



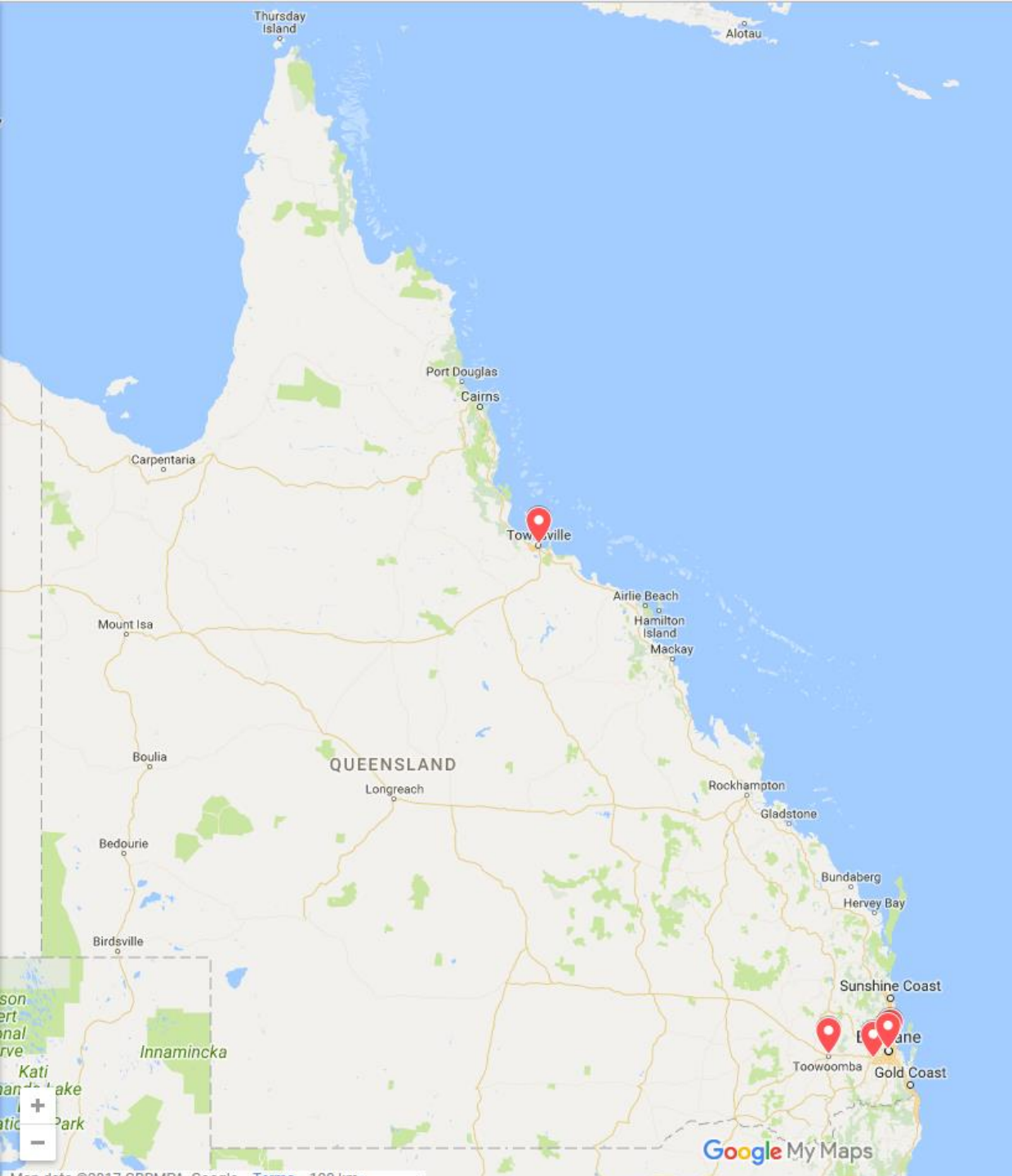
**Amy Boulding**  
Head, Lifelong Learning



## Queensland, Australia

Area:  
1,853,000 km<sup>2</sup>  
(almost 5 times as big as Japan)

Population:  
4,820,000 people  
(4% of Japan's population)



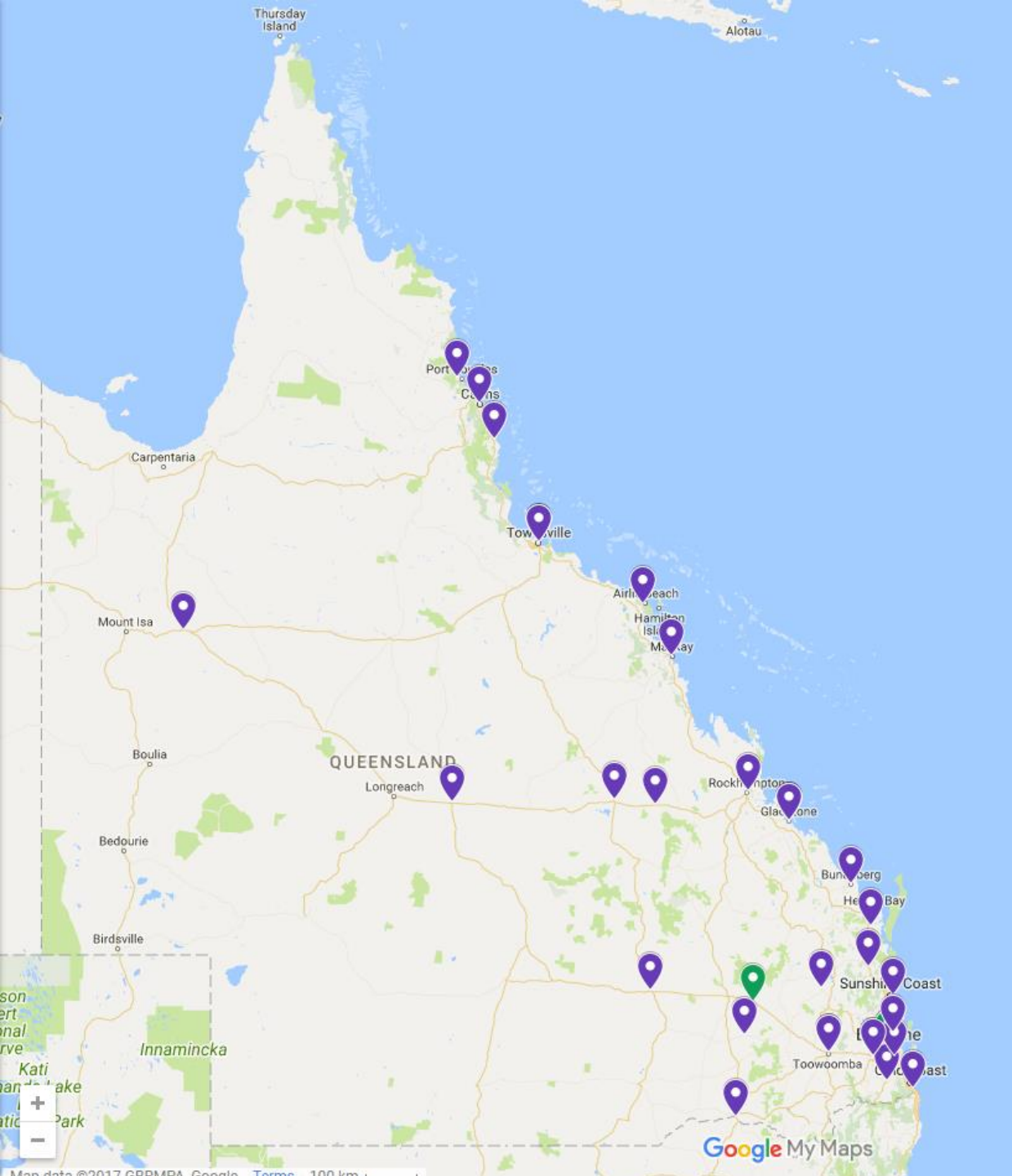
## Queensland Museum Network

- 4 Museums
- 1 loans and research facility

In 2016/17:  
2,345,010 visitors

including  
63,621 students and teachers





## Queensland Museum Network

- 4 Museums
- 1 loans and research facility

In 2016/17:  
2,345,010 visitors

including  
63,621 students and teachers

plus  
793,241 loans kit users





A Sciencentre *within* a Museum!



**A huge variety of ways to engage with STEM!**

**QGC**



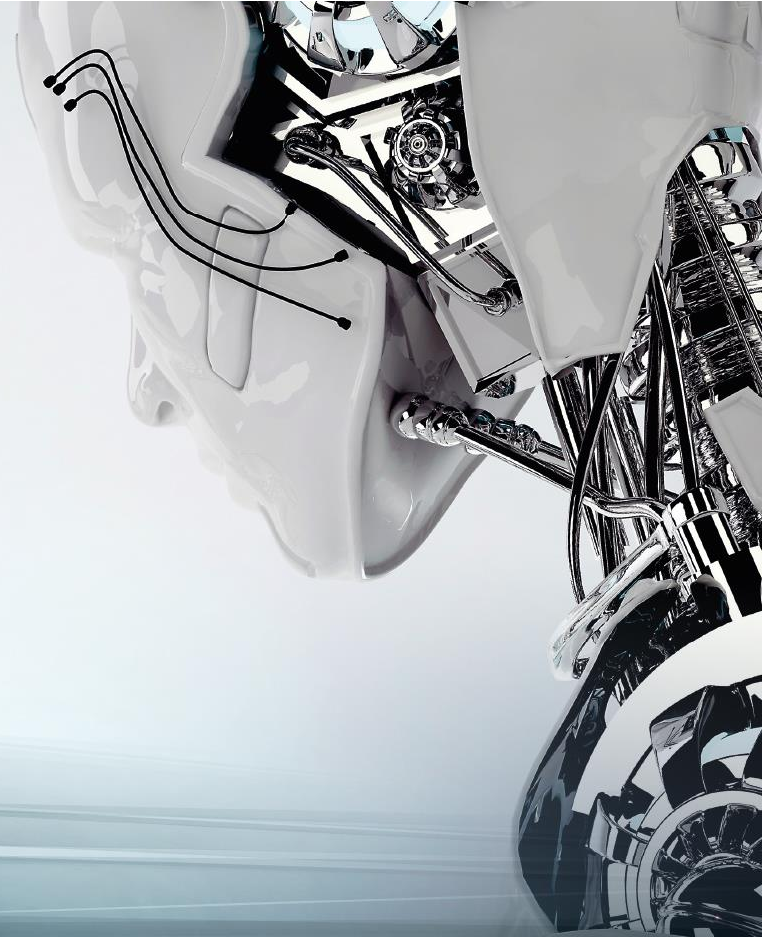
**QUEENSLAND  
MUSEUM NETWORK**



**Queensland  
Government**

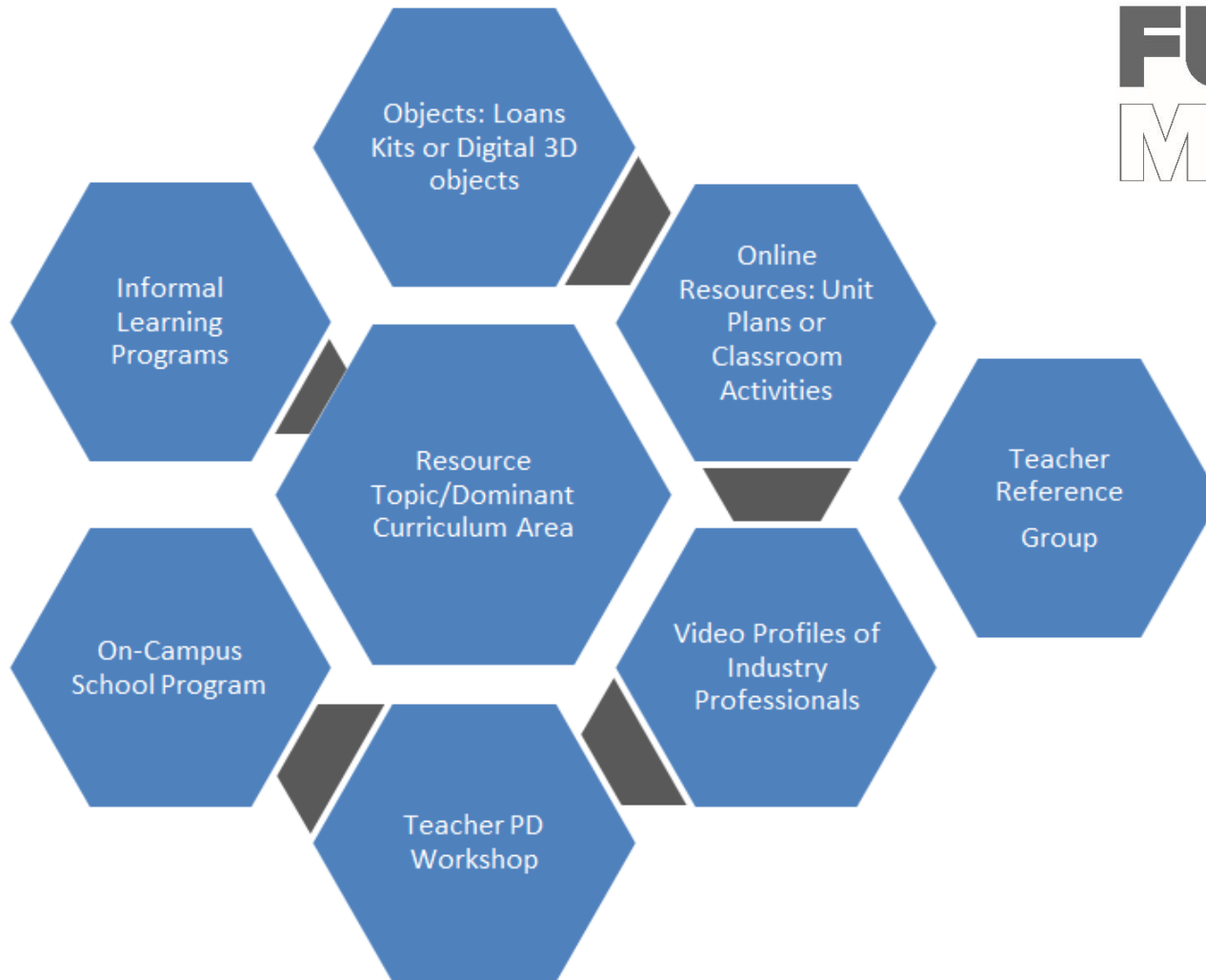
# **FUTURE MAKERS**

**Bringing wonder and innovation  
to our community.**



**QUEENSLAND  
MUSEUM NETWORK**

# FUTURE MAKERS







## Future Makers Pilot Program

Connecting teachers with resources and professional development, and students with STEM professionals



## ***Creative Lab* Teacher Professional Development**

Connecting our collection with the curriculum, for increased capability in teaching STEM



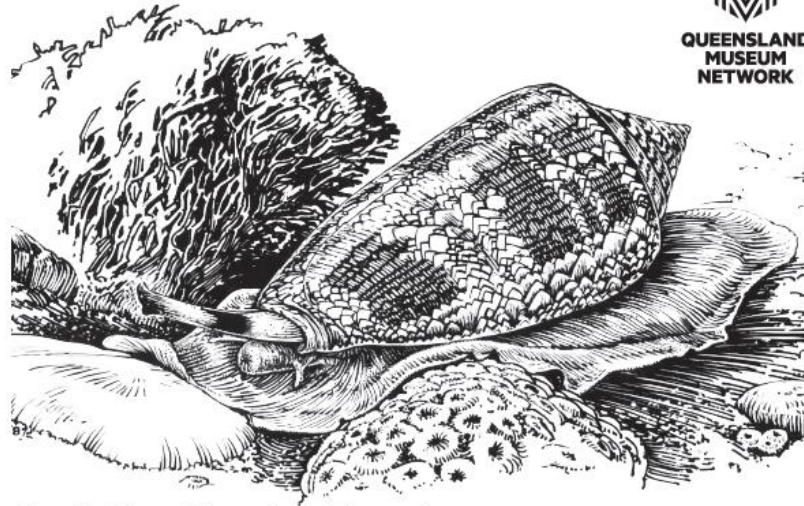
Queensland Museum Network | Future Makers Resource | Shell Classification  
© Queensland Museum



Queensland Museum Network | Future Makers Resource | Shell Classification  
© Queensland Museum

## Online Resources and Loans Kits

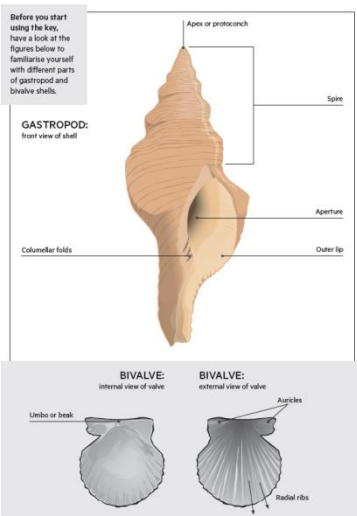
Connecting our collection with the curriculum, for use in the classroom



## Shell Classification Exercise

Shell Classification  
USING A DICHOTOMOUS KEY

YEAR SEVEN STUDENTS



### Classification start: know your animals

Seashells are made by organisms called molluscs, which are soft-bodied invertebrates. Molluscs have an organ called the mantle that secretes, or builds, the shell. The mantle covers the mollusc like a roof covers a house, and the word is originally from the Latin *mantellum*: a cloak.

Not every mollusc lives in a shell - for example, squids have a reduced internal shell, and octopuses have lost their shell entirely.

Most of the shells we see on the beach are made by two groups of molluscs: bivalves and gastropods. Gastropods include organisms like snails and slugs, while bivalves

include organisms like clams, oysters, and scallops.

Gastropods have a single, coiled shell, while bivalves have two shells, or valves, that fit together. Together these two groups are very diverse; there are around 80,000 gastropod species, and around 9,000 bivalve species!

While it might seem like a difficult task to differentiate all these species, there are many tools that can help us. These include dichotomous keys: step-by-step guides that we can follow to identify an organism. When using dichotomous keys, you pick a particular creature or part of a creature (here, a shell), start at step 1 and follow the instructions.

### GASTROPODS



### BIVALVES



### Dichotomous Key for Queensland Museum Reef Invertebrate Classification Loans Kit/Shell Cards

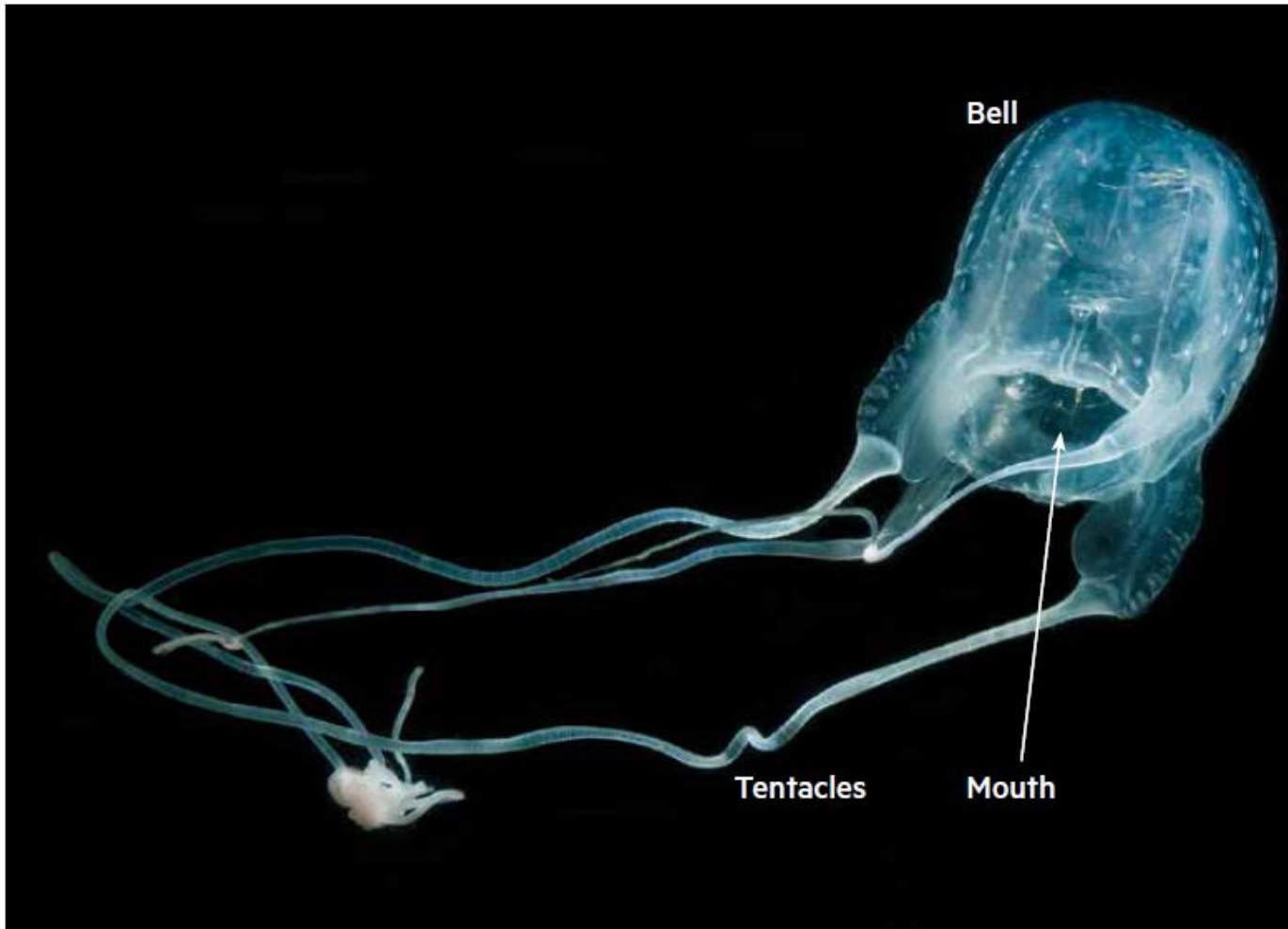
Please note that every dichotomous key is different. This key cannot be used as a general shell identification guide, because it has been developed specifically for the shells in the Queensland Museum Reef Invertebrate Classification Loans Kit, and the Queensland Museum Shell Cards.

1a Single shell (gastropod)	go to 2	1a Valves have greater width than height	Go to 10
1b Two shells (bivalve)	go to 9	1b Valves have similar width and height	Go to 11
2a Shell has spiky projections along outer lip	Spider Conch Lambis lambs	10a Projecting spicules present along external side (see image)	Fished Clam Clam
2b Shell does not have spiky projections along outer lip	go to 3	10b Projecting spicules absent along external side	Tudicula spicules
3a Aperture of shell faced with "tooth" (see image)	go to 4	11a Radial ribs present on external sides	Stephanus Clam Hippopus Hippopus
3b Aperture of shell not faced with "tooth"	go to 5	11b Radial ribs absent on external sides	Go to 12
4a Shell is covered in dark brown spots	Tiger Conch Cypraea tigris	12a Radial ribs absent or unobvious	Orange Clam Verticardium verticardium
4b Shell is brown with dark brown multi-band pattern	Aradus Clam Cypraea aradus	12b Auricles present at umbos	Go to 13
5a Shell has highly ornamented spire	Spiral Snail Turris maculata	13a Mother of pearl (nacre) present on internal sides	Pratt Clam Pectinaria sp.
5b Shell does not have highly ornamented spire	go to 6	13b Mother of pearl (nacre) absent on internal sides	Jewel Box Clam Chama sp.
6a Shell has a line of holes	Dorothy's Ear Alusona Mollusca alusona	14a Mother of pearl (nacre) present on external sides	Jewel Box Clam Chama sp.
6b Shell does not have a line of holes	go to 7	14b Mother of pearl (nacre) absent on external sides	Jewel Box Clam Chama sp.
7a Columellar folds present	Blood-red Volute Cymbiola vulgaris	15a Mother of pearl (nacre) present on external sides	Jewel Box Clam Chama sp.
7b Columellar folds absent	go to 8	15b Mother of pearl (nacre) absent on external sides	Jewel Box Clam Chama sp.
8a Shell has numerous fine lines across surface	Striated Cone Cassis striata	16a Mother of pearl (nacre) present on external sides	Jewel Box Clam Chama sp.
8b Shell has a pattern of white triangles on a dark brown background	Marble Cone Cassis marmorata	16b Mother of pearl (nacre) absent on external sides	Jewel Box Clam Chama sp.

**Mother-of-pearl: what is it?**  
Mother of pearl, or nacre, is an iridescent (colour-changing) layer of shell produced by some molluscs. It is secreted by the mantle and helps protect molluscs from parasites or predators of debris. The secretion of nacre can lead to the formation of pearls.

## Online Resources and Loans Kits

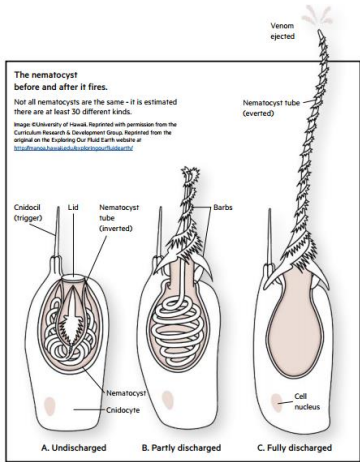
Connecting our collection with the curriculum, for use in the classroom



*Morbakka fenneri*, a type of Irukandji Jellyfish from the Gold Coast, Queensland.  
Image: Queensland Museum, Gary Cranitch.

## Online Resources and Loans Kits

Connecting our collection with the curriculum, for use in the classroom



**How big?**  
 Nematocysts (the organelles within stinging cells) vary in size from about 4-10 microns (also known as micrometres) in length, but on average are 20-30 microns long. Cnidocytes (stinging cells) also vary in size, but as the nematocyst takes up much of the cell (see figure above), cnidocytes are only slightly bigger than the nematocyst inside them.

From this we can see that nematocysts are much bigger than mitochondria (~2 microns in length), and are more similar to the size of a mammalian cell nucleus (~10 microns in diameter).

Queensland Museum Network | Future Makers Resource | Specialised Stinging Cells | 4



The nematocysts on the following pages are from *Pelagia noctiluca* (above), the mauve stinger. This jellyfish was collected at Point Lookout on North Stradbroke Island, Queensland. The species name

*noctiluca* means "night light" and this animal has the ability to flash bioluminescence at night.  
 Image above © Queensland Museum, Heron Stone.  
 The following images © Queensland Museum, Melissa McManus.

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## Specialised Stinging Cells

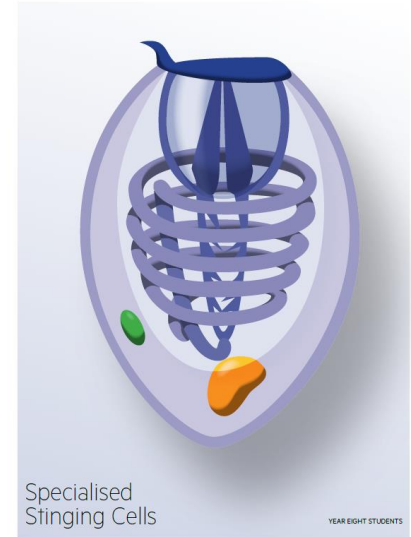
Have you ever been stung by a jellyfish? Ouch! Jellyfish (and other organisms like coral and sea anemones) have special stinging cells called cnidocytes (pronounced "NYE-dough-sites").

It is these cells that define the phylum Cnidaria (pronounced "nye-DARE-ee-uh"), meaning that every organism in this phylum has these cells.

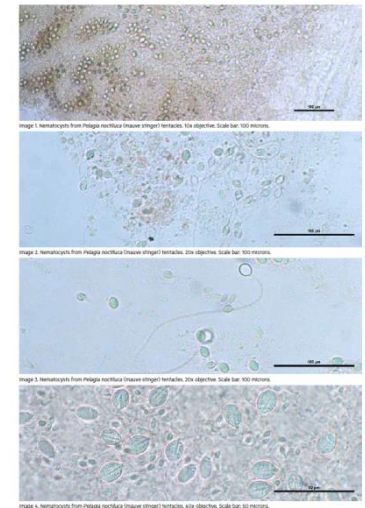


Phylum Cnidaria includes Jellyfish (top), corals (left), anemones (middle) and soft corals (right). All cnidarians have stinging cells called cnidocytes. All Images: Queensland Museum, Gary Cranitch.

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## Online Resources and Loans Kits

Connecting our collection with the curriculum, for use in the classroom

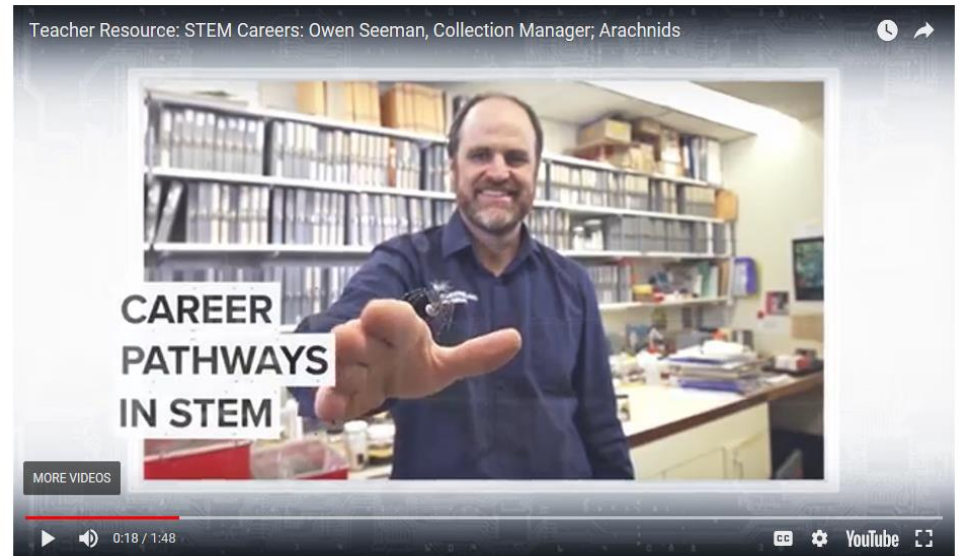




Teacher Resource: Year 8 Biology, Cells, Dr Jessica Worthington-Wilmer



Teacher Resource: STEM Careers: Owen Seeman, Collection Manager; Arachnids



## STEM Professional Videos

Connecting students with STEM in the real world, and the industry professionals who do it

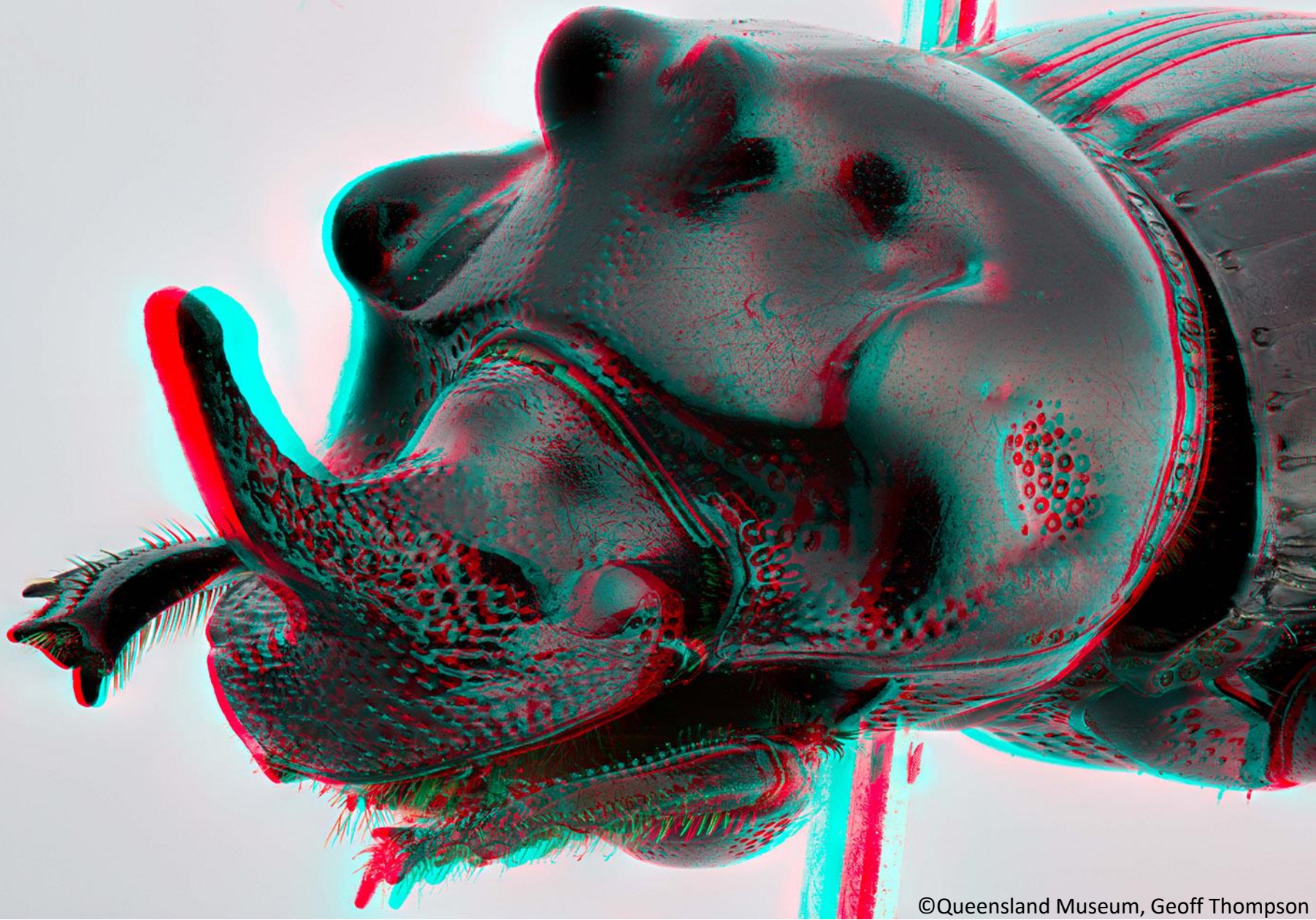


# Put your 3D glasses on now!



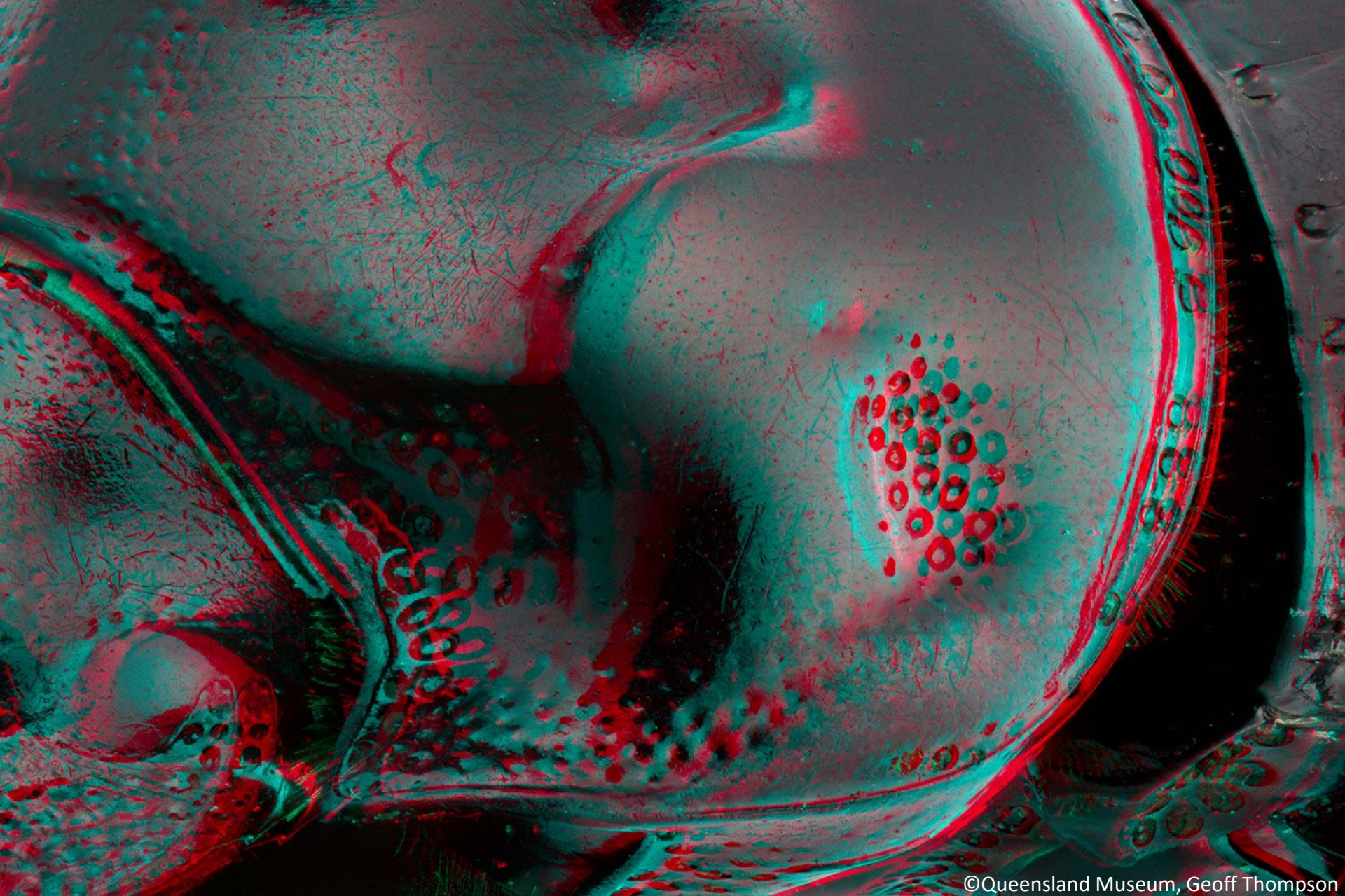
## Programs and Experiences

Creating opportunities for everyone to connect with our collections and research in meaningful and memorable ways



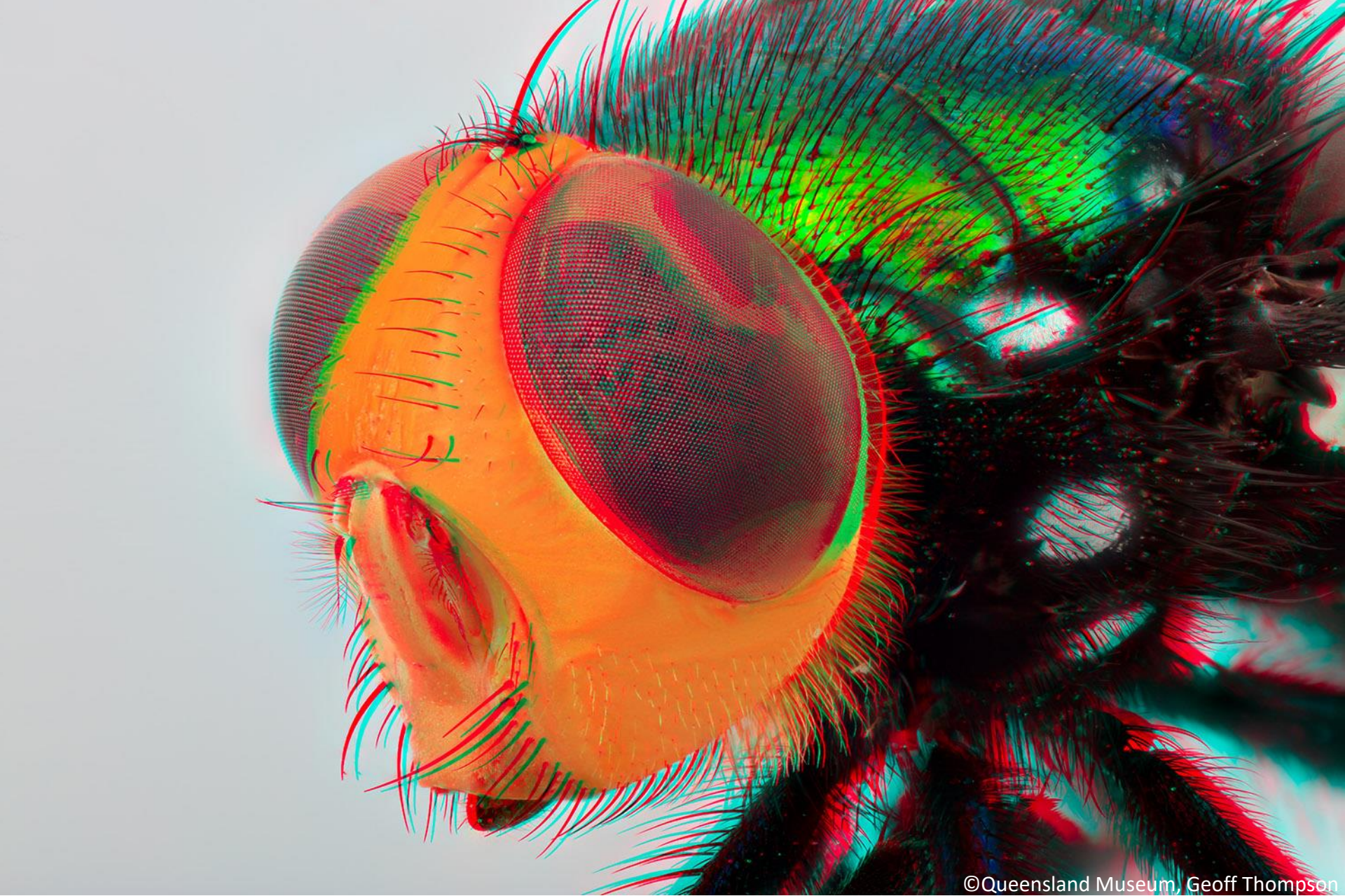
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Dung beetle, *Coptodactyla brooksi*



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Dung beetle, *Coptodactyla brooksi*



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Yellow-faced blowfly, *Amenia* sp



©Queensland Museum, Geoff Thompson

Yellow-faced blowfly, *Amenia* sp



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Spider, *Phlogiellus* sp.



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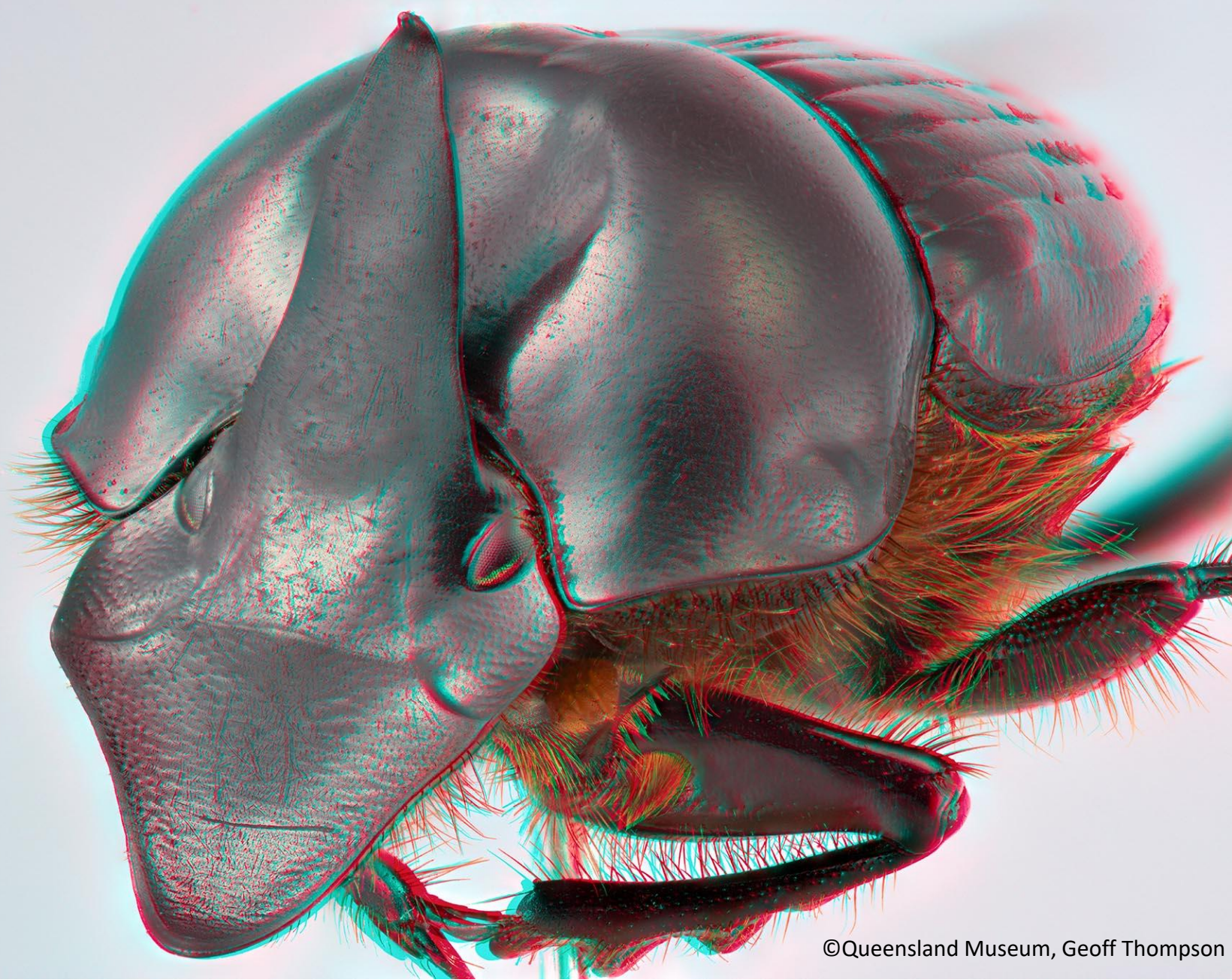
Spider, *Phlogiellus* sp.



©Queensland Museum, Geoff Thompson

Spider, *Phlogiellus* sp.





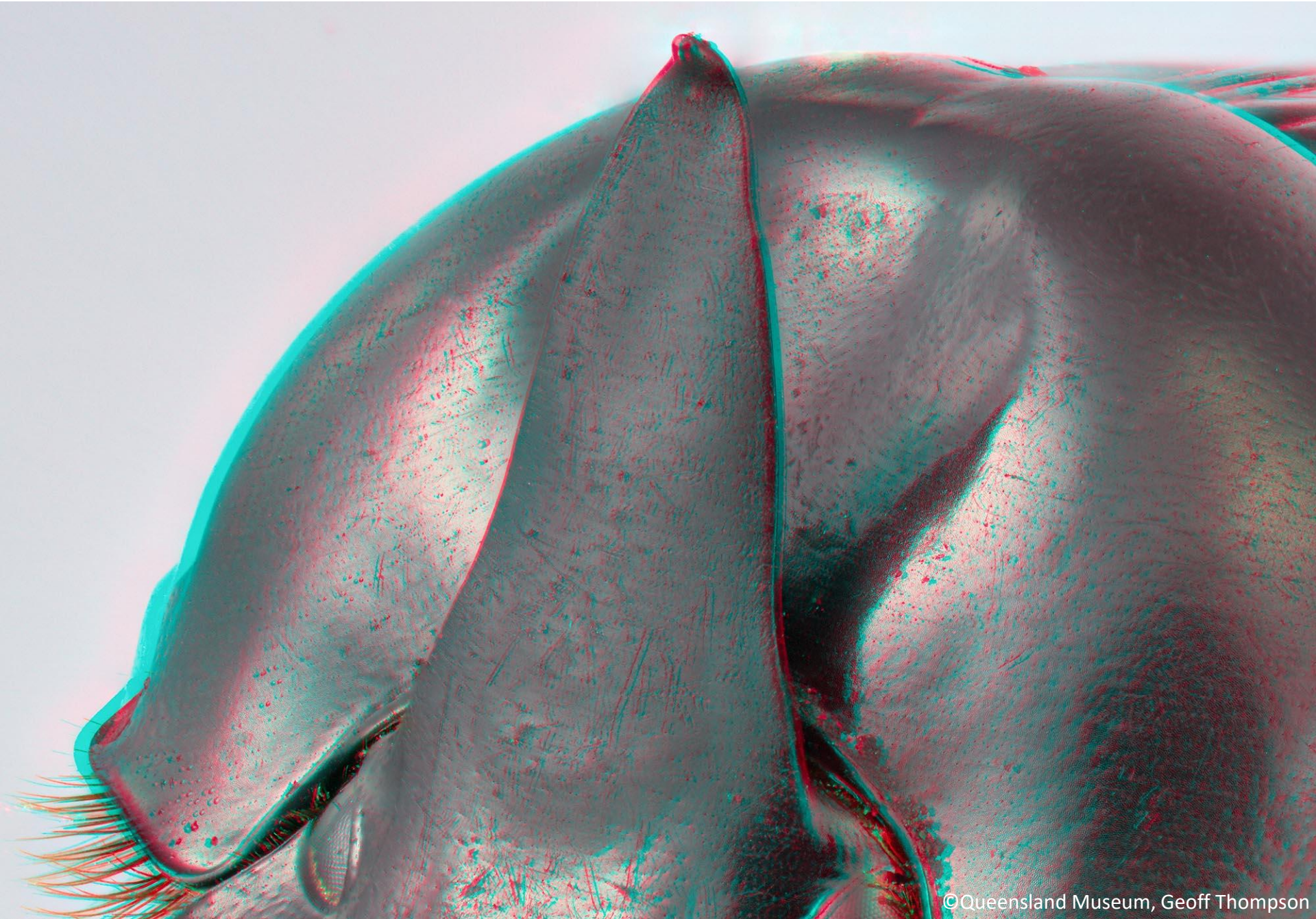
©Queensland Museum, Geoff Thompson

Dung beetle, *Onthophagus macrocephalus*



©Queensland Museum, Geoff Thompson

Dung beetle, *Onthophagus macrocephalus*



©Queensland Museum, Geoff Thompson

Dung beetle, *Onthophagus macrocephalus*

100% of teachers surveyed said *Creative Lab* was beneficial

95% indicated they would continue engaging with the museum to enhance their student's learning journey

*"Our data has shown that there has been a high level of engagement and participation from students since we started in the Future Makers project. In 2014, about 75% of our students were at a pass or better level in science, in 2015 that increased to about 88% and in 2016 it was 94.6%."*

*"I now have more ideas about how to start inquiry based learning in my classroom"*

*"So good to have world-class presenters and a real-world experience of how we would work with students in a highly productive manner"*

### **Lessons learned so far...**

Connecting with teachers is valuable, and connecting offerings is good for us all





## Our next steps...

Launch our Learning Platform, kick start the ARC Project, open a new Sciencentre on 1 July 2018 – you're invited!



qm.qld.gov.au



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