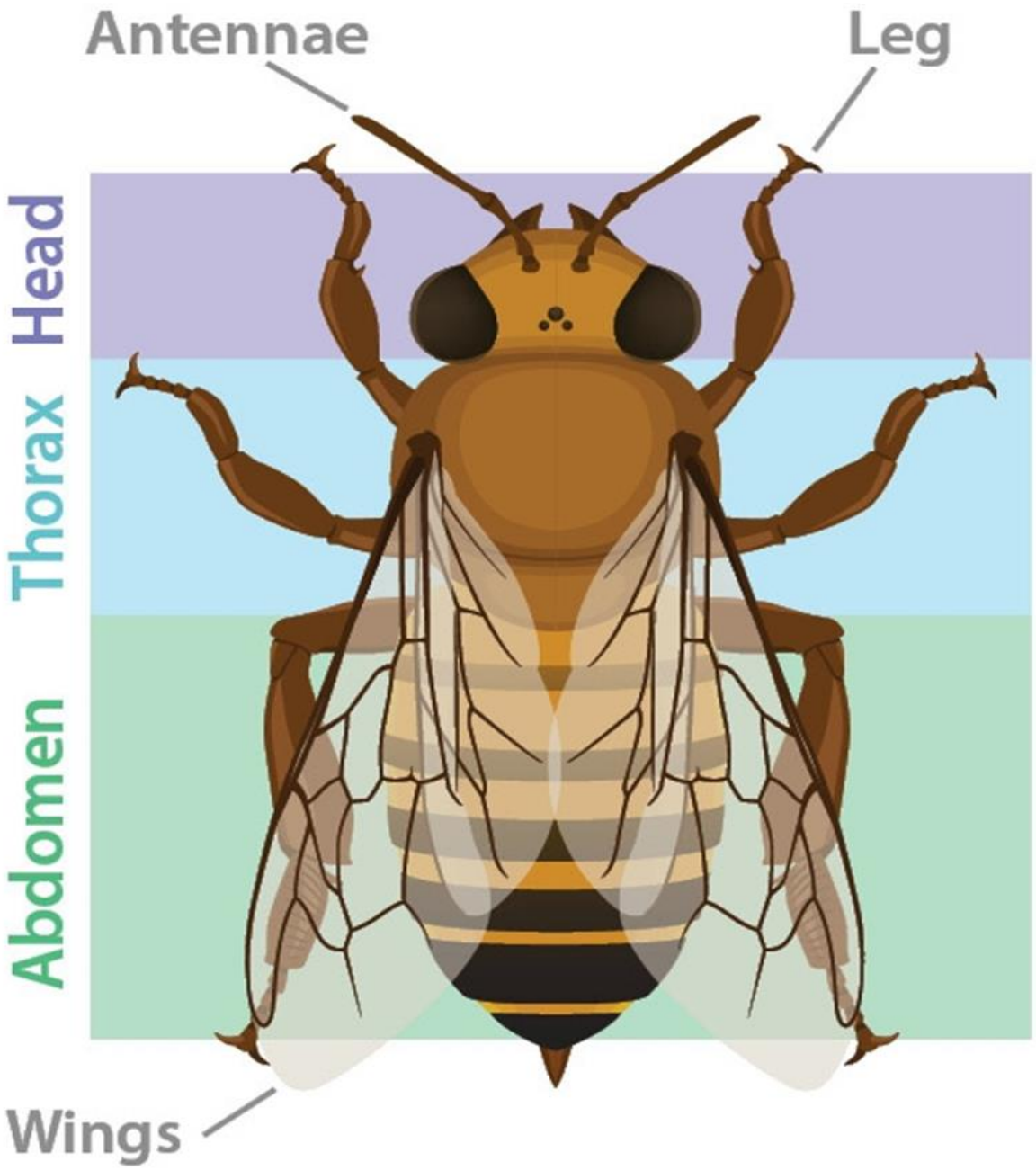
BEES VS WASPS

- Bees are golden and black in colour with tiny hairs all over their bodies which make them appear 'fuzzy'
- When a bee stings a human, its stinger becomes embedded in the skin which kills the bee
- Bees live in hives made of wax, or can be solitary and live in soil, wood or clay

- You can spot a wasp by its bright yellow and black rings, defined waist and tapered abdomen
- Wasps can sting more than once
- Wasps make their nests out of small pieces of wood which they chew to a pulp and spit out to build their walls, similar to paper

BLUE HONEY?

- Beekeepers near the town of Ribeauville, in France reported their bees produced blue and green honey
- The bees picked up the colour by feeding on the sugary waste from the M & M manufacturing plant
- Honey was blue and green!



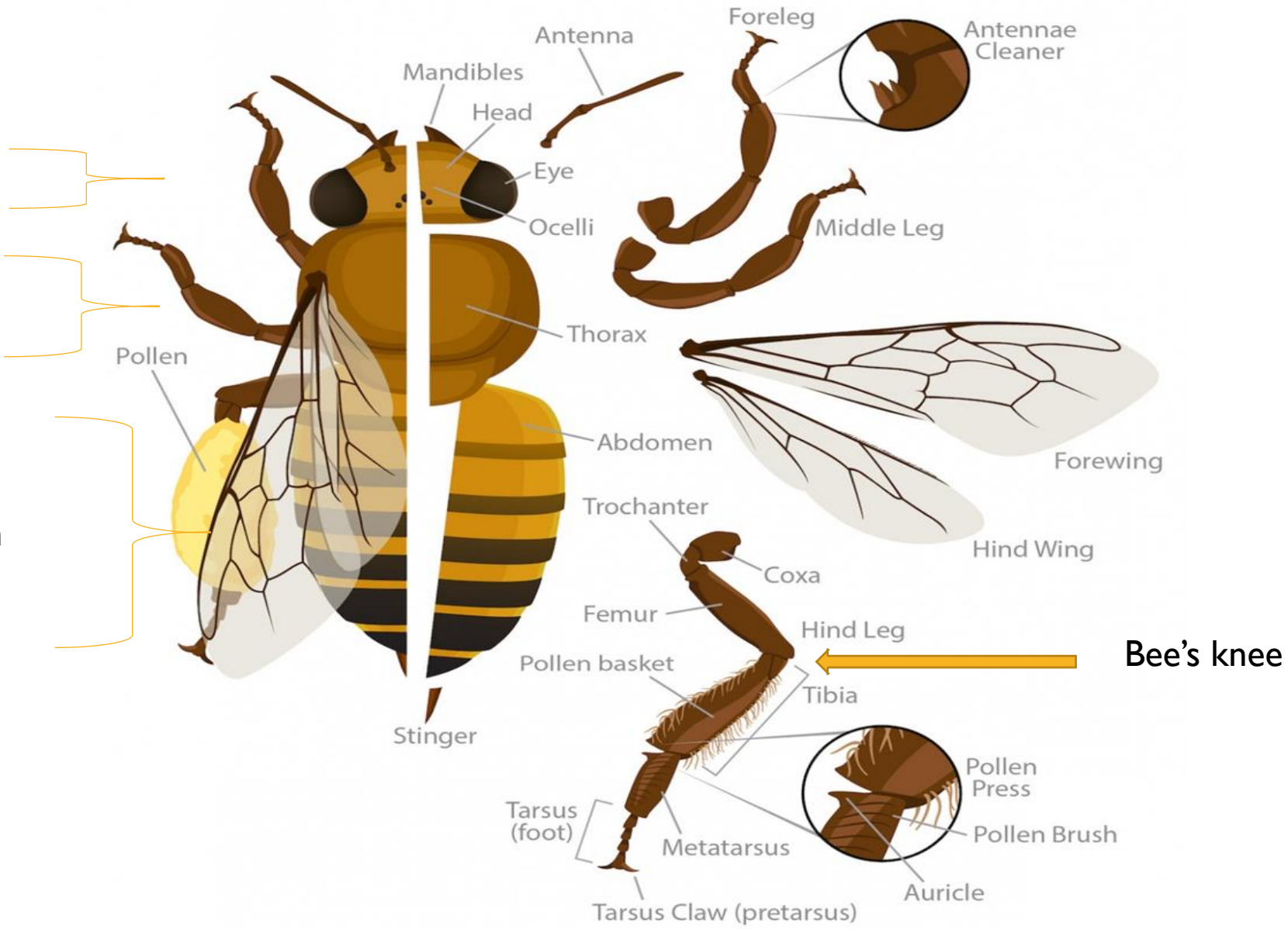
PARTS OF A BEE

- Bees have a hard, outer shell called an **exoskeleton**
- Bees have three main body parts: head, thorax, abdomen
- Antennae that are attached to their head
- Three pairs of legs used for walking
- Two pairs of wings
- **Proboscis** is the tube-like mouth part used to suck up fluids
- Did you know bees do have knees? The knee is between the femur and tibia

Head

Thorax

Abdomen



Bee's knee

https://askabiologist.asu.edu/honey-bee-anatomy

BUILD A BEE

ACTIVITY TIME

LET'S BUILD A BEE!

LET'S MAKE A BEE!

- USE THE MATERIALS PROVIDED TO MAKE A BEE
- REMEMBER THE PARTS OF A BEE WE JUST LEARNED
- HOW WILL YOUR BEE COLLECT NECTAR AND POLLEN?
- VOTE ON YOUR FAVORITE BEE

BUILD A BEE

END OF ACTIVITY

WHAT DO BEES EAT?

What Bees Eat

1. **Nectar**
2. **Pollen**
3. **Water**

- Nectar provides **carbohydrates** - sugar
- Pollen is collected for **protein**
- Water is collected for drinking, honey production, and to help cool down the hive

HOW NECTAR IS CONVERTED INTO HONEY

Nectar is extracted by the bee through the **probiscus** (tongue) and stored in its **crop** (stomach)

In the crop, the nectar mixes and changes its chemical composition and **pH**

When the bee returns to the hive, it passes the nectar to another bee by **regurgitating** the liquid into the other bee's mouth

Regurgitation from bee to bee is repeated until the partially digested nectar is finally deposited into a honeycomb

To get excess water out of their honey, bees fan the honeycomb with their wings, to speed up **evaporation**

The bee seals the comb with a secretion of liquid from its **abdomen**, which eventually hardens into beeswax

Away from air and water, honey can be stored indefinitely, providing bees with a food source for winter

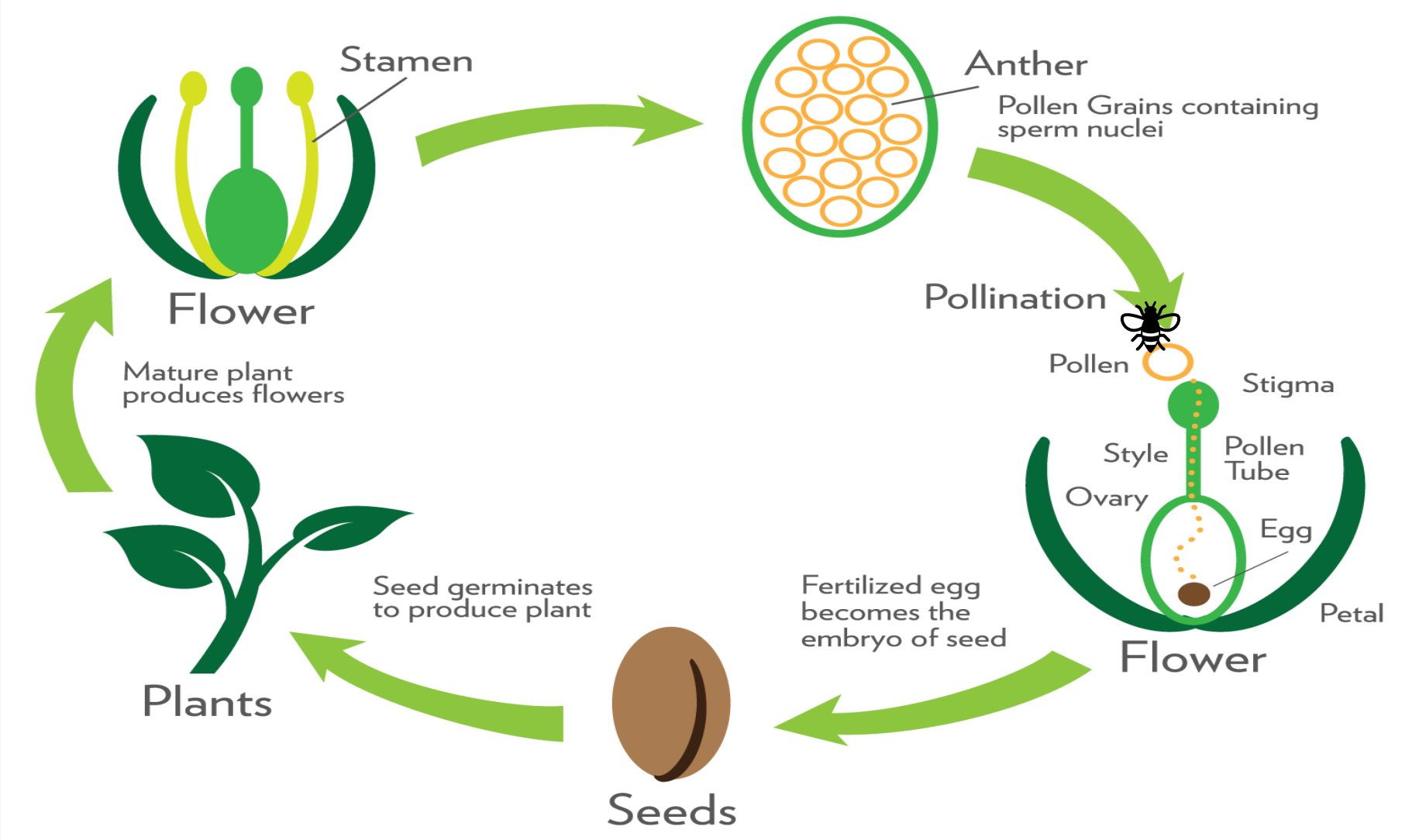
Nectar contains compounds from the plant it comes from, which can give honey its **antibacterial** properties

POLLEN IS BEE FOOD

- Pollen is an important source of **protein** and is produced by the plants
- Flowers produce two types of pollen
  - Tasty for the bees to encourage them to visit the plant, not needed for **fertilisation**
  - Supports **sexual reproduction**- contains the plants **DNA**- needed for fertilisation
- Bees have special hairs on their body that develop a charge which attracts pollen grains to their bodies so that they can transfer them to other flowers
  - The pollen has a negative charge, and the bee a positive charge
  - Things that have different charges attract each other, similar to magnets

The pollen basket where bees store pollen

FERTILISATION



- Plants have two forms of reproduction, sexual and asexual.
- **Sexual reproduction** makes use of pollen which contains the plant's DNA
- Bees carry the pollen between plants and this spreads the DNA
- Sexual reproduction creates **genetic diversity** – why is this important ?

DIFFERENT TYPES OF POLLEN

- Pollen has different shapes depending on the way in which it is spread from plant to plant
- Heavy and sticky pollen must be carried from flower to flower by insects.
  - Plants like dandelion and chicory produce pollen grains which stick to the body of the insects like bees, which are hairy and **electrostatically charged**
  - Dandelion pollen has hooks that can stick to the bees' legs
- Some pollen grains can be **airborne** and blown in the wind for long distances
  - Plants like grasses, corn, and many trees, have pollen that blows in the wind

POLLINATORS ARE NOT JUST BEES !

- There are around 25, 000 different species of wild bees that pollinate plants
- Moths, flies, wasps, beetles and butterflies as well as several animals pollinate plants
- Vertebrate pollinators include bats, monkeys, rodents, lemurs, and tree squirrels
- Birds such as hummingbirds and some parrot species
- What other pollinators can you think of?

BEE DECLINE

- Disease
- Weather/Climate Change
- Loss of **Habitat**
- **Pesticides**

BEE DECLINE

Bees and other pollinators are under threat.

Loss of natural **habitat** results in the loss of important food and nesting sites for pollinators

Present species **extinction** rates are 100 to 1,000 times higher than normal due to human impacts

Insects will likely make up the bulk of future **biodiversity** loss

40% of **invertebrate** pollinator species – particularly wild bees and butterflies – facing extinction (not honey bees)

HOW CAN HUMANS HELP?

- Learn more about bees and other pollinators
- Plant pollinator friendly plants at unused areas of schools or gardens
- Encourage your friends and family to do the same
- Don’t cut the grass!
  - Allow weeds and wildflowers to grow in long grass
- Go on a bee hunt
- Keep or create nesting areas for pollinators
- Learn how to become a beekeeper

HOW DO BEES HELP HUMANS?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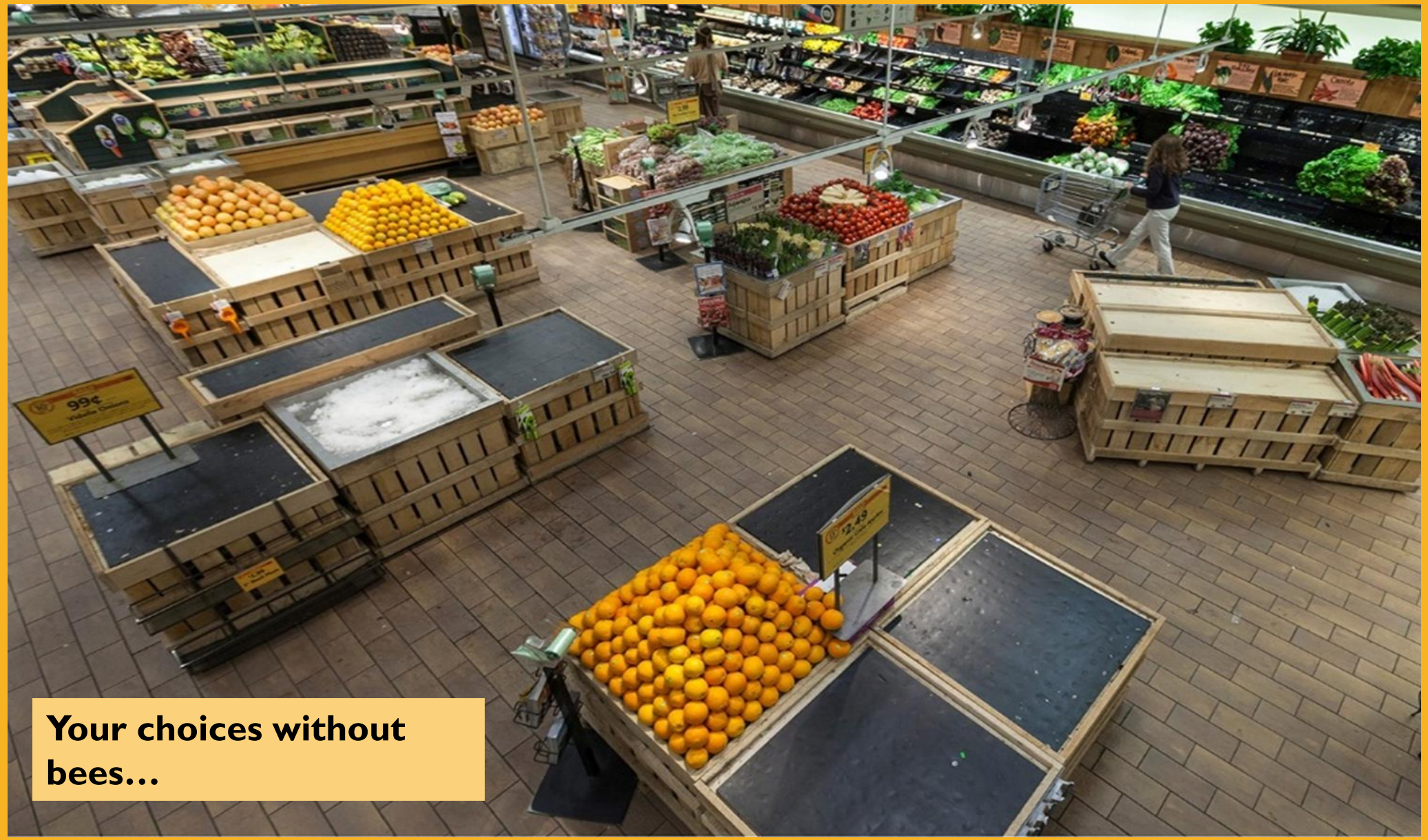
Your choices with bees...



Your choices without bees…


BEES ARE SHIPPED AROUND THE
USA IN TRUCKS

TRAVELLING BEES – LETS GO ON HOLIDAY!

Throughout a year bees may travel to:

- California for pollinating almonds (winter)
- Pacific Northwest for pollinating apples (spring)
- North and South Dakotas for clover, canola and sunflowers (late summer)
- New York for apples (spring)
- Maine for blueberries (summer)
- Massachusetts for cranberries (mid summer)

HAND POLLINATION IN CHINA

- In Hanyuan county, in China's Sichuan province farmers must hand pollinate crops
- Hanyuan is known for its pears
- Pesticide use has led to an extreme reduction in the area's bee population
- Pollination must now occur by hand
- Let's say it takes 30 seconds to pollinate each blossom on a pear tree. Each tree produces about 300 pears. How long would it take you to pollinate 1,000 blossoms to hopefully get 1,000 pears?

LET'S DO THE MATHS

- Let's say it takes 30 seconds to pollinate each blossom on a pear tree. Each tree produces about 300 pears. How long would it take you to pollinate 1,000 blossoms to hopefully get 1,000 pears?
- 1,000 x 30 (Pears x seconds)
  - 30,000 seconds
- 30,000 ÷ 60 = 500
  - There are 60 seconds in 1 minute
- 500 ÷ 60 = 8.333 hours
  - 1/3 of an hour is 20 mins
- It would take you 8 hours and 20 minutes to pollinate 1,000 blossoms, which is only 3 1/3 trees
  - 1,000 ÷ 300 = 3.333

THE MEDICINAL PROPERTIES OF HONEY

- Honey has **antimicrobial** properties
- Honey has low **pH** and high sugar content
- Honey contains **hydrogen peroxide**
- The antimicrobial activity of honey is affected by where the bee feeds, and which plants they visit
- Different plants have different compounds that cause honey to be **antimicrobial**
  - For example, dandelions fight against viruses

BEES IN THE CITY

TIME FOR A VIDEO:

HTTPS://WWW.YOUTUBE.COM/WATCH?V=TQCTVN4QQQU&T=21S

Researchers at Cardiff University have analysed different honey samples from across Wales to look for bacterial resistance

500 honey samples from across Wales were tested

Honey was tested for **antimicrobial** properties

One sample of honey acted as an **antibiotic**

The pollens were identified from this special honey

The plants were identified from their pollen and further studied for their medicinal properties

RESEARCH TIME

POLLEN ACTIVITY

POLLEN

Some of the pollen that researchers identified from our super honey:

- Dandelion
- Clover
- Bluebell
- Oxeye Daisy
- Oak
- Knapweed


Dandelion

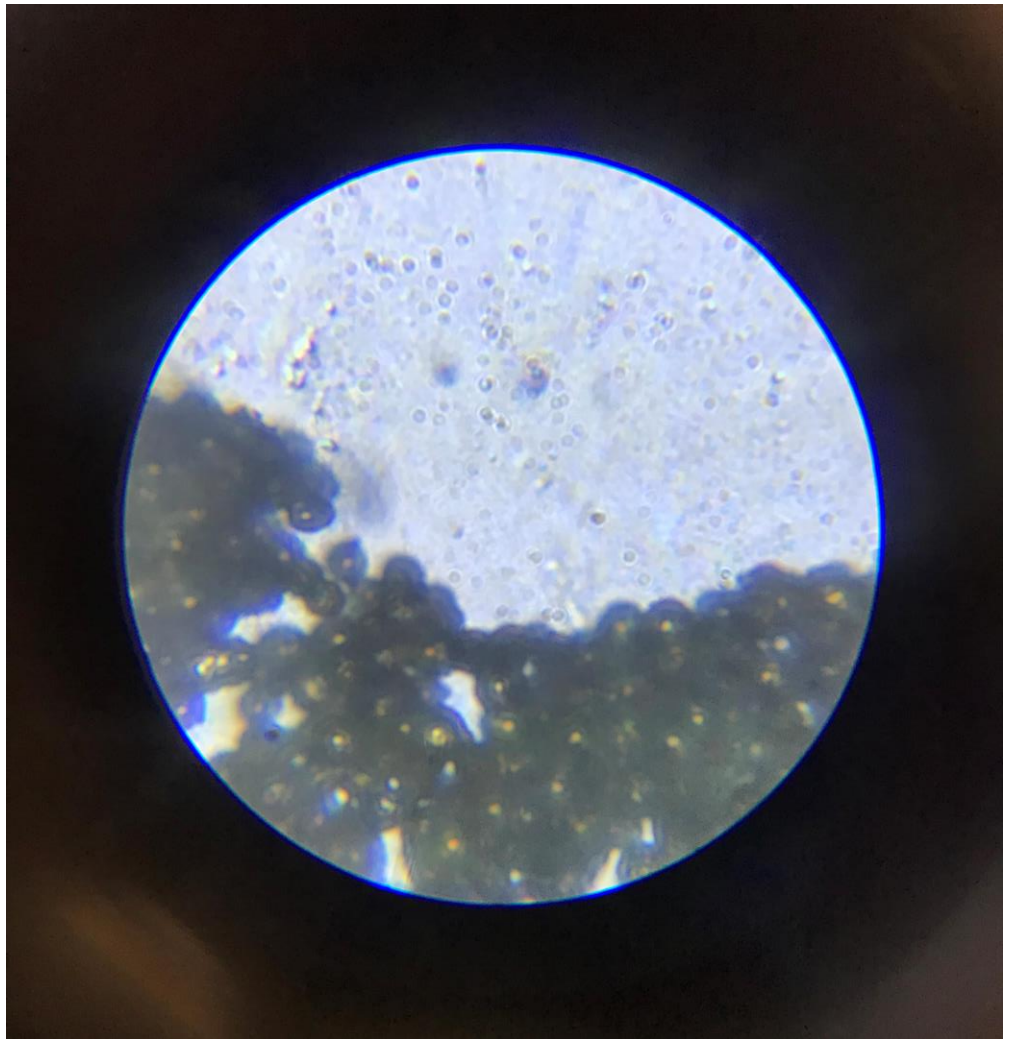

Bluebell


Oak

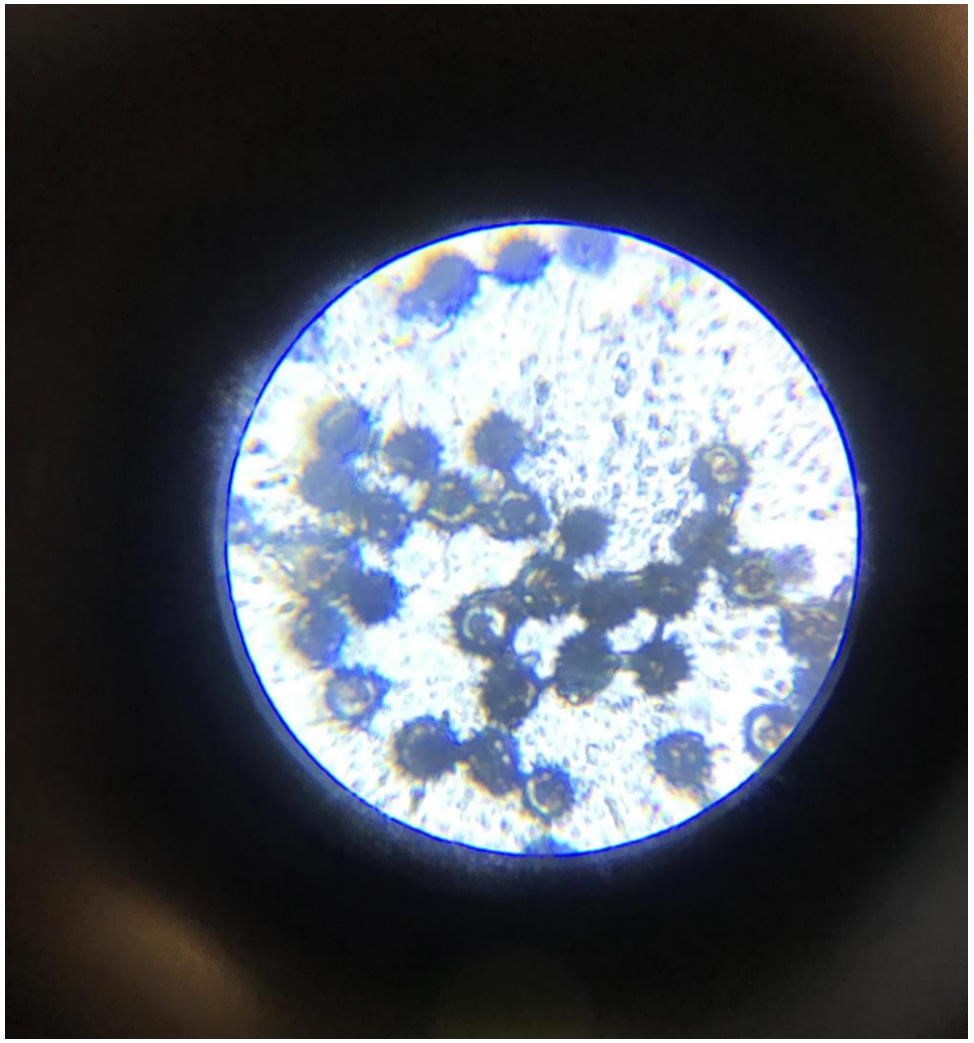

Knapweed


Oxeye Daisy


Clover



Clover Pollen



Dandelion Pollen


ANY QUESTIONS?