GREEN ADELAIDE

Ants

teacher information pack

About this pack

This pack is a resource for students and/or as a teaching aid in developing lesson plans and units of work. It provides you with background information on ants and some of the amazing things they do. A number of interactive links to online fact sheets, websites and others resources are included in this pack, so we recommend using it as an electronic document saved on your computer or tablet, rather than printing it.

The pack also contains a number of fun activities that you can run with your students. These activities are complete with detailed instructions and worksheets for students, as well as other learning ideas that you can tailor for you and your students' specific needs.

We have attempted to use language easily understood by most readers and to explain complicated concepts in plain English. Due to the scientific nature of the topic, some more advanced terms are used. For the most part, these words are underlined on first use and have been listed and defined in the glossary at the back of this document.

Contents

Ant anatomy and lifecycle

What is an ant?

Ants are insects (Class: Insecta) belonging to the Order Hymenoptera (along with their closest relatives bees and wasps) and the Family Formicidae.

Insects have:

- three main body segments (head, thorax, abdomen)
- three pairs of jointed legs
- one pair of antennae.

Ants have:

- one pair of compound eyes, located on each side of the head
- mandibular mouthparts (jaws)
- thin waist (petiole) consisting of one or two connecting segments (nodes)
- colonies with complex social structures.

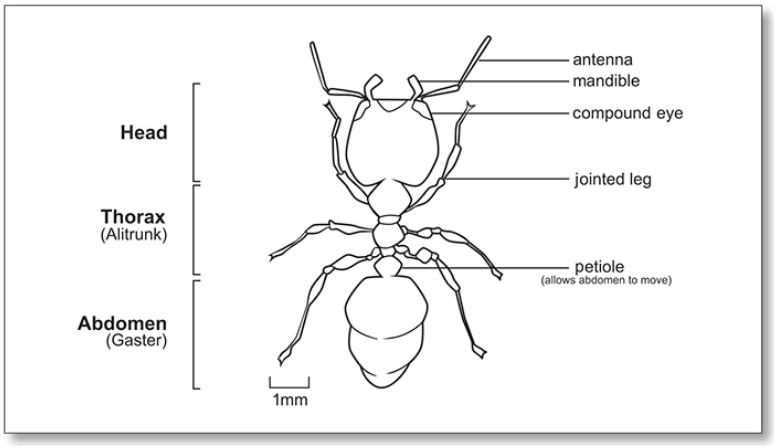


Figure 1 – Diagram of the anatomical features of an archetypical ant

Refer to **Figure 1** for a diagram of the main anatomical features of an ant.

Male vs female ants

The vast majority of ants in any given ant colony are female. Female ants are the *worker* ants commonly seen foraging in the backyard, schoolyard, kitchen and elsewhere. These ants are sterile, wingless and, depending on the species, may live for as little as 70 days (e.g. Pharaoh Ants) or as long as five years.

The exceptions to this are *queen* ants, which are fertile and winged, larger, and usually live much longer than worker females and male ants. In some species queen ants can live for decades!

Male ants, also known as *drones*, are far less common and can be identified by their smaller heads and longer antennae. They are winged and fertile and their only purpose is to mate with the queen, after which they die.

Ant senses

Sight

Most species see with two compound eyes. Some species also have ocelli that detect light, while others are completely blind. The compound eyes of an ant are composed of dozens to thousands of tiny lenses called facets. Species that rely on their vision for hunting have very well developed eyesight; an example of this is the Inch Ant (*Myrmecia pyriformis*), which is capable of tracking prey at distances of up to 1 metre.

Hearing

Ants lack ears; however, they are capable of 'hearing' by detecting sounds in the form of vibrations via sensory organs located in their feet and just below their knees. Research suggests that ants are able to produce and detect sound cues that recruit other ants to food sources, and as alarm signals.

Touch

Tactile communication (communication by touch) is one of the most important means of communication among ants. This occurs primarily through an ant's antennae, also known as 'feelers', which are located upon its head. Specifically, communication occurs via fine hairs located on the tips of the antennae. Ants may touch one another with their antennae to determine if the other ant is from the same colony, and to solicit food from an ant of the same colony, among other reasons.

Taste

Ants taste food through receptors located in their mouths and antennae.

Smell

Smell is an extremely important sense for ants. The main use of smell among ants is for olfactory communication. Ants communicate with members of their own colony and other colonies primarily using chemicals known as pheromones, which they secrete to convey a variety of messages. Ants detect the pheromones via olfactory (scent) receptors located in their antennae.

Ant life cycle

The life cycle of an ant includes metamorphosis and consists of four stages; egg, larva, pupa and adult. Refer to **Figure 2** for an illustrated representation of this cycle.

Stage 1: Egg

After mating, a fertile winged female (also known as a *princess*) becomes a queen and is ready to begin her own colony. She lays the eggs that will eventually become the first workers. In mature colonies, the queen can lay thousands of eggs every day. Some eggs never develop; instead, nest mates eat them for extra nourishment.

Stage 2: Larva

Larvae (singular: *larva*) are the small, white, maggot-like creatures that hatch from eggs.
They have no eyes or major organs and are entirely dependent upon adult worker ants to care for and them. When a nest is disturbed, worker ants can often be seen carrying larvae to safety.

Stage 3: Pupa

After reaching a certain size, the larvae begin to pupate and metamorphose into their adult form; changing shape into a pale version of the adult ant, with legs held tightly against the body. In some species, the larvae spin a silk cocoon around themselves before beginning pupation.

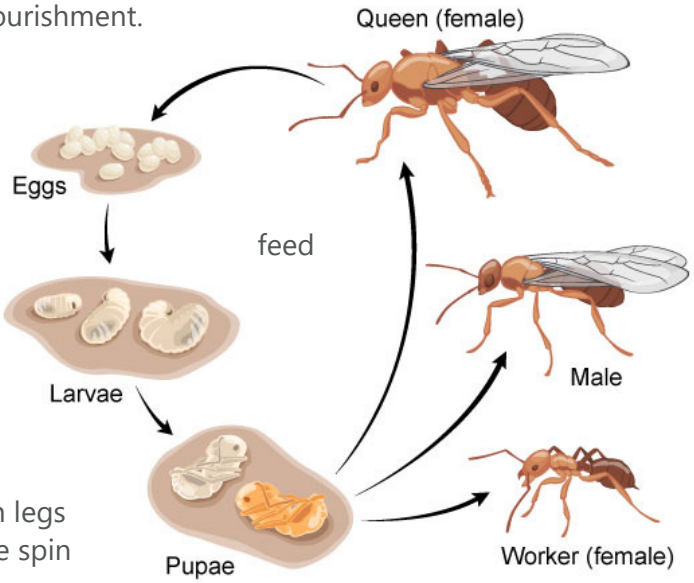


Figure 2 – Diagram of the life cycle of an archetypical ant

Stage 4: Adult

After the development of the pupa (plural: *pupae*) is complete, the ant emerges from the cocoon (if present) as an adult ant. The events during the previous stages determine the nature of the adult ant. The vast majority of eggs will become sterile, female worker ants after pupation. However, specially fed larvae develop into fertile princesses and male ants (drones). Interestingly, drones actually arise from *unfertilised* eggs.

Ant diet and habitat

Ant diet

The collective diet of all ant species on Earth is incredibly diverse, though some individual species have highly specific diets. Most ants are omnivores, scavenging for food such as seeds, fruits, nectar and, in some species, hunting for insect prey. Some species of ants have developed unique and fascinating methods of obtaining food, such as:

Leafcutter Ants (the farmers)

Leafcutter Ants have evolved an amazing symbiotic relationship with fungi that allows them to grow, harvest, and consume their food in a controlled environment; in the same way that humans grow and harvest crops. Leafcutter Ants live in South and Central America and some parts of the southern United States. They live in forested areas where they cut leaves from trees, carry them back to their nest, and chew them into a pulp. This pulp 'fertilises' a colony of edible fungus that lives within the nest and is maintained by the ants (see **Figure 3**).

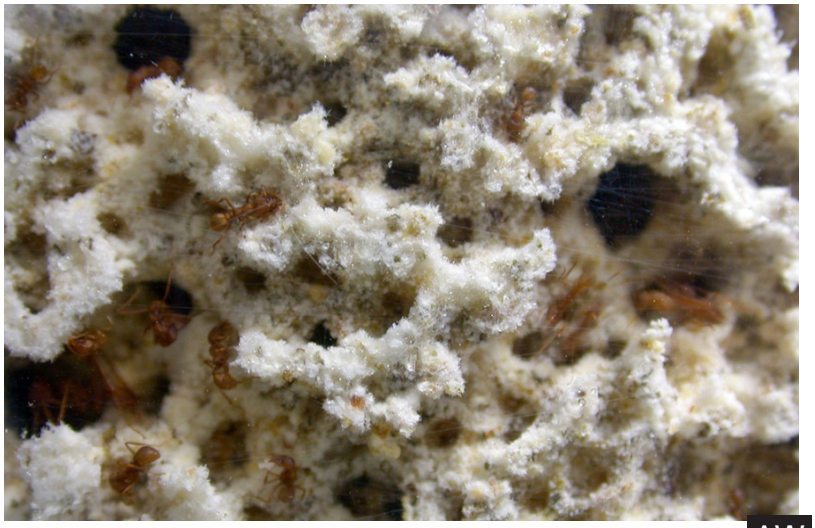


*Figure 3 – Fungus garden of Leafcutter Ants (*Atta laevigata*)*

To prevent infection, the fungus is cleaned, fed with leaf pulp and, when it matures, is eaten by the ants. The fungus is the ants' sole source of food and the relationship between the ant and the fungus has existed for so long (about 50 million years) that neither can survive without the other. When a young leafcutter queen leaves the nest to establish her own colony, she takes a piece of fungus with her to start a fungus garden in her new nest.

Dairying Ants (the herders)

Some ants belonging to Genera such as *Camponotus* and *Rhytidoponera* have the amazing ability to domesticate and 'milk' scale insects such as aphids in a similar way to humans farming cows for milk. Aphids are tiny insects that feed upon the sap of plants and secrete a sweet, nutrient-rich substance known as honeydew. Some ants have a mutualistic relationship with these insects as the ants protect both the aphids and the plants they live on. In return, the ants feed upon the honeydew produced by the aphids. Ants that gather food in this way are known as 'dairying ants' and some species stimulate the aphids to release the energy-rich honeydew by stroking them with their antennae.

Dairying ants defend the aphids from predators, move them up and down the plant to areas with the best sap and even carry them to shelter, sometimes into their own nests, during rain.

Some highly specialised ant species even collect the eggs of aphids that feed upon plant roots and then carry them into their nest. The ants care for the eggs as they develop and, when they hatch, they move the young aphids into suitable chambers where they can feed on plant roots and provide food for the ants within the safety of the nest.

Humans and ants are the only animals in the world known to domesticate and farm other animals.

Army Ants (the hunters)

Unlike most ants, Army Ants are exclusively carnivorous, fearsome predators capable of killing animals many times larger than themselves. The term 'Army Ant' refers to any member of about 300 species characterised by their aggressive group hunting behaviour. Army Ants have a unique way of hunting in which they move forwards together in a large, densely packed group, devouring any suitable prey in their path without stopping. This foraging behaviour is known as a *raid*. During raids, Army Ants may consume prey such as spiders, grasshoppers, beetles, other ants, lizards, frogs and even small snakes. Army Ant raids can have lines up to 200 meters long, 20 meters wide and can involve hundreds of thousands of ants. During raids, ants can create bridges with their own bodies, sometimes for several hours, allowing other members of the colony to climb over them and continue the raid at a faster pace.

Army Ants are also unlike many other ant species, as they do not construct a permanent nest. Instead, they simply move from place to place over time in search of prey, resting between raids.

Ant habitat

Ants live on every land mass except Antarctica, the Arctic, and a few remote islands. The habitats of individual species vary; some are *arboreal* (live in trees), whereas others lack a home entirely and live a nomadic lifestyle, such as the aforementioned Army Ants. However, most species of ants live in an underground network of tunnels and chambers known as a nest.

New queens start construction of their own nests, with the first brood of workers further developing these structures. Nests vary between species, ranging from shallow holes in the ground housing only a few individual ants to large networks containing tens of chambers connected by tunnels and housing a colony of hundreds of thousands of ants.

Nests can also be extraordinarily deep. *Messor aciculatus*, a species of Harvester Ant found in Asia, builds the deepest nest of any known species of ant, with nest depths up to four meters.

Refer to the 'ant nest excavation' video (see 'More activities and resources' section) for a demonstration of the massive size and intricate structure of the nest of a Leafcutter Ant colony.

Figure 4 shows a plaster cast of a Harvester Ant nest next to an adult man for scale. This particular nest contained 135 chambers and a total of 12 meters of vertical shafts. Note the spiral-like structure of the descending vertical tunnels.

Figure 4 – Plaster cast of Pogonomyrmex badius *nest showing internal structure*

The structure of a specific ant nest is tailored to suit the needs of the colony, with different chambers serving different purposes. In a typical nest, the chambers are divided into the following uses:

Queen's chamber – The queen digs this chamber when she establishes the nest and it is where she resides and lays the eggs.

Egg chamber – Nurse ants move the eggs into this chamber.

Nursery chamber – Once eggs have hatched into larvae, mature worker ants tend them in this temperature-controlled environment. The pupae also remain here until they fully develop into adult ants.

Food storage chamber – Some species have dedicated chambers for storing food such as seeds, while other species, such as Leafcutter Ants, use this chamber for the fungus garden that provides the colony's source of food.

Waste chamber – This chamber is where waste material produced by the colony, such as seed husks and dead ants, is deposited to maintain the cleanliness of the nest.

Ant colonies move nests surprisingly often — for most species, once or twice a year. However, some species have been recorded moving nests after as little as 15 days (e.g. *Pristomyrmex pungens*). Other species, which construct mound nests or deep, highly secure nests have been observed at the same location for more than 10 years (e.g. *Camponotus herculeanus* and *Myrmecocystus mimicus*).

We do not completely understand why ants move nests, although most nest-relocations are due to either physical disturbance, flooding, change in nest microclimate, or predation.

Ant behaviour

Ant communication

The communication system of ants is highly sophisticated and extremely efficient. It allows individual members of a colony to work together towards a common goal with no leader coordinating their actions.

The main method of ant communication is via chemical signals known as pheromones. Pheromones are strongly scented chemicals secreted by ants from glands located all over their bodies. These chemicals convey a specific message when detected by other ants. Pheromones are detected via sensory organs found in ant antennae. This olfactory communication is one of the most important ways in which ants communicate.

The foraging system of ants relies heavily upon pheromones and occurs as follows:

1. Worker ants wander randomly in the area around their nest until they find a suitable source of food. As the workers travel, they lay behind them a faint pheromone trail.
2. After finding a food source, the ant then either feeds upon the food it has found or carries it back to its nest, using the pheromone trail laid earlier to guide it. As it returns to the nest, the worker lays an even stronger trail of a 'positive' marking pheromone.
3. Other ants that come across this trail follow it until they too reach the food, feed upon it or pick it up and then return to the nest, laying more pheromones as they go and strengthening the existing trail.
4. This cycle continues until they deplete the food source. At this point, workers will still follow the trail of pheromones to the spot where the food was located, however, upon discovering that the food is no longer present, they will return to the nest without laying any more positive pheromones. Pheromones are extremely volatile substances, which evaporate quickly. Without reinforcement, pheromone trails leading to depleted food sources disappear quickly and are no longer followed.

In some species this system is even more sophisticated, as some workers have the ability to lay negative 'do not follow' pheromones. Workers returning to the nest from a trail that leads to an unproductive food source lay these pheromones. The pheromones indicate that the trail is not worth following and prevent ants from wasting energy following a trail that does not lead to a food source.

This foraging system is simple yet highly efficient. If workers find multiple paths to a food source, the shortest path is selected and used. A simplified version of this system is shown in **Figure 5**.

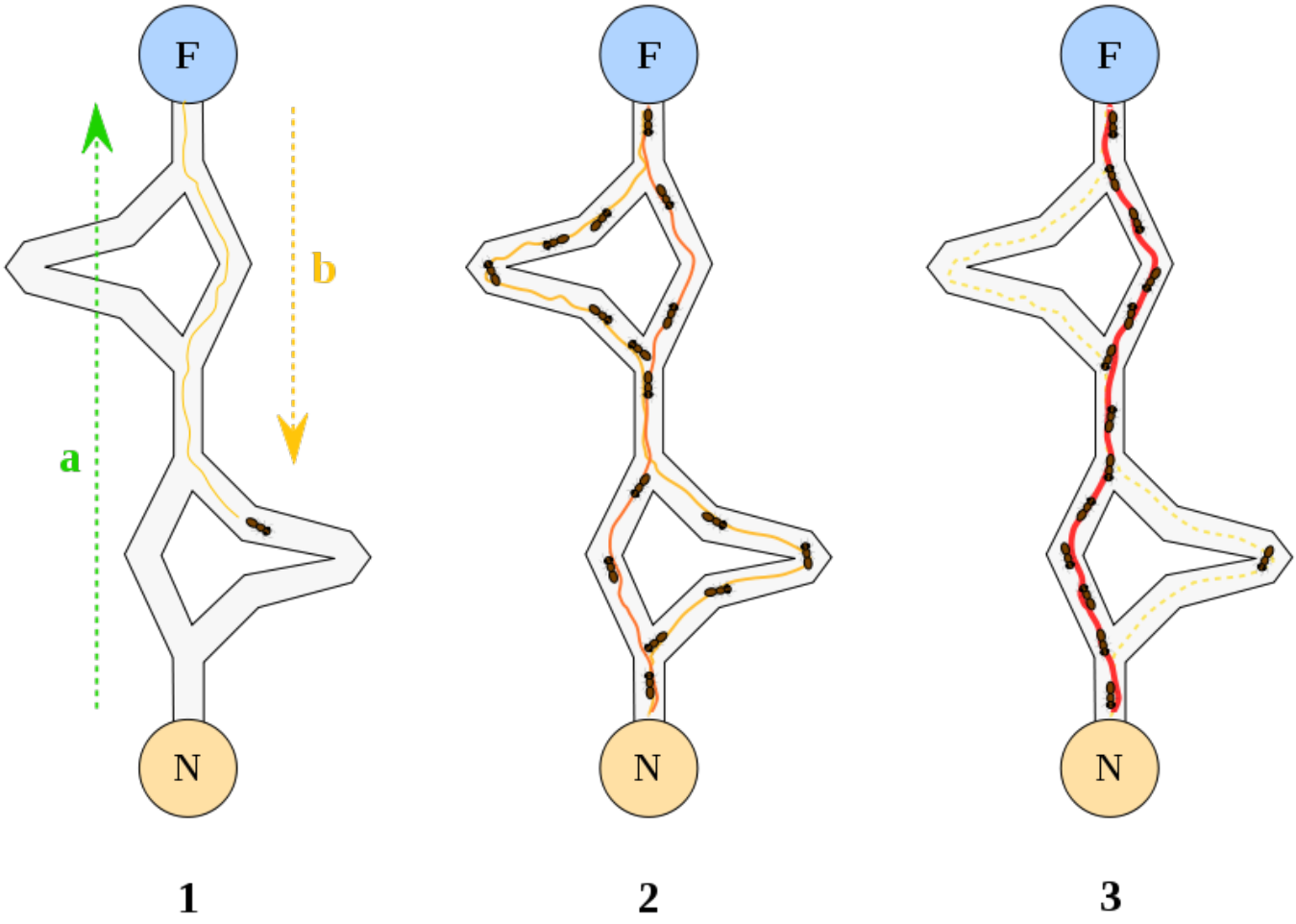


Figure 5 – Ant foraging trail optimisation along the shortest route from nest (N) to food (F)

The first ant finds a food source, then returns to the nest while laying a pheromone trail. Other ants follow one of the four possible paths, but the shortest path is reinforced more quickly than the longer paths, making this one more appealing. The ants continue following the shortest path and adding to pheromone trail. The pheromone trails of the longer paths evaporate.

Ant roles and daily activities

Within an ant colony a social structure exists; each ant has a role to play that is most suited to its age, body type, and caste. The main factors that determine an ant's role in the colony are its age and its gender. See the table below for an outline of the roles commonly undertaken by ants within a colony.

Role	Daily activities	Gender	Age
Nurse	Nurse ants take care of the eggs, larvae and pupae of the colony. They feed, clean and move them around to ensure that they hatch safely.	Female (worker)	Young age
Nest worker	Nest workers maintain and expand the nest by digging. In Leafcutter Ants, nest workers also tend to the colony's fungus garden.	Female (worker)	Middle age
Forager	Foragers search the area near the nest entrance to find food, return it to the colony and signal other ants to do the same using pheromones.	Female (worker)	Middle to old age
Soldier	Soldier ants defend the colony from rival ants and other threats. In some species, some ants are born larger than others and are destined to become soldiers. Soldier ants may bite, sting or spray poisonous chemicals to ward off attackers.	Female (worker)	Age varies

As shown, female worker ants carry out all of the work within a colony. The only function of the males is to mate with young queens and the only functions of the queen are to found a new colony and lay eggs.

Ant ecology and significance

Ants in the ecosystem

Ants have a huge influence upon the ecosystems in which they live and they are often referred to as 'ecosystem engineers'. It is estimated that ants constitute approximately 15—20% of the terrestrial animal biomass and, in tropical regions where ants are especially abundant, they account for 25% or more of the biomass.

Some of the most significant impacts ants have upon their environment are:

As decomposers

Decomposers recycle nutrients within an ecosystem by breaking down dead matter and returning it to the soil in a form usable by plants. Some of the most important decomposers are fungi, earthworms and, according to recent research, ants.

Ants feed on organic waste and dead animals, returning the nutrients found in this material to the soil in a usable form via their faeces. The other effect of this feeding is to 'clean' the environment by reducing the amount of waste and dead material in the ecosystem, which prevents the growth of dangerous bacteria, thereby preventing disease.

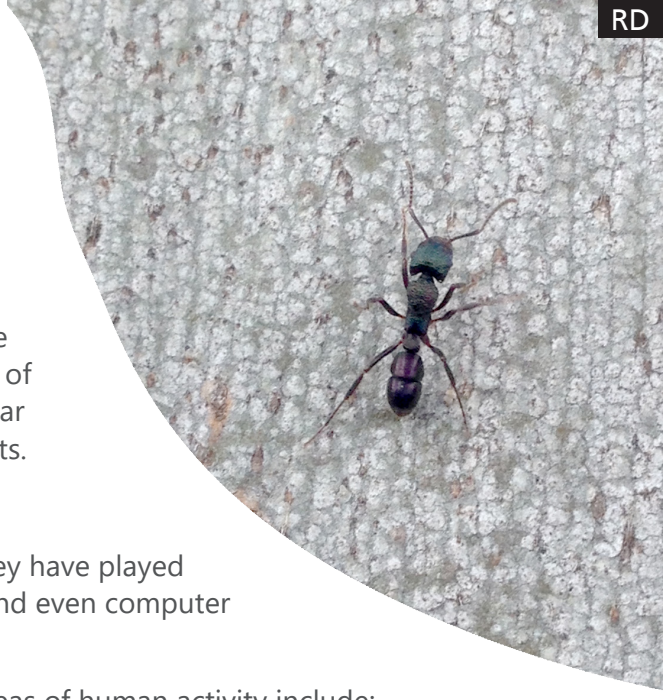
As seed dispersers

Seeds form a large part of the diet of many different ant species, and ants in general are one of the most important seed dispersing insects on the planet. Seed dispersal by ants is known as *myrmecochory*.

Many plants produce seeds with two parts: a hard-coated component containing the plant embryo, and a food body known as an *elaiosome*. This food body is rich in fats and carbohydrates and is sometimes laced with a chemical attractant that stimulates collecting behaviour in ants. After finding these seeds, ants carry them back to their nests where the elaiosome is consumed, the hard seed component is then moved by the ants to their waste pile (see **Figure 6**). The waste pile provides the seed with a warm, moist environment that promotes germination and the organic material in the pile nourishes the young plant.

This behaviour greatly benefits the biodiversity of the local environment by increasing the distribution of seed-producing plants.

*Figure 6 – An ant (*Rhytidoponera metallica*) carrying a seed by its elaiosome*



As food for other animals

Ants are an important source of food for many different species of animals in a variety of ecosystems; including *mammals*, *spiders*, *lizards*, *frogs*, *birds* and *fish*. Some animals have evolved to feed specifically on ants and other similar insects. These species include *Echidnas*, some ants, and *antlions*, which are the larvae of a group of insects belonging to the Lacewings (Order Neuroptera). A particular species of parasitoid fungi also infects and eventually kills ant hosts.

Importance for humans

Ants are a highly beneficial group of insects for humans where they have played significant roles in science, technology, agriculture, horticulture, and even computer programming.

Some of the important contributions that ants make to various areas of human activity include:

Agriculture

Ants are capable of improving soil aeration and water penetration due to their tunnelling. They increase the level of nutrients present in the soil by breaking down complex molecules that would otherwise be unavailable to plants; thereby increasing nutrient availability in the soil and promoting crop growth.

A study conducted in Western Australia found that the presence of ants and termites in a dryland agriculture setting increased wheat yield by 36%. The same study also found that the presence of seed-eating ants resulted in a 50% reduction in the number of weeds.

Pest control

Ants prey upon household pests and/or their larvae, including insects such as flies, fleas, silverfish, cockroaches, and termites. These pest insects can consume food, spread disease and, in the case of termites, cause structural damage to buildings.

Ants also feed on agricultural pests such as fruit flies and caterpillars, reducing and sometimes eliminating the need for expensive and potentially harmful chemical pesticides. Ants are widely used as a form of biological control in less developed countries.

Ecosystem indication

Ants can be useful biological indicators for the health of ecosystems in both disturbed and undisturbed sites. In Australia, ants have been used as indicators to evaluate pollution, soil conditions, and pesticide contamination in undisturbed sites such as conservation sites and disturbed sites such as mines undergoing rehabilitation. This is because they:

- are extremely abundant
- have a high species richness (many different species can be found in a given area)
- are easily sampled
- are responsive to changing environmental conditions.

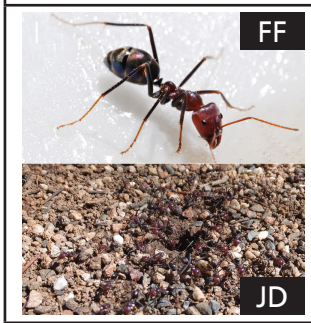
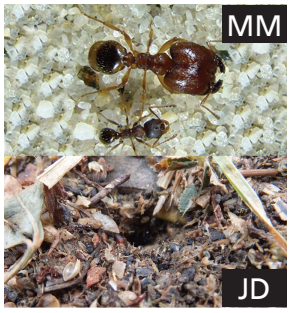
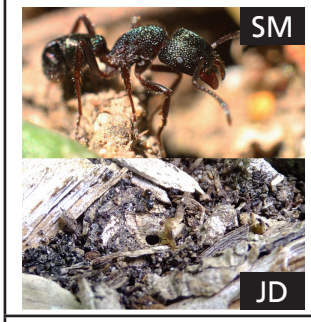
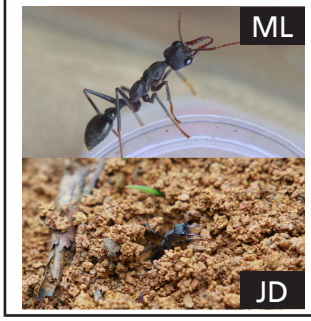
Biomimicry

Biomimicry is the development of materials or systems based on biological organisms and processes. The foraging behaviour of ants, which relies on pheromone communication to find the shortest route from nest to food source, has been studied by scientists and used to program robots to find the shortest route through mazes. The research has also led to the development of computer software that directs traffic through a network in the most efficient manner.

Ants of Adelaide and the Mount Lofty Ranges

Interesting features and characteristics outlined in the earlier sections, such as extensive nest construction, pheromone communication, caste allocation, and aphid farming, can all be found in ant species that are seen in our backyards, schools and parks every day.

The table below provides an image and a brief outline of some of the ant species found in the Adelaide and Mount Lofty Ranges region. An identification key which also contains useful information for these and other native ants of the region is also available.

Meat Ants (*Iridomyrmex* spp.)	
	• Often live in huge 'super colonies' consisting of interconnected colonies, also known as 'super colonies', with potentially hundreds of queens and over 300,000 workers. • Are fiercely territorial and patrol the region surrounding their nest rigorously. If ants from another colony enter this territory, the defending ants will attack them. This makes it nearly impossible for any other ant species to exist in the same area as *Iridomyrmex* species.
Big-headed Ants (*Pheidole* spp.)	
	• Most species of the *Pheidole* genus are dimorphic, meaning that they contain two different types or castes of ants: the 'minor' workers (small heads) and the 'major' workers (big heads). • Many species are the prey of parasitic *Phorid* flies, which lay eggs on the heads of the major workers. The fly larvae then grow and develop inside the heads, eventually decapitating them when emerging.
Green-head Ants (*Rhytidoponera* spp.)	
	• Some species in this group have a powerful sting caused by venom that they inject through a stinger in their abdomen. • These ants are one of many species to practise farming behaviour through their interactions with aphids and other scale insects. (see *Ant habitat and diet* in the 'References' section). • Other foods include seeds and other insects, such as wasps.
Inch Ants (*Myrmecia pyriformis*)	
	• Have incredible vision for their size and are able to spot, track and follow intruders from as far as one metre away. • Play and important role in balancing the food chain and breaking down carrion. • One of the largest species of ants in the world and workers can grow as long as 2.6 centimetres.

Ants at school – learning and monitoring

The NATURE code

Learning about ants in the classroom and transferring this knowledge into practice by observing ants in their natural habitat is a great way of engaging with nature. Before heading outside to observe ants, write down a few things you already know about ants. Then, after watching them for a while, add any new things you have observed to your list. Remember to show care and respect for the ants and any other creatures you encounter – they are living beings and deserve our respect.

Principle	What does this mean for ants?
Notice with all of your senses – look, listen, smell, taste, touch (but only after checking with your teacher!)	• Stop and observe the ants you see passing by: How large are they? What colour are they? Do they have short or long jaws? • Note their behaviour: are they moving slowly, quickly or hopping? • Follow an ant back to its nest and watch how it interacts with other ants it meets along the way. • Be careful around especially large ants with big jaws. These can give you a painful bite or sting!
All creatures have a right to life in peace	• Do not disturb the ants and take care not to damage their trails or their nests.
Think – What, how, and why is this happening in nature right now?	• Think about why the ants are doing what they are doing. • Where are they going? Do they all go back to the same nest or different nests? Think about why. • If they have food what are they doing with it? Eating it or carrying it? • Are any of the ants carrying small, white bundles? These are the eggs, larvae or pupae. Why do you think they might they be moving them?
Up, down and all around – look all around you, at the ground, the bushes, the tree trunks, and the treetops	• Ants can live on the ground or in trees. Look around you to find them. • Even most soil-dwelling ants forage on plants so look out for ants moving along branches and leaves.
Respect – all living things have a right to live	• Watch where you are walking and take care not to squash any ants or their eggs, larvae or pupae.
Everyone – look after every creature, and make sure you have everyone before heading back to class	• Look after the ants, their habitat and each other. If an ant bites you and it is very painful or you feel dizzy, tell a teacher.

Ant fun facts

The total population of all ants on Earth is estimated to be **10 thousand trillion** to **100 thousand trillion ants!**

That's **10,000,000,000,000,000** to **100,000,000,000,000,000** ants!

Ants are as old as the dinosaurs — over 110 million years old!

They also survived the asteroid impact that killed the dinosaurs.

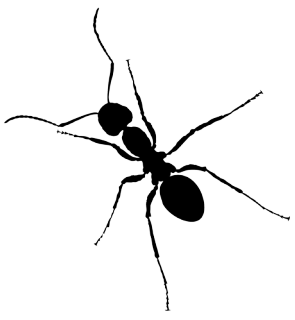
Some ants are **slave-makers**!

They raid the nests of other ants and steal their larvae, taking them back to their own nest where they spend their entire lives working for their captors.

There is a fungus that infects ants and turns them into **zombies**!

The fungus infects an ant's brain and causes it to climb up a blade of glass where the fungus then kills the host ant and grows out of its head!

Note the stalk growing out of the ant's head. This is part of the fungus and will release tiny structures called spores that will infect other ants.



More activities and resources

Activities

See the following pages for activities suitable for primary school students. These activities may be printed and used during lessons to complement ant-related lessons.

Activity 1: 'Ant map'

Intended student year level: 3-7

Activity type: Experiment + questions

Indoor/outdoor: Mostly outdoor

Time frame: Single lesson (<40 minutes)

Activity 2: 'Trail tracker'

Intended student year level: 6-7

Activity type: Experiment + questions

Indoor/outdoor: Mostly outdoor (excluding wait time)

Time frame: Single lesson + 1 hour wait time (90-120 minutes total)

Activity 1. Ant map

For this activity, you will need:

- paper
- coloured pencils
- ruler
- magnifying glass.

Steps:

1. Using your ruler draw a map of the area around your classroom. Include features on it like trees, buildings, benches, bins and paths.

2. Head outside with your teacher and look around the ground and on the trees in the area you have drawn on your map to find as many ant nests and trails as possible.

3. When you find an ant nest or trail, use your magnifying glass to take a close look at the ants moving along the trail and into the nest. Look at their colour, size, jaw shape and anything else you notice. Be careful not to get too close. Ants can bite and sting!

4. Mark the trail of ants and the nest they are going into on your map using a coloured pencil.

5. Continue looking around at the ants you can see. If you see any trails or nests with different types of ants going along/into them, mark those nests and trails on your map in a different colour.

Questions:

1. How many nests could you find? Where were they? (In the ground, in trees, etc.)

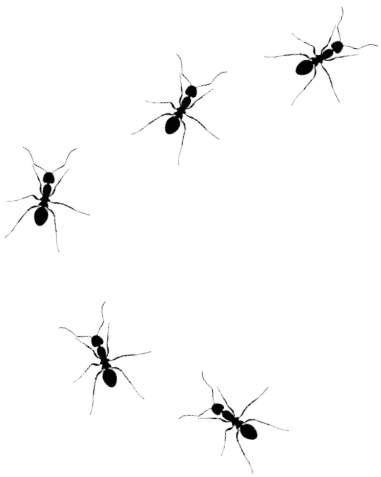
2. Were there any ant nests connected to each other by trails?

3. How many different types of ants did you find?

4. Were the nests and trails of different types of ants close together or far apart? Why do you think they were like this?

5. Did you see any ants eating or carrying anything? What were they eating/carrying?

Activity 2. Trail tracker



For this activity, you will need:

- an ant nest
- honey
- fine paintbrush
- small piece of paper (about 10x10cm)
- notebook
- stopwatch.

Steps:

1. Place a few drops of honey about 30 centimetres from the ant nest away from any existing ant trails.

2. Wait for about an hour for the ants to find the honey and establish a trail from the honey back to their nest.

3. Observe the ants on the trail and record in your notebook how many new ants reach the honey in 30 seconds.

4. Using the paintbrush, gently brush a few ants off the trail about halfway between the honey and the nest and place the paper on the ground over the trail. Weigh down the edges so it is flat on the ground.

5. Observe the ants' behaviour. Use your notebook to record how many new ants reach the honey in 30 seconds now that the paper is in place.

Questions:

1. How do you think the ants communicate with one another to lead other ants in the colony to a source of food?

2. How did the ants react when you placed the paper over the trail?

3. Complete the table below:

Number of ants reaching honey in 30 seconds **before** paper is placed	Number of ants reaching honey in 30 seconds **after** paper is placed

4. Was there any difference between the before and after paper results? Why/why not? (Think about how this relates to your answer to Question 1.)

Useful online resources

ANTS: Nature's Secret Power

- A fascinating documentary on the behaviour, habitat and ecology of ants by esteemed myrmecologist Bert Höllbodler. Extremely worthwhile. Running time: 54 minutes.

Planet Ant: Life inside the colony

- Another excellent documentary focusing upon the life of ants within the colony, covering nest construction, social structure, food gathering and more. Running time: 1hr 18min.

Ant nest excavation video

- Useful video mentioned in the 'Ant habitat' section showing the excavation of a huge ant nest filled with concrete to show its internal structure. A short but fascinating excerpt from the previously mentioned documentary 'Ants: Nature's Secret Power'. Running time: 3 minutes.
- You could also have a discussion with students on the ethics of filling the nest with concrete – killing in order to study and understand.

Ant farm

- An ant farm is one of the best ways to allow children to view the activities of ants 'underground' within their nest.
- This website has a quick, easy and inexpensive description of how to make an ant farm from everyday materials.
- If the ant farm is intended to be a long-term classroom project, ensure you capture a queen when harvesting ants to stock the ant farm.

Ant Wiki

- One of the most comprehensive online resources for information on ants. Endorsed by CSIRO.
- Contains detailed and accurate information on all aspects of myrmecology as well as photos, descriptions and distribution information on individual species.

Books

Hölldobler, B & Wilson, EO 1990, The Ants, Harvard University Press, Cambridge, MA.

- Pulitzer-prize winning book considered to be one of the best scientific sources of information on ants of all time.
- Highly informative although quite dense and often uses complex scientific jargon. Only recommended for teachers interested in expanding their knowledge of ants.

Moffett, MW 2010, Adventures Among Ants: A Global Safari with a Cast of Trillions, University of California Press, Berkeley.

- A fascinating book that teaches about ants in general by focusing on six remarkable species and their unique physiology and behaviour.
- Contains stunning photographs and vivid descriptions. Highly recommended.
- Writing style is fun and easy to read with even very limited scientific knowledge. However, this book is probably only suited for teachers and interested students in year 7 and perhaps 6.

Glossary

Biological control: The control of a pest by the introduction of a natural animal predator or enemy.

Biomass: The total mass (weight) of living organisms in a given area.

Brood: In insects; a group of individuals of a given species which have hatched into young or developed into adults at approximately the same time and which continue to live together.

Carnivorous: Feeding on animals, by means of predation or scavenging.

Caste: In an insect society it is a class of physically distinct individuals that performs a specific role within the colony. Usually consists of worker (female), queen (female) and drone (male) although some species may also have other castes such as a female 'soldier' caste.

Class: The taxonomic rank below Phylum and above Order. For example, all ants belong to the Class Insecta (the insects).

Cocoon: A case made by larvae partly or completely of silk that protects the pupa in many insect species.

Facets: An individual unit containing a lens that, along with hundreds to thousands of other facets, makes up the compound eye of an insect or crustacean.

Family: The taxonomic rank below Order and above Subfamily. For example, all ants belong to the Family Formicidae.

Genera: Plural form of Genus, it is the taxonomic rank below Subfamily and above Species. For example, the Inch Ant belongs to the Genus *Myrmecia* (the bull ants).

Glands: An organ within an animal's body that secretes specific chemical substances for use within the body or for discharge into the surrounding environment.

Metamorphose: To undergo metamorphosis.

Metamorphosis: The changes that occurs to an animal's body as it develops from an immature form into an adult in two or more distinct stages. In ants, the process in which an egg develops into a larva, then a pupa, then an adult is known as complete metamorphosis.

Microclimate: The climate of a specific small or restricted area. Often different to the climate of the surrounding region.

Mutualistic relationship: A form of inter-species relationship where two organisms of different species interact with one another and both benefit.

Myrmecology: The scientific study of ants.

Ocelli: A form of simple eye present in some insects, usually in a group of three on the head, capable of detecting light and movement but unable to form a complex image.

Olfactory: Relating to the sense of smell. For example, the nose senses smell and is the olfactory organ in humans.

Omnivore: An animal that eats food of both plant and animal origin.

Order: The taxonomic rank below Class and above Family. For example, ants belong to the Order Hymenoptera.

Parasitoid: An organism that spends a significant portion of its life history attached to or within a single host organism in a relationship that is essentially parasitic, however, unlike a true parasite, it ultimately sterilises or kills, and sometimes consumes, the host.

Pheromones: A chemical secreted by an animal that elicits a particular reaction (such as the desire to mate) in members of the same or different species.

Pupate: To develop from a larva into a pupa. Often occurs within a cocoon.

Symbiotic relationship: A relationship between two organisms where the two organisms live together in close association with one another. Includes relationships that are beneficial for both species (mutualisms) and relationships that are only beneficial for one species (parasitism).

Terrestrial: In animals; living on or in the Earth. For example, ants are a terrestrial group of insects.

Volatile: When referring to a substance; easily evaporated at normal temperatures.

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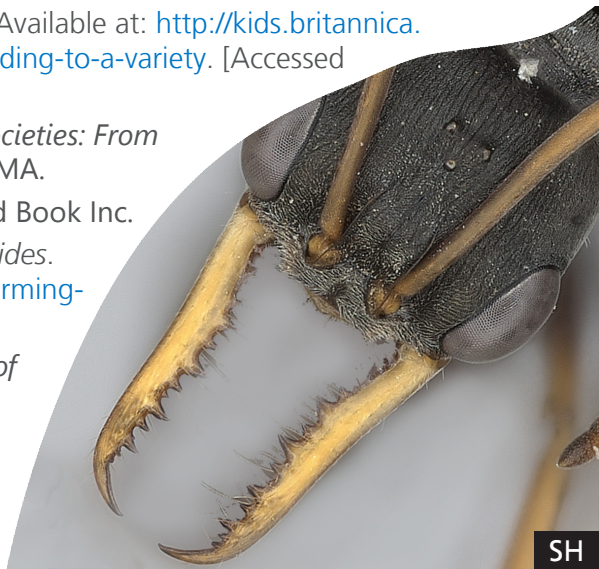

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Green Adelaide would like to dedicate this resource to Archie McArthur.

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