EYES on FLIES

DR BRY the FLY GUY

TEACHER'S NOTES

THEMES

- Insects and biodiversity
- Lifecycles and anatomy
- Environment and conservation
- Human uses for insects

CURRICULUM LINKS

Science: Science Understanding (biological sciences, earth and space sciences); Science as a Human Endeavor; Science Investigation.

English: Language, Literature and Literacy.

Arts: Visual Arts, Media arts.

Cross-curriculur priority: Sustainability.

KEY LEARNING OUTCOMES

- Understand insect diversity, lifecycles and behaviours
- Explore insect habitats and endangered species
- Learn insect anatomy and how they communicate
- Recognise species classification
- Appreciate biodiversity and the role of insects in the ecosystem

PUBLICATION DETAILS

Eyes On Flies by Dr Bryan Lessard

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Teacher's notes prepared by Bryan Lessard.

ABOUT THE BOOK

Flies are the most ingenious animals on the planet! Did you know that without flies, there would be no chocolate? Flies help pollinate our fruit and veggies, clean our forests and are the stars of the show – ask the Beyoncé fly! It's time to start celebrating these hairy, buzzing, wriggling and hard-working insects.

Why are flies important in the garden? Do flies play sports? Can flies dance? What would happen if all the flies suddenly disappeared? (Spoiler: We would go hungry!)

Join entomologist Bry the Fly Guy as he takes you on a hilarious, myth-busting adventure to discover the astonishing world of flies!

RECOMMENDED FOR

Primary school readers.

ABOUT THE AUTHOR

Dr Bryan Lessard, better known as Bry the Fly Guy, is an award-winning Australian entomologist and science communicator. He has previously worked at CSIRO and named 50 species of flies new to science, most famously the eye-catching Beyoncé and RuPaul flies. His work has appeared on the ABC, BBC and even *The Ellen Show*. Bryan is passionate about sharing his love of insects with the world and hopes to inspire the next generation of nature-loving scientists to discover and protect our unique biodiversity.

DISCUSSION QUESTIONS: SCIENCE

1. **Ecosystems**

   What are ecosystems? Name five different types of ecosystems and the flies that might live in them. (See 'Mighty maggots', 'Weirdest places flies live', 'When it's warm, they swarm' and 'Catch them all!')

   Ecosystems are areas where living animals, plants and other organisms live and work together. Ecosystems also have non-living (abiotic) factors like temperature, humidity and rocks. Five examples of flies living in different ecosystems:
   1) Antarctic midge ***Belgica antarctica*** living in frozen snow of Antarctica
   2) Brine fly larvae living in volcanic hot springs
   3) Wingless stilt fly living in Albany pitcher plant stomach acid
   4) ***Gyrostigma rhinocerontis*** living in rhinoceros' stomachs
   5) Glow-worms living in caves.

2. **Mimicry**

   What is mimicry? (See 'Masters of Disguise'). Discuss examples of mimicry and the advantages of why certain species look like other animals or things.

   Mimicry is when something has a close resemblance to another animal, plant or object. Bee flies (Bombyliidae) and hover flies (Syrphidae) look like stinging bees to deter hungry predators like birds from eating them. Camouflage is another example of mimicry. An extreme example of mimicry is the ***Macrocilicix maia*** moth that evolved to look like it has bird poo and flies on its wings to hide from predators in the rainforest. The better the mimicry, the better the fly's chances are of not being eaten!

3. **Conservation**

   Why is it important to identify species from areas burned by bushfires?
   (See 'Future flies and why they need our help'.) Discuss the importance of protecting ecosystems and the species living within them.

   Bushfires not only destroy the plants in a burned area, but also the insects, spiders and other animals living there. Strong flying animals like birds can escape the fires, but smaller species like insects can't get away that quickly and lost in the fire. If they are lucky, the eggs or larvae are buried deep in the soil and will survive the fire, waiting for the vegetation to return before they hatch into adults. It's important to know which species are found in burned areas so scientists can track how they are recovering. Unfortunately, it might be too late for some insect species that are endangered. We can help endangered species by protecting their environment, planting native plants that they live in or feed from, and stopping harmful activities like deforestation that can destroy the homes of vulnerable species.

4. Communication

Insects have special structures used to sense their surroundings. How do insects communicate with each other? (See 'On the fly, Love is in the air'.)

Insects use their modified body parts to sense and communicate with the world around them. Compound eyes are used to see the world in detail. Antennae are used to smell by detecting pheromones or scents in the air. Tarsi (a.k.a. feet) are used to taste food. Hairs are used to 'hear' by detecting vibrations in the air.

5. Inspired by Nature

Discuss with the class how nature inspires humans to develop new technologies or better ways to do things.

Some examples include:

1) The tiny anatomy and biological functions of insects inspire new machines and engineering advances (e.g. mini flying robots designed on the wings of flies).
2) New medicines are developed from nature, like penicillin from mould, painkillers from robber fly venom, or even antibacterial spit from maggots.
3) Flies have influenced human languages, including the fly hieroglyphic used by the Ancient Egyptians to mean 'flying through the air', or how flies shaped the Australian accent.
4) Nature can inspire art, like the waterlilies painted by Monet, or inspire characters in science-fiction films such as ***The Fly.***
5) Some businesses are creating new sustainable ways to reduce food waste by diverting food scraps from landfill and feeding it to black soldier fly larvae that are high in protein and can even be fed to fish, chickens or pets, helping to create sustainable animal food.

DISCUSSION QUESTIONS: ENGLISH

1. Why do scientists use special names for animals and plants?

Scientists use both common names (e.g. horse fly) and scientific names (e.g. ***Plinthina beyonceae***). Common names are easy to understand and can represent a broad group of species (e.g. mosquitoes, pitcher plants, etc.). Scientific names are more specific and unique to that species (e.g. ***beyonceae*** is a species name specific to the Beyoncé fly, and it shares its genus name *Plinthina* with its sibling species). Species names are always italicised. (See 'Famous flies'.)

2. What would you name a new species? Species can be named after:

- A place where it was found by adding -ensis at the end of the name (e.g. a species found in Sydney can be called ***sydneyensis)***.
- A male name by adding -i to the end of the name (e.g. ***leei*** named after Stan Lee)
- A female name by adding -ae to the end of the name (e.g. ***beyonceae*** named after Beyoncé).
- A group of people by adding -orum to the end of the name (e.g. ***irwinorum*** named after the Irwin family).

3. What is the name of a scientist who studies insects? What does a day in the life of an insect scientist look like?

Entomologists are scientists who study insects. As part of their job, they go on expeditions in nature to collect insects and bring them back to a museum or laboratory to identify and study them. Entomologists can identify and classify new species to understand their role in nature; protect endangered species; study species that have a role in disease transmission and help keep the insect and disease from spreading (e.g. malaria); develop new medicines from insects (e.g. new painkiller medication); and develop new machines (e.g. flying drones) or applications from insects (e.g. reducing food waste by feeding it to insect larvae).

4. Practise saying scientific words:

- Metamorphosis (meh-tah-MOR-foh-siss)
- Proboscis (pro-BOSS-siss)
- Antennae (ant-TEN-nay)
- *Drosophilidae* (droh-so-FILL-ih-dee)
- *Calliphoridae* (cah-lee-FOR-ih-dee)
- *Plinthina* (PLYN-thee-nah)
- *beyonceae* (bee-YON-say-ee)

CROSS-CURRICULUM ACTIVITIES

1. Discovering and classifying a new species

Imagine that you are an entomologist who just discovered a brand-new insect species! Draw your new species so other scientists can identify it. Don't forget to colour it!

What are you going to name this exciting new species? (Remember you can't name it after yourself and the name can't be rude!)

What makes this species unique? What are the features that makes it different to other species?

Where did you find this new species? Where does it live in nature?

Does your new species have a special role in the ecosystem? (Is it a pollinator, a nutrient recycler, or does it have any special skills?)

Present your new species to the class.

Discuss with the class why it's important to name and classify species. Get the students to add their new species in a shared pile and work together to classify them into groups (e.g., sort by insect orders, colours, shapes, where they live or what their role is in nature, etc.).

2. See, snap and share! Start a digital insect collection.

Encourage students to start a digital insect collection by photographing insects that they find in the playground or backyard. Get the students to become citizen scientists by using apps like iNaturalist that allow students to upload photographs to species databases and identify species (kind of like a Pokédex from Pokémon). This data will also be used by real life scientists to keep track of biodiversity!

Challenge the students to collect species from at least five different insect orders, including flies (Diptera), bees and wasps and ants (Hymenoptera), dragonflies (Odonata), moths and butterflies (Lepidoptera) and beetles (Coleoptera). Bonus points for including additional insect orders. Get the students to write down biological information for each species, like where the species was found, the date it was spotted, and any notes on its microhabitat (e.g. was it found in leaf litter or on a flower?).

RESOURCES

Hatching a horse fly from pupa to adult:
youtu.be/JL9lcAR1xe4

Why did scientists name a species after Deadpool?:
youtu.be/4GbwEf-dgGA

Behind the News: new superhero insects:
youtu.be/80vkRNLFP_8

Collecting insects on Lord Howe Island with Bry the Fly Guy:
youtu.be/mKf1UDAxaw4

Bry the Fly Guy tells us why flies are cool:
youtu.be/arWhMk1sxr0

Bry the Fly Guy's TEDx talk on why we should appreciate the humble fly:
youtu.be/HUrv57P0VAg

3D scanning insects with Bry the Fly Guy:
youtu.be/G8bqwxSJzrM

ABC Landline: using technology to protect our wildlife and insects:
www.abc.net.au/catalyst/the-wildlife-revolution/13482358

10 Reasons Why Entomology is Pokémon In Real Life:
www.buzzfeed.com/brytheflyguy/10-reasons-why-entomology-is-pokamon-irl-2hisx

Where do flies sleep?:
theconversation.com/curious-kids-where-do-flies-sleep-92175

This is why you won't be able to swat that fly:
theconversation.com/this-is-why-you-wont-be-able-to-swat-that-fly-89755

Atlas of Living Australia:
www.ala.org.au

iNaturalist (citizen science):
www.inaturalist.org/places/australia

More videos and resources:
www.brytheflyguy.com

WORKSHEET

Lifecycles

ndergo a shape-shifting process called metamorphosis. Print and carefully cut out each life stage and arrange the fly lifecycle in the correct order. Label each life stage. (Alternatively, students can draw and label each life stage).

Watch this video of a horse fly hatching: **youtu.be/JL9lcAR1xe4**

Fly life cycle

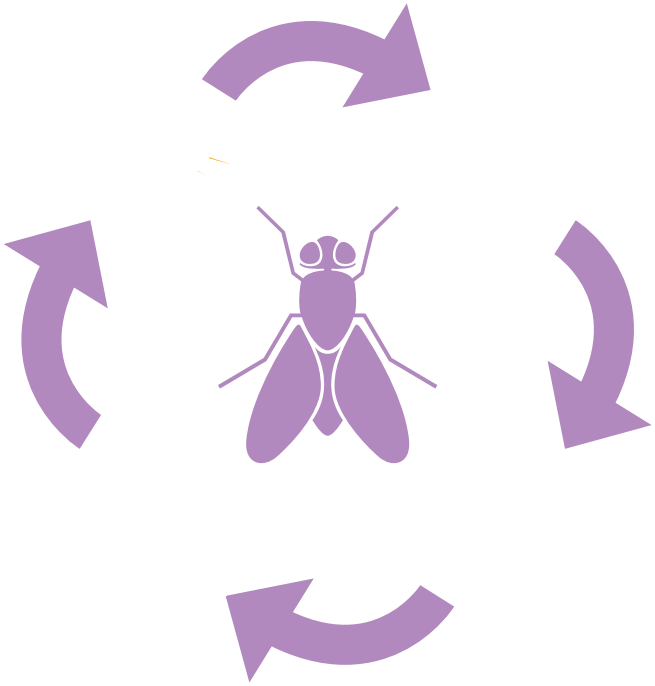


Image credit: Shutterstock

ANSWERS

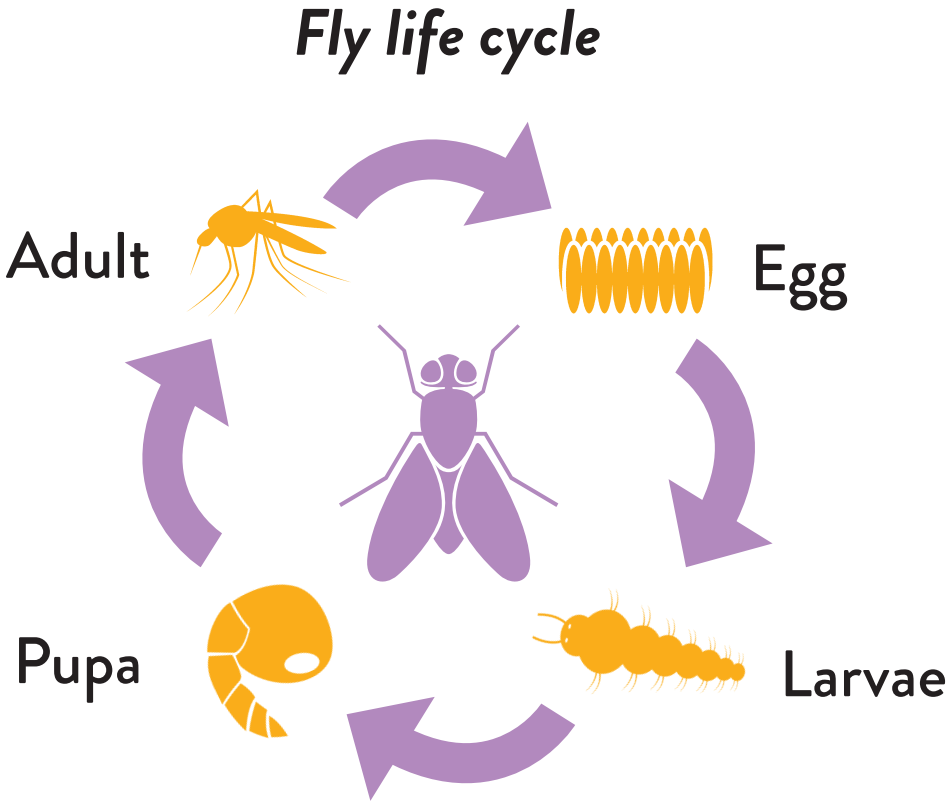


Image credit: Shutterstock

WORKSHEET

Anatomy

Scientists need to know what an insect looks like and the different parts of its anatomy to correctly identify species. Label the main features of the RuPaul fly (*Opaluma rupaul*). What is the function of each structure?

Bonus activity: draw and label another insect species and compare their similarities and differences.

Haltere | Abdomen | Thorax | Eyes

Leg | Wing | Antenna

Image credit: CSIRO, Bryan Lessard

ANSWERS

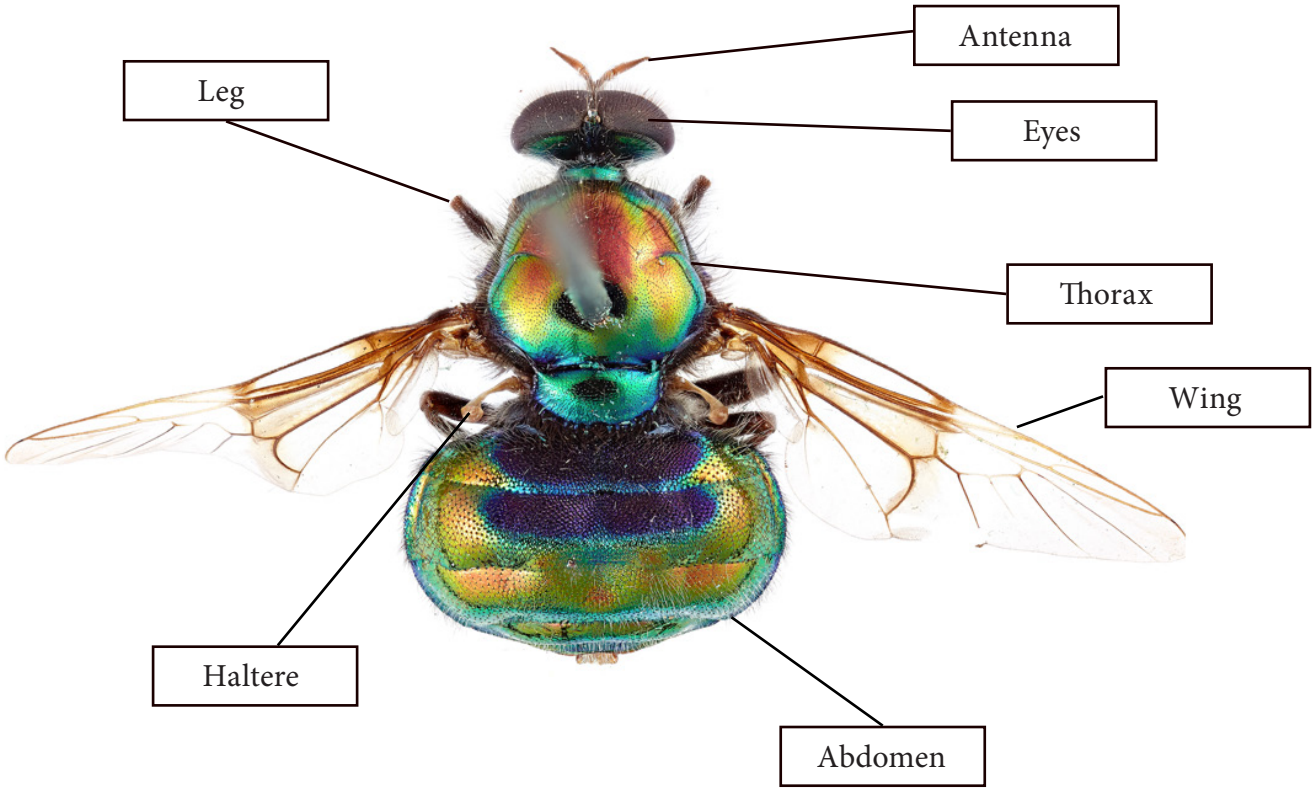


Image credit: CSIRO, Bryan Lessard

WORKSHEET

Classification

Classifying species is an easy way for scientists to organise the millions of species living on the planet. Scientists use different ranks to group similar species together, starting with kingdom, phylum, class, order, family, genus and species (see 'Famous flies' on page 19). An easy way to remember the ranks in the correct sequence is by using the saying Keep Pots Clean Or Family Gets Sick.

Fill out the classification table below to see what you and these fun species have in common. (Hint: if you can't find the name of the rank in the book, you can use the Atlas of Living Australia to find it using the 'Classification' tab).

Rank	You	RuPaul Fly	Bird Poo Moth	Koala
Kingdom				
Phylum				
Class				
Order				
Family				
Genus				
Species				

1. What rank do all these animals share in common?
2. What is the highest rank where all of these animals are different?
3. What ranks do humans and koalas have in common? What separates us and koalas from insects?
4. Discuss why classification is important.

ANSWERS

Rank	You	RuPaul Fly	Bird Poo Moth	Koala
Kingdom	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Athropoda	Athropoda	Chordata
Class	Mammalia	Insecta	Insecta	Mammalia
Order	Primates	Diptera	Lepidoptera	Diprotodontia
Family	Hominidae	Stratiomyidae	Drepanidae	Phascolarctidae
Genus	Homo	Opaluma	Macrocilix	Phascolarctos
Species	sapiens	rupaul	maia	cinereus

1. Kingdom

2. Order

3. Humans and koalas are from the same kingdom (Animalia), phylum (Chordata) and class (Mammalia), which means we are all animals that have backbones and feed our young with milk. Insects are also animals but from a different phylum (Arthropoda) and class (Insecta). They have exoskeletons instead of backbones, and they do not feed their young with milk.

4. Classification is important because it allows us to organise the millions of living species in the world into common groups that share characteristics. This helps us separate larger groups, like animals and plants, and identify species. Without classification we wouldn't be able to identify species and wouldn't know which species are food, which are endangered and in need of our protection, which have useful chemicals that could be turned into medicines, or which carry disease or could become pests.

WORKSHEET

A Pretty Fly Quiz

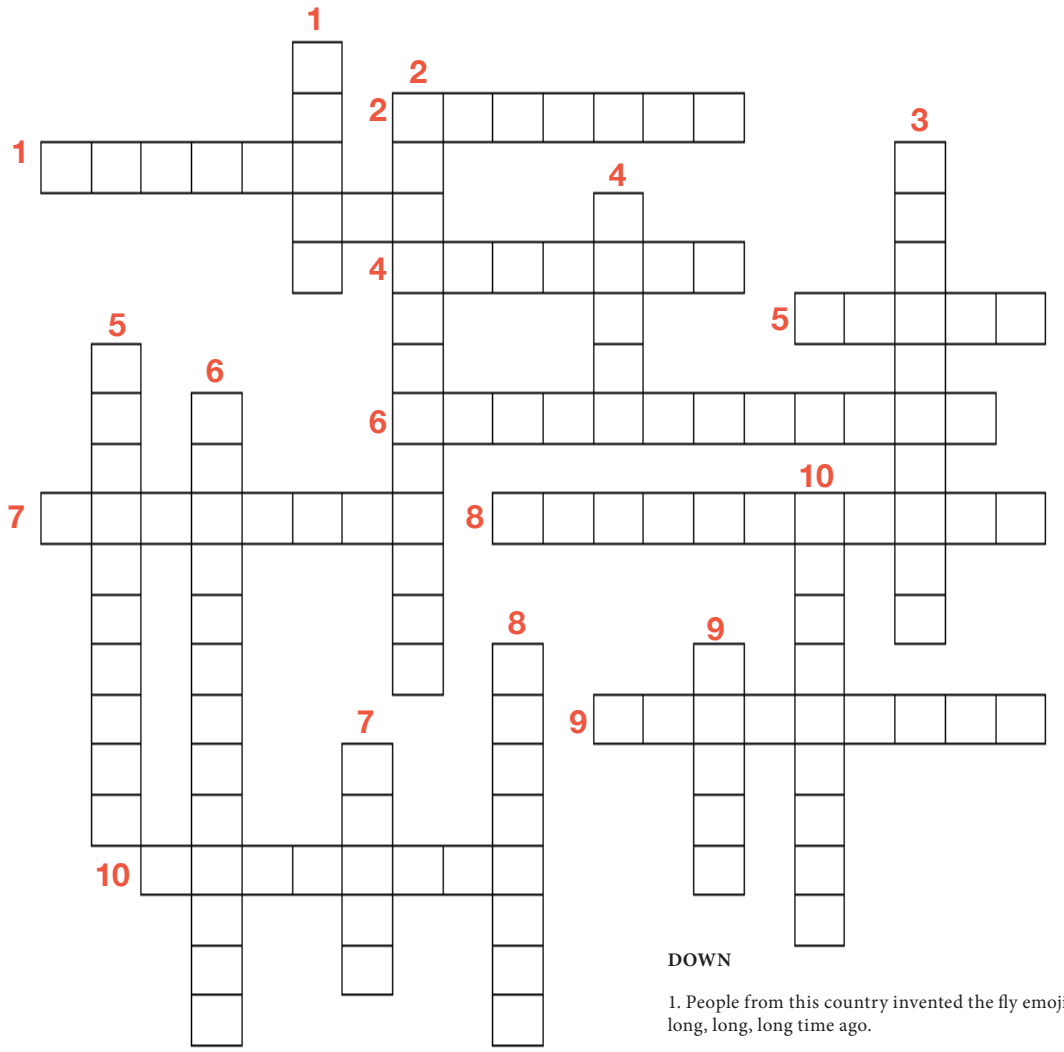
1. How many species of flies are there in the world?
2. What kind of fly bowls her eggs down a spider burrow?
3. What three ingredients in our tears and sweat are bush flies looking to slurp?
4. How long ago did the earliest flies roam the Earth?
5. What does ‘mosquito’ mean in Spanish?
6. How many people in the world already eat edible insects?
7. What is the family name of glow-worms?
8. Why do some blow flies blow bubbles?
9. How many new species has Bry the Fly Guy named?
10. Why is the family Milichiidae called freeloading or jackal flies?
11. What proportion of all the species on Earth have scientists already named?
    a) one quarter,
    b) two quarters,
    c) three quarters,
    d) all of them!
12. What is insect blood called?
13. True or false: scientists send insects to each other in the mail?
14. How many years did the *Opaluma* flies wait to be named?
15. Do bat flies have wings?
16. How high can mosquitoes fly in the air?
17. What is the scientific name for the biggest fly in the world?
18. Why is it that only female horse flies and mosquitoes bite?
19. What do you call a food gift that is given by a male dance fly to a hungry female?
20. Name four things that flies are good at doing in the garden.

ANSWERS

A Pretty Fly Quiz

1. 160,000 species.
2. A bee fly.
3. Water, protein and electrolytes.
4. 247 million years.
5. Little fly.
6. Two billion people.
7. Keroplatidae.
8. To stay cool.
9. 50.
10. They steal food from spiders.
11. a) one quarter.
12. Haemolymph.
13. True.
14. 100 years.
15. No.
16. 300 metres.
17. *Gauromydas heros*.
18. They need the protein in blood to ripen the eggs.
19. A nuptial gift.
20. Pollinating, eating pest insects, feeding animals and composting/recycling nutrients.

WORKSHEET



ACROSS

1. The RuPaul fly and black soldier fly are from the same _____ rank Stratiomyidae.

2. A singer who shares her name with a famous horse fly.

3. Gross to us, but a blow fly maggot's favourite food.

4. The scientific name for flies.

5. A nicer, more scientific name for a maggot.

6. A scientist who studies insects.

7. The scientific name for the second pair of fly wings that turned into lollipop-like knobs.

8. Move over bees, flies are amazing_____ in the garden.

9. We can thank flies for this delicious treat.

10. _____ entomologists study maggots to solve crime.

DOWN

1. People from this country invented the fly emoji a long, long, long time ago.

2. One word to describe the huge variety of all living things like animals, plants and microorganisms.

3. Scientists use one of these to look at tiny insects up close in more detail.

4. Robber flies inject _____ when they bite prey which could one day be turned into new medicines.

5. A super chill species of fly that shares its name with a frozen continent.

6. The process of how an egg shapeshifts into a larva, pupa, and finally an adult.

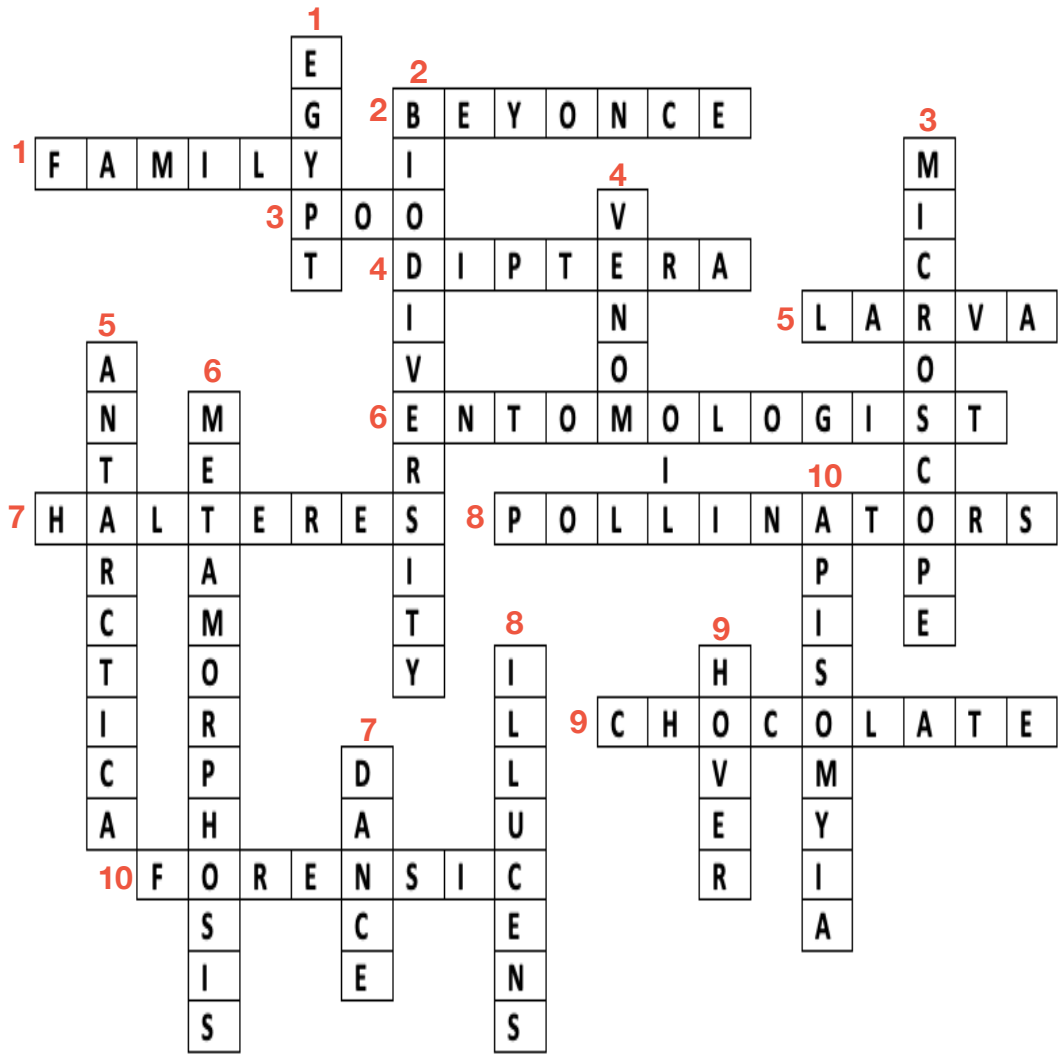
7. Empididae are better known as _____ flies because they love to bust a move.

8. From fly burgers to flying cars, this superpowered fly species could help save the world.

9. Adult _____ flies pollinate, their larvae eat aphids and ants are scared of getting gifts from them.

10. A fly that looks like a bee so much, it's scientific name literally means 'bee fly'.

ANSWERS



ACROSS

1. Family
2. Beyoncé
3. Poo
4. Diptera
5. Larva
6. Entomologist
7. Halteres
8. Pollinators
9. Chocolate
10. Forensic

DOWN

1. Egypt
2. Biodiversity
3. Microscope
4. Venom
5. Antarctica
6. Metamorphosis
7. Dance
8. *illucens*
9. Hover
10. *Apisomyia*