BOTANICAL BRAINTEASERS

This activity is a discovery trail full of subliminal science! Your students should take up the challenge, suggest 'answers' and have lots of fun!

The teacher notes include explanations and some ideas for extension work when you are back at school.

Suggested level: Years 4-7+

Australian Government
Australian National Botanic Gardens

Further resources are available to you through the Gardens web-site, www.anbg.gov.au/education and through the Department of the Environment and Heritage web-site, www.deh.gov.au

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BOTANICAL BRAINTEASERS

Nardoo — find out more about this unusual fern later!!

There are lots of questions in this booklet and of course your aim is to answer them. They aren't all that easy, though!

Don't despair! Sometimes there is more than one correct answer for each question, and we give you lots of clues. The clues are marked like this:

There is also lots of interesting information that is marked like this:

Write your thoughts where you see this:

Botanical Brainteasers takes you along the main pebblecrete path but you may wish to go down minor paths for short distances. The Main Path has **Markers** (black numbers on a grey background) spaced 10 metres apart, starting at the footbridge near the café.

You begin at Marker 9 by the Ellis Rowan Building.

Here are some rules you need to keep in mind

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Getting started

If you have a large group, there are various ways you can organise your walk to accommodate them. Please see the *WHAT TO DO ON THE DAY* sheet in your booking kit for suggestions.

Suggested approach

Pre-visit

- Familiarise yourself and your students with the booklet.
- Check our web-site for tasters and ideas.

While at the Gardens

- It is more beneficial for your students to observe, discover and develop attitudes and values rather than to read and write comprehensive answers.
- Many of these activities are designed to heighten observation skills and encourage students to think about what they are seeing.

Post-visit

There are many extension ideas in the teacher notes.

Curriculum links

To help you evaluate your visit to the Gardens, some of the objectives and skills that are practised by your students when doing the exercises in this booklet are:

- observation
- evaluation
- making comparisons
- cooperative group activities.

They link across all the Key Learning Areas.

Marker 9 or 17.2...

- **The Question:** The actual age of the bottlebrush plant does not really matter, as different elements will vary, such as which branch a student selects, whether it has been pruned, whether it has flowered every year etc.
- **The Process:** What matters here is the process. Students are challenged to observe closely, discuss, estimate and apply logic.
- **The 'Answer':** We would hope that students will use the visual clue in the booklet, count the number of fruits along the stem, then add three to arrive at a total.

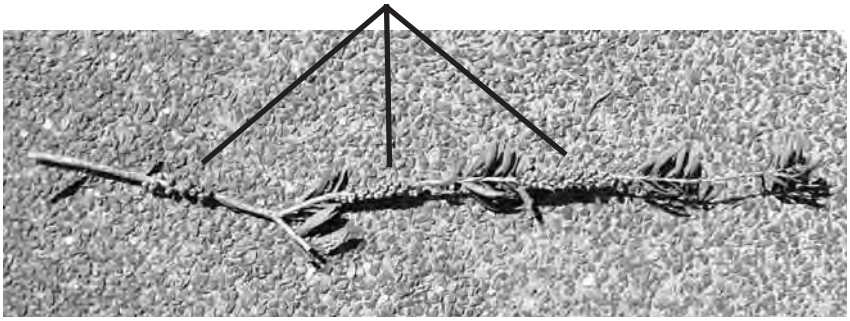
  Some students might even count the fruits on several stems and find an average.
- **The Science:** So what science have your students learned? Perhaps that:
- 'fruit' does not always mean 'delicious' or even 'edible'
- fruits can also be hard and woody
- all fruits contain seed
- seeds can remain in some unopened fruits for years
- new leaves and flowers can alternate at the end of the same stem, but this is not common

Back at school:

What do these four have in common?

Marker 9...

How old do you think the bottlebrush at Marker 9 might be?



The bottlebrush (*Callistemon*) usually takes three years before it flowers. It then flowers each year, producing clumps of hard, woody fruits which look like small gum nuts.

You can see the older ones back along the stem from the tip.

Markers 17.2 to 21...

The point of this question is for students to observe closely and look for common features.

Markers 17.2 to 21...

Choose your favourite bark. Why is it your favourite?
What do you think these plants have in common?

This family of plants is called Myrtaceae and contains many species. There is certainly a lot of variation between the barks of these plants!

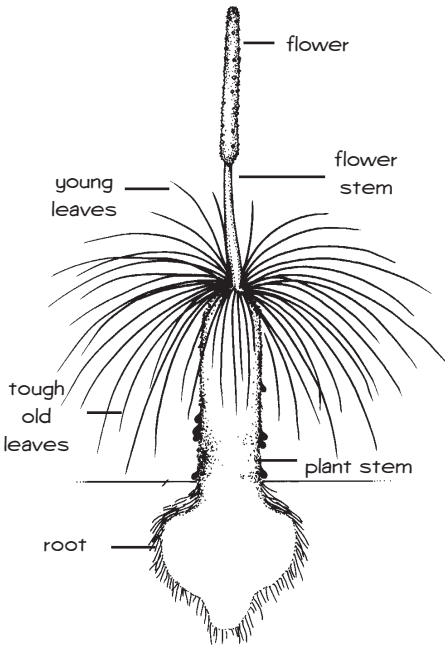
But they do have something in common. Look for the fruits.

Did you spot any of these?

Marker 24...

The tall flower stems of this plant were used as spear shafts by some Indigenous Australians. Resin gathered from the trunk was softened by heating and used as a glue. The seeds were ground to make flour.

- **Back at school:** Why not find out more about how Indigenous Australians used this plant? Find out how all the labelled parts were used. You can look it up on: **www.anbg.gov.au/aborig.s.e.aust/xanthorrhoea-species.html**



Marker 24...

How old do you think the tallest grass tree might be?

_____

Grass trees can grow to be very old! Many grow about one centimetre a year.

Marker 25...

How many new Gymea Lily plants might you get from a clump?

_____

Remember — you can't dig it up to find the answer! You have to estimate. Try the nearest clump.

Gymea Lilies produce seed from their spectacular tall flowers, but they also produce offshoots from the base of the parent plant. Each offshoot forms a separate plant that can be divided from the clump.

Marker 25...

There are two challenges here!

- Students need to work out what is meant by a 'clump'.
- Then they must estimate the number of new plants contained within a single clump. The answers will depend on where they are at mathematically.

The Science: Plants multiply using methods other that seeds. In this case, new plants grow by shooting from the parent plant. This is an example of asexual or vegetative reproduction.

Marker 27...

Here, you might expect students to deduce that the seeds are held within the hollows inside the fruit. Seeds are the result of sexual reproduction.

Back at school:

- What is the floral emblem of your own State or Territory? Find out! Go to the Gardens website at **www.anbg.gov.au/education/floral-emblem-ed**. Here you will find lots of information about the floral emblems of Australia's States and Territories. On this website you will also find associated fun activities. We encourage you to investigate your local patch of bushland and decide on a floral emblem for your own school, town or district. Then we encourage you to send us your findings!
- Find out how the shape of waratah seeds helps them to disperse.

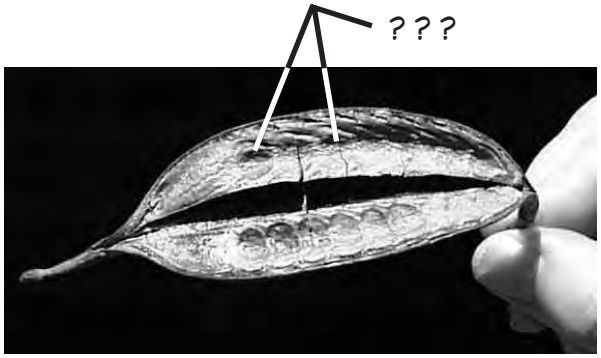
Marker 27...

REMEMBER!

How many plants do you think you could grow from seeds in a single waratah fruit?

_____

Find a fruit which has already opened and dispersed its seeds. There may be clues inside.



The Waratah (*Telopea speciosissima*) flower is the floral emblem for NSW.

Marker 33...

Back at school: The Australian mallee habitat is named both for its multi-stemmed eucalypts and as a distinct vegetation type.
Students might research:

- where it occurs
- why it is unique.

Marker 33...

Find a lignotuber on a mallee gum.

A short distance along the gravel path is a *Eucalyptus* tree. It is one of a special group of eucalypts that has many trunks growing from a large woody base which is called a lignotuber.

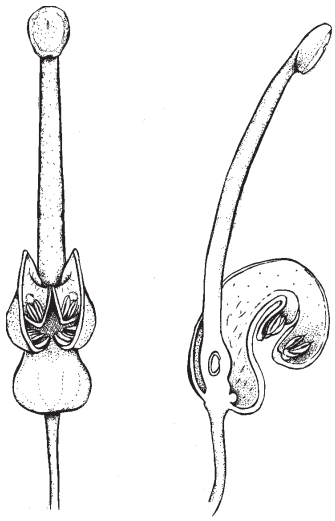
Circle it on the diagram.

Markers 34 to 37...

Grevilleas belong to the family Proteaceae. The family Proteaceae was named after the Greek god Proteus, who could change his shape and form at will. The widely varying shapes of the leaves led scientists to name this family after him.

Get your students to compare any *Grevillea* flowers they find with the photo in their booklet.
What is the common finding?

Did you know? Ripe *Grevillea* fruit splits open explosively, dispersing all the seed suddenly. How might you collect the seed? (One answer: Wrap the unripe fruit in pantyhose!)



Markers 34 to 37...

How many different leaf forms can you find here along the path?

_____

Grevilleas have a wide variety of leaf forms. You might like to draw 3 that interest you. Look closely to see the detail.

Now see if you can spot what ***grevilleas*** have in common.

_____

Find a flower that looks like these. Write its name here.

_____

Marker 49 (just past)

How high must a vine climb?

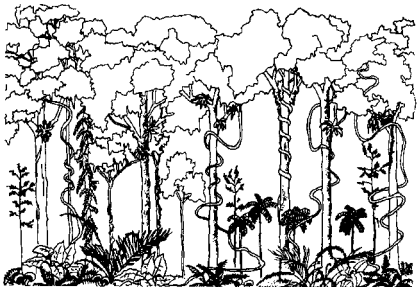
_____

Pandorea usually lives in dense rainforests where little direct sunlight can penetrate. It must have light to make food, however, so that it can grow. But instead of growing a thick trunk, vines twine high around other plants so the leaves can get enough light. Can you see the *Pandorea* foliage in the crown of the gum tree?

If this tree were in a rainforest, estimate how high the canopy would be.

Marker 49 (just past)

- **Back at school:** Why not investigate the layers in a rainforest? Get your students to decide where *Pandorea* would fit in this diagram.



Vines, orchids and staghorns are examples of epiphytes, that use other plants as supports.

- In a mature rainforest there isn't much light at ground level, so when a *Pandorea* seed germinates, it would be unlikely to survive. How might you explain the presence of Pandorea in a mature rainforest?

When an old tree falls, direct sunlight might reach the forest floor, so new plants can grow. New vines and their host trees can then grow tall together.

Marker 49...

- Banksia fruits are called follicles.
- They open up like clam shells and the seed can then be released.
- In many Banksia species the follicles can remain closed for several years.
  - The heat from a bushfire may cause them to open.
  - The seed still remains deep inside, protected by the separator.

- **Back at school:** Maybe you could reinforce this message back at school by scorching a closed Banksia cone. Remove the heat as soon as you see a follicle begin to open. (Note: Australian bushfires tend to be brief.)

Markers 54 to 55...

Remember...

Spot other differences!
The number of flower parts is a good indicator of the two main groups of flowering plants. The grass-like monocotyledon group has its flower parts in threes and sixes. The dicotyledon group has its in fours and fives. You might find another difference if you look closely at the leaves. **(~~shape~~ ~~colour~~ ~~size~~ veins)**

(NB: Veins are not a good indicator in every case. The important point here is to get your students to look closely.)

Marker 49...

Which *Banksia* fruits do you think hold the mature seed?

_____

Look carefully at the *Banksia* fruits. Do they all look the same?

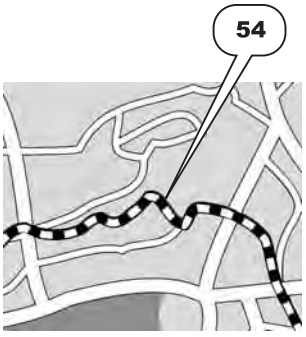
Do you think a bushfire would do any damage to seed in a closed fruit? Why do you think this?

_____

_____

Markers 54 to 55...

Mark the location of your favourite plant on the map.



First, work out where you are on the map. Then look across and down to the creek to see a range of plants which can be found in and around the Sydney region. Look around you and decide which kind of plant is your favourite. Mark its location with an **x** on your map.

As you walk up the path, see if you can find any flowers that have their flower parts arranged in **threes or sixes.**

Can you find any that have them arranged in **fours or fives?**

Marker 59.5...

Did you know that some casuarinas have either male or female plants? Others have separate male and female flowers on the same plant! If you observe them in the spring, this is very obvious. Here are photos a male and a female plants. Which one is which?

Marker 59.5...

Can you find a leaf?

Walk up the dirt path about 10 metres to the tap. Look carefully at the *Allocasuarina nana* plants and try to work out where the leaves are.

REMEMBER!

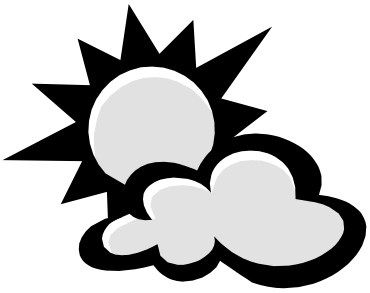
The leaves aren't green, but you can find them spaced along the green stems. (Was it actually a stem that you chose?) If you had a magnifying lens you would see crowns fit for a king or queen. They are the tops of the leaves, which are otherwise joined to the stem.

When you get to the Eucalypt Lawn you might like to take a break. Check out the Ducrou Pavilion and its patterned floor, or the different barks on the many eucalypt trees. Then move on to the next challenge.

Teachers please note: The Ducrou Pavilion is a great place for your group to take a break. You could stop for morning tea or lunch, or simply break for a few minutes to work off that excess energy! A great place from which to do Yard Duty.

Marker 91...

What's the time?



Up from Marker 91 is a sundial. Can you use the sundial to measure the time? Read all about it, then without looking at your watch, calculate the correct time for today.

Marker 91...

How do you tell the time:

- during daylight saving?
- when it is cloudy?
- at night?

Marker 99...

Explorers Burke and Wills hoped to survive on Nardoo spores when they ran short of food, but they didn't prepare it as the local Indigenous Australians did.

Eating raw Nardoo leads to a severe lack of Vitamin B1 in humans. In the case of Burke and Wills it proved fatal. Wills himself wrote not long before he died, "starvation by nardoo is by no means very unpleasant..."

Back at school: If your students are interested, you could investigate this subject further. These two web-sites might prove interesting:
www.burkeandwills.net/archives/willsfieldnotestxt.html
www.ansci.cornell.edu/plants/toxicagents/thiaminase/thiaminase.html#thia.10

If you look carefully, you might find two different types of Nardoo here. It was the hairy one that Burke and Wills ate!

Marker 99...

Don't eat Nardoo!

Remember the 'unusual fern' on the front cover of this booklet? Look for it around the pond. Nardoo is a fern that produces leaves that look like a large four-leafed clover.

But be careful! If you eat the spores from this plant, you might end up like explorers Burke and Wills! Find out what happened to them!

Marker 102.5

Keeping flora (or fauna) in a cage is only one way of preserving it. Can you think of any others?

- One way (that is also occurring with the Wollemi Pine) is to grow the endangered species in large numbers so that people can buy one.
- Another might be to conserve the natural habitat in which they live.
- Which do you think is the best method?

In the Rainforest...
students might spot some of the following ways that leaves can obtain as much light as possible:

- height
- large surface area
- horizontal arrangement
- dark green leaves (increased chlorophyll)
- epiphyte habit (i.e. the plants cling to the trunks of trees or branches, which are higher up).

Marker 102.5

Where's Wolly? Why?

_____

Is the cage to keep the tree **in** or the people **out**? This is one way to conserve our rare and endangered species.

The Wollemi Pine (*Wollemia nobilis*) was discovered in 1994 in a deep gorge in the Blue Mountains area. Pollen from this plant is known from two-million-year-old fossils but until this discovery, it was thought to be extinct. There are only about forty mature specimens left in the wild.

Follow the Main Path down through the Rainforest Gully. Look for some ways that plants obtain as much light as they can in order to grow.