

Welcome to the.....

TINY TERRITORY

MUSEUM
AND ART
GALLERY
NORTHERN
TERRITORY

Humans are giants in a territory where tiny things are really what runs the show. Between ants and termites alone, there are more individuals than every other animal combined.

Yet we overlook these tiny things and underestimate their importance, mainly because they are so hard to see; their size make them difficult to observe and therefore to understand their behaviour, function and services they provide our ecosystems every day. It takes focused attention and sustained effort to truly comprehend the tiny invertebrate world we share the earth with.

So at MAGNT we have made large some of the most extraordinary species that call the Northern Territory home. Darwin wildlife photographers Nick Volpe and Lucyna Kania help us see the unseeable. You might want to look up more of Nick and Lucy's work. They own and operate a company called NL Wild Nature Media. See more of their images on their website.

In the MAGNT exhibition Tiny Territory, we've chosen to highlight some cool research and concepts that you may not have known about: structural colour, size constraints in insects, Top End insects and the hyperdiversity of ants in savannah ecosystems.

These supplementary education resources aim to expand your experience; from Tiny Territory the exhibition to ongoing experiences and learning about tiny invertebrates at home or school, in your backyard, at the playground or at the beach! We have covered some literacy, numeracy, storytelling, ethics and a huge diversity of ways to get to know the little things that run the world better. Included in this pack is:

- 10 ways to get to know insects
- Find A Word
- Story writing prompts
- Creative symmetry activity
- Ants on a stick numeracy puzzle
- Code of Conduct for collecting & working with insects
- Observe Describe Classify activity

Please feel free to use these resources at home or school, and share them with whomever they may be a useful resource for.

Yours in tiny things,



Dr Kirsti Abbott
Head of Science at MAGNT



CODE OF CONDUCT

Collecting live insects for research and education

Researchers, educators and students, including citizen scientists, typically act in a reasonable and responsible manner, respecting the environment and the animals and plants within it. However, in order to make the ethics of collecting insects transparent for non-scientists, we have developed a Code of Conduct that anyone collecting insects, and in particular ants or other social insects, ought to abide by.

No animal ethics approvals are required to conduct research on insects (in Australia and elsewhere around the world). If you are interested in understanding more about animal ethics requirements in research, please follow the links that appear at the end of this Code of Conduct. The links will lead you to Australian guidelines for the use of animals in research.

The **THREE R's** guide ethical use of animals in research. Always **REDUCE** the number of animals that you think you need to use in your research. Never collect just for collecting sake. **REFINE** your methods of collection and research so that you only need to use the minimal number of animals to ask and answer your questions. And **REPLACE** animals with tissue sample, digital models or other non-animal techniques if you can to reduce the number of animals used at all.

Some interesting things about insects, including ants and the colonies they live in. These small pieces of information are intended to inform thinking and understanding of biology in order to make ethical decisions about collecting insects.

- Insects generally have more than one generation a year. This is called multivoltine. So they reproduce much faster than vertebrates, and especially humans who have one generation every 20 years.
- Ants act as a colony rather than as individuals. One colony is often referred to as a superorganism because they work together so well.
- The majority of worker ants you will ever see are females. These worker ants DO NOT all become mothers like females of non-social insects and other organisms (e.g. birds, mammals, crabs). They forage for food, nurse baby ants and clean up the colony's territory.
- When collecting and killing even up to 100 worker ants from a colony there is very little chance of influencing the life span of that colony, which will persist as it would have if you had not removed some of the workers.
- The non-reproductive female worker ants live for a relatively short time compared to the egg-laying queen.
- Male ants are produced in order to mate with a queen. They die soon after. Some don't even live for a week.
- It is highly unlikely that you will collect any queens or male ants. These reproductive individuals typically do not forage for food, and are only on the surface of the ground during dispersal events.

THE CODE:

1. General collection

- No more individual insects should be caught than is necessary to undertake the activity you are doing.
- No individual organism of any other type should be killed as you attempt to catch insects for your specific purposes.
- Do as little damage to the habitat as possible. Do not remove any litter layer, grass or organic material from the collection area.
- Collected insects should be kept in a container with air if possible. If you are observing the insects for a relatively short period of time (e.g. 1 hour), then the container does not need to have air holes.
- It is illegal to take an action that will have a significant impact on a listed species or ecological community (EPBC Act 1999, Subdivision C, Subsection 18 and 18A).

2. Recording data

- Ensure you record information about your specimen, especially if you are keeping it or donating it to a museum for their collection.
- Write down, and keep with your specimen where you collected it, when you collected, how you collected it and who collected it.
- Use graphite (lead) pencil on white paper for recording all data, which ensures that it will not wash off labels in ethanol or in the rain.

3. Permissions

- Collectors must obtain specific permission from private landholders and/or Traditional Owners of the land if wishing to carry out any collecting on land that is not their own.
- If a species is an Aboriginal totem, the person whose totem it is must not collect that species.

4. Health & Safety Issues

- Some insects have painful bites and/or stings. If collecting in an area with known biting insects, spiders or other animals that pose a risk to the collector, please proceed with caution.
- Wear gloves and do not poke or touch insects or spiders with your fingers. Beware of ants or other insects crawling into your socks or clothing.

A note on the animals in the Museum and Art Gallery of the Northern Territory

All the specimens you see on display at MAGNT have been acquired ethically, most of them with the primary intention of being on display in our galleries. But MAGNT also works with vets, researchers, Parks & Wildlife and other agencies to use animals who have accidentally died for research and exhibition. MAGNT always adheres to the 3 R's when accepting animals into our collection. For more information on the 3 R's, see [The 3Rs | NHMRC](#)

Links to animal ethics guidelines and international regulations Australian Animal Ethics Infolink:
<http://www.animaethics.org.au/>

National Health and Medical Research Council Publications relating to animal ethics:
<http://www.nhmrc.gov.au/guidelines/publications/subject/Animal%20ethic>

Observe it. Describe it. Classify it.

Go outside and collect FIVE different insects. The table below will help you classify them into morphotypes, which means dividing up animals based on their morphology, or outward appearance. It's the first step to recognising and naming species. Grab a magnifying glass to see them up close, and you might even need to put some really fast ones in the fridge for half an hour to slow them down enough to see them. Once you've described them, use a dichotomous key to classify them into insect Order.

Character	Insect #1	Insect #2	Insect #3	Insect #4	Insect #5
Colour Describe the colour best you can, e.g. light brown, orange, many colours					
Lustre e.g shiny, matte, iridescent					
Size Small 0.5mm – 10mm Medium 5mm – 20mm Large >25mm					
Behaviour E.g. swarming? On a trail, sitting still on a leaf, flying.					
Wings? Does it have wings? How many?					

TINY TERRITORY

MUSEUM
AND ART
GALLERY
NORTHERN
TERRITORY

10 easy ways to get to know the little things that run the world...

1. **Watch them!** Get down on the ground and watch what's there for 2 minutes. Gather a list of verbs and adjectives to describe what you see. Then repeat this on a tree, on a flower bush and near some water. The words generated are a great stimulus for story writing.
2. Buy a cheap plastic **bug catcher** (or get a jar and some gauze) and try your luck at catching flying insects. It's harder than you think! But with these catchers you can keep your specimens under observation for the day, and then release them again.
3. **Draw them.** Try and draw the insect you've caught. If it's too small to see with your naked eye, either take a photo of it and enlarge it, or grab a magnifying glass. Use an app called RakugakiAR to bring them to life with Augmented Reality.
4. **Photograph them.** You will learn a lot about patience and insect behaviour when you try and photograph insects! iPhone macro attachment lenses are useful here, as is the macro setting on a point and shoot camera. iPads can be useful too. Try an app called Chatterpix to make your insects talk!
5. **Make models.** Using playdough, clay, plasticine or any other modelling material, create anatomically correct bugs to decorate your spaces. There are rule though – THREE body parts, SIX legs, TWO antennae, TWO eyes, WINGS or NO WINGS can be the wild card.
6. **Do a bug treasure hunt.** Try and find one of each of an ANT, CATERPILLAR, BUTTERFLY OR MOTH, GRASSHOPPER, TRUE BUG (aphids, stink bugs, cicadas), COCKROACH, DRAGONFLY and any other types of insects. Take a magnifying glass with you to help see the small ones.
7. **Feed them.** Insects, especially ants, love a picnic! Put some food out that will attract ants to a specific location in your playground (don't put it near the classroom unless you want ants in there!). Leave it out there for half an hour or more, and see how many ants come to your food goodies. Count them too! What type of ants are they? Observe and describe them.
8. **Write about them.** As you learn more about insects, use poetry and stories to make your insects come to life. What would you do if insects were as big as elephants?!
9. **Read about them.** There are a plethora of books dedicated to insects and their relatives, starting with The Very Hungry Caterpillar by Eric Carl. Check your school or local library, and get the librarian on the job.
10. Enjoy a documentary/movie or two. Suggestions for great movies about insects are:
 - a. Microcosmos
 - b. Life in the Undergrowth – BBC/David Attenborough
 - c. Miniscale: Valley of the Lost Ants
 - d. A Bugs Life
 - e. Antman
 - f. James and the Giant Peach

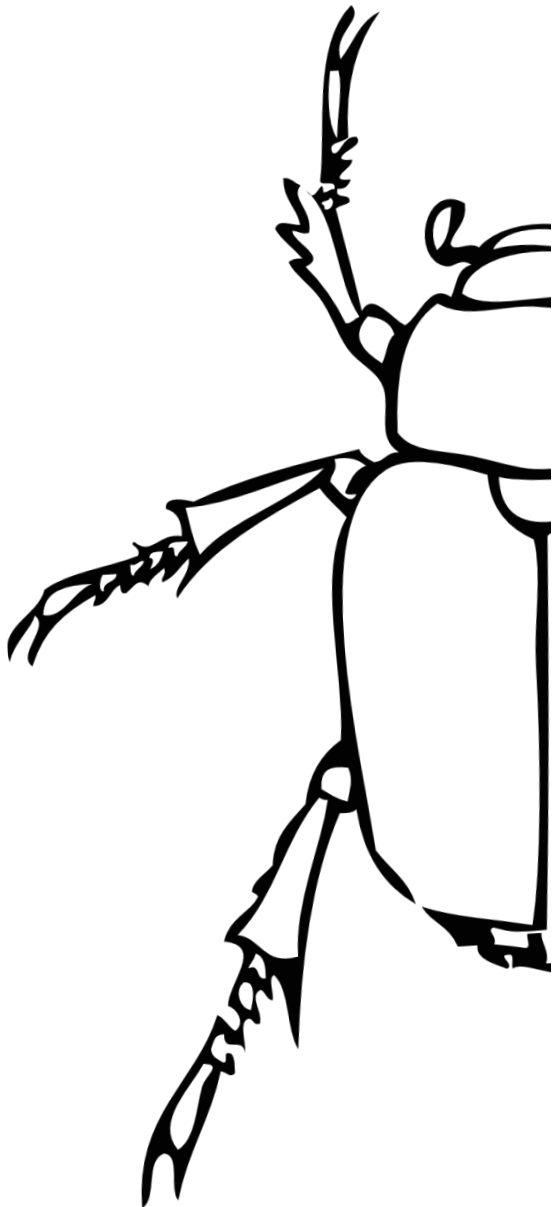
TINY TERRITORY

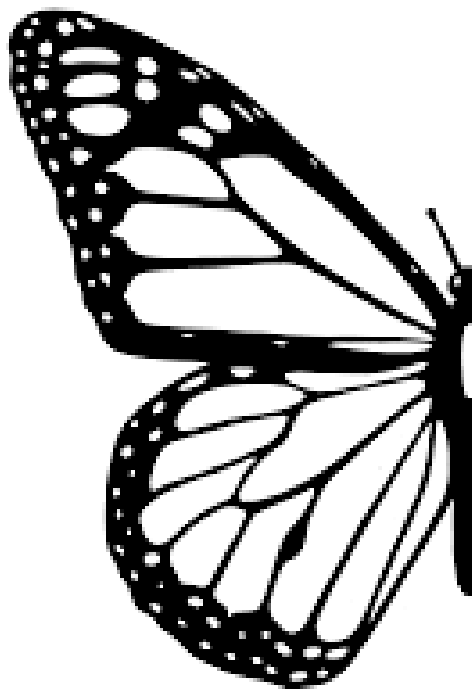
MUSEUM
AND ART
GALLERY
NORTHERN
TERRITORY

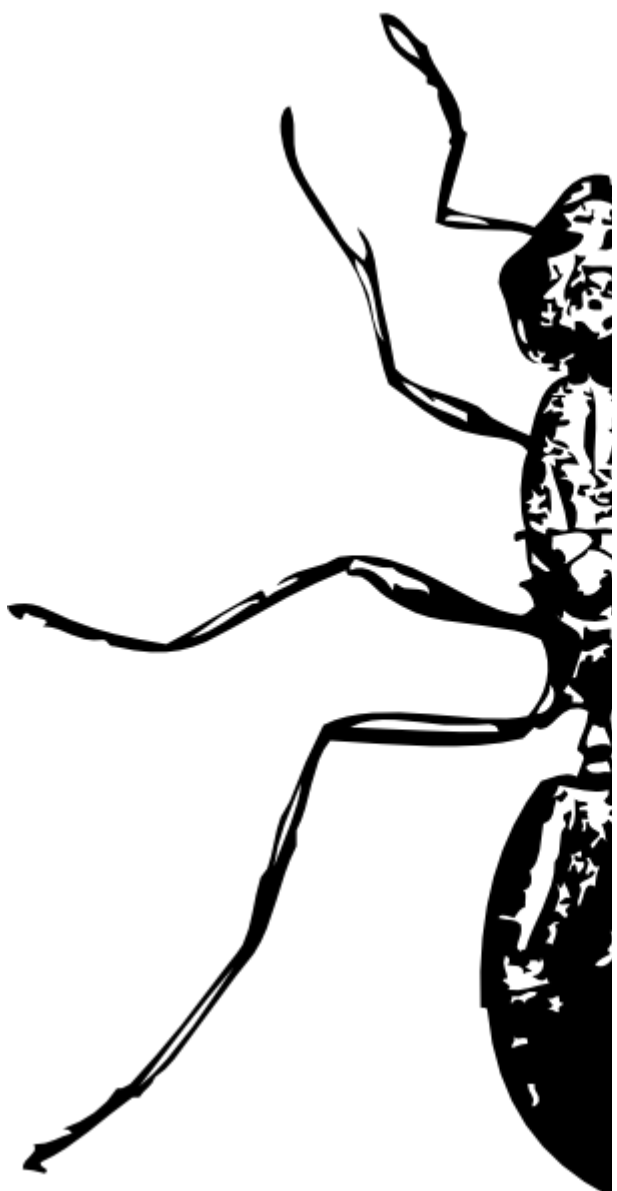
An exploration in symmetry

Bilateral symmetry is the term used to describe symmetry that has roughly a mirror image, or two sides that are the same either side of a linear plane. This type of body plan allows animals to move rapidly through their environment with legs that function together for fast running!

On the following insects however, YOU GET TO DECIDE what the other half looks like! Go crazy!









Writing prompts for stories about tiny things!

Make these writing prompts big and colourful, and place them on your classroom wall. When students are stuck for a start, suggest they use one of these.

Sentence/Paragraph starters:

1. If mosquitoes were as big as elephants they would.....
2. If I was a green tree ant, I would....
3. Suddenly, the small red beetle jumped on the giant butterfly's back and shouted....
4. It was unfortunate that the dragonflies' navigation system had shut down.
5. "Help me carry this leaf back to the nest" shouted the worker to the soldier. "Sorry, I'm programmed to protect, not forage" replied the soldier.

Narrative ideas:

1. Write a story about nighttime adventures in a land where all the insects glow in the dark.
2. Pretend you are a moth fighting a bee for nectar in a flower. What do you do? How does it end? Who gets the sweet juice?
3. Imagine you are an ant trying to adapt to a warming planet. You can't regulate your body temperature. What do you do?
4. Write a story about how flies got their wings.
5. Australian Aboriginals have harvested honey ants for thousands of years. Write a recipe using honey from the abdomen of a honey ant.

TINY TERRITORY

**MUSEUM
AND ART
GALLERY**
NORTHERN
TERRITORY

I	S	E	F	B	H	U	J	M	N	W	I	O	P
N	J	E	X	O	S	K	E	L	E	T	O	N	A
S	Q	V	M	P	L	K	F	T	X	A	C	V	Y
E	O	H	B	D	N	M	H	S	R	U	P	S	S
C	G	I	F	K	B	N	O	P	W	T	E	X	T
T	E	S	A	R	C	Z	Q	I	B	O	W	K	R
A	N	H	C	T	I	F	V	D	L	P	I	E	U
Z	F	J	M	O	K	L	E	E	Q	B	N	V	C
R	E	L	V	P	R	W	J	R	W	I	G	S	T
T	H	B	M	E	T	P	Q	X	K	Z	P	E	U
I	R	Y	G	N	B	E	I	U	P	A	C	V	R
D	N	O	U	D	J	T	A	O	T	L	Q	L	A
W	K	V	L	H	Y	H	X	Y	N	I	M	E	L
I	W	M	E	V	C	R	A	I	U	P	O	Q	C
Z	T	A	B	R	J	B	O	M	A	Z	T	X	O
T	R	D	N	M	T	E	Z	T	P	L	H	B	L
L	A	B	S	I	U	E	Z	W	I	S	V	T	O
P	C	Q	N	L	O	T	B	H	K	R	Y	G	U
S	H	Y	G	C	Z	L	A	R	N	W	R	P	R
R	E	F	H	J	T	E	E	O	A	S	Z	E	X
J	A	B	U	T	V	X	W	P	N	T	C	Q	T
M	J	K	S	U	A	S	I	E	J	L	E	S	P
W	Y	G	R	E	E	N	T	R	E	E	A	N	T

Green Tree

Ant

Scorpion

Spider

Insects

Invertebrate

Structural

Colour

Exoskeleton

Wing

Trachea

Moth

Beetle

Tiny

Territory

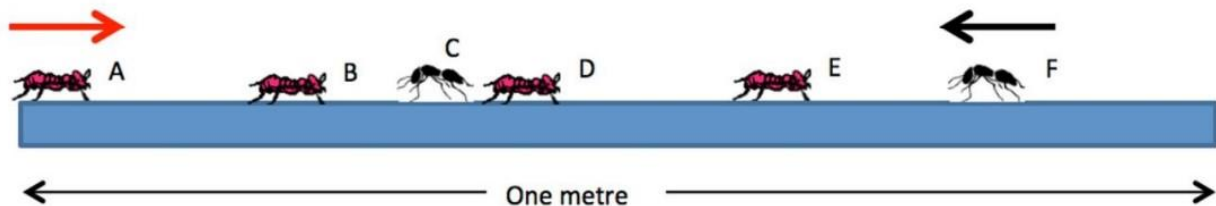
Top End

The ant maths puzzle By Rob Eastaway

The same and other versions can be found online in written and video form at:

The Guardian [Did you solve it? The ants on a stick puzzle | Mathematics | The Guardian](#)

YouTube [Logic and Riesen: Episode 4 | Ants on a Stick - YouTube](#)



Four red ants and two black ants are walking along the edge of a one metre stick. The four red ants, called Alf, Bert, Derek and Ethel, are all walking from left to right as we look at the diagram, and the two black ants, Charlie and Freda, are walking from right to left.

The ants always walk at exactly one centimetre per second. Whenever they bump into another ant, they immediately turn around and walk in the other direction. And whenever they get to the end of a stick, they fall off.

Alf starts at the left hand end of the stick, while Bert starts 20.2 cm from the left, Derek is at 38.7cm, Ethel is at 64.9cm and Freda is at 81.8cm.

Charlie's position is not known - all we know is that he starts somewhere between Bert and Derek.

So here is the puzzle: Which ant is the last to fall off the stick? And how long will it be before he or she does fall off

The answer....

Charlie falls off last after exactly 100 seconds.

The arbitrary-sounding distances - 20.2cm, 38.7cm, etc - were a decoy. These lengths were a sign that you needed to think laterally about the puzzle. No half-decent puzzle is going to require algebra or arithmetic with numbers like 20.2 and 38.7.

Of course, it would be possible to work out the answer by calculating the positions but this will be messy. (Full marks for effort for all of you who tried to do it this way.)

The piece of insight that makes this an elegant puzzle is this: imagine two ants colliding and turning around. If you blur your eyes, this is equivalent to those two ants walking past each other. In other words, this puzzle can be treated as if it is six ants each on their own track walking to the end of the stick. Since Alf starts at the left end of the stick walking to the right, one of these 'blurred' ants will walk the maximum possible distance - the entire length of the stick - and then fall off. So, it will take 100 seconds - 1m at 1 cm per sec - until the last ant drops.

Imagine that each ant has a leaf, and on each collision they exchange leaves. The leaves will be moving at 1cm per sec in a unique direction. The leaf that will take the longest to fall off the edge is the one that starts with Alf.

As for the identity of the ant that falls last, remember that the order of the ants cannot change since they can't walk past each other. At the start, four ants are walking to the right. So four ants will drop off the right hand end. So the ant that is positioned fourth to the right will fall last. Stand up Charlie, that's you.

The fact that we don't know his position to start with is irrelevant.

TINY TERRITORY

**MUSEUM
AND ART
GALLERY**
NORTHERN
TERRITORY

I	S	E	F	B	H	U	J	M	N	W	I	O	P
N	J	E	X	O	S	K	E	L	E	T	O	N	A
S	Q	V	M	P	L	K	F	T	X	A	C	V	Y
E	O	H	B	D	N	M	H	S	R	U	P	S	S
C	G	I	F	K	B	N	O	P	W	T	E	X	T
T	E	S	A	R	C	Z	Q	I	B	O	W	K	R
A	N	H	C	T	I	F	V	D	L	P	I	E	U
Z	F	J	M	O	K	L	E	E	Q	B	N	V	C
R	E	L	V	P	R	W	J	R	W	I	G	S	T
T	H	B	M	E	T	P	Q	X	K	Z	P	E	U
I	R	Y	G	N	B	E	I	U	P	A	C	V	R
D	N	O	U	D	J	T	A	O	T	L	Q	L	A
W	K	V	L	H	Y	H	X	Y	N	I	M	E	L
I	W	M	E	V	C	R	A	I	U	P	O	Q	C
Z	T	A	B	R	J	B	O	M	A	Z	T	X	O
T	R	D	N	M	T	E	Z	T	P	L	H	B	L
L	A	B	S	I	U	E	Z	W	I	S	V	T	O
P	C	Q	N	L	O	T	B	H	K	R	Y	G	U
S	H	Y	G	C	Z	L	A	R	N	W	R	P	R
R	E	F	H	J	T	E	E	O	A	S	Z	E	X
J	A	B	U	T	V	X	W	P	N	T	C	Q	T
M	J	K	S	U	A	S	I	E	J	L	E	S	P
W	Y	G	R	E	E	N	T	R	E	E	A	N	T

Green Tree

Ant

Scorpion

Spider

Insects

Invertebrate

Structural

Colour

Exoskeleton

Wing

Trachea

Moth

Beetle

Tiny

Territory

Top End