

FROGS – ANATOMY AND PHYSIOLOGY

Background

Amphibians are unique in their ability to live both on the land and in water and metamorphose during their life cycle. Frogs lay eggs, usually in a string or a mass that sticks to vegetation and are fertilised by the male as they are laid. The eggs hatch into the first larval stage which lasts for 2-25 days depending on the temperature or species of frog. Life as a tadpole is spent in the water and during this life stage they have gills rather than lungs and don't possess legs. As a tadpole, frogs grow longer and form fins, develop hind then front legs, their tail becomes shorter and their gills are replaced by lungs.

Frogs have moist skin through which they can conduct gas exchanges, as well as with their lungs and they also secrete poison through their skin, though only some species are toxic to humans. Usually the brighter colours indicate greater toxicity to humans.

Aim

The aim of this session is to:

- Investigate and understand frog anatomy and physiology

Materials

- Frog model worksheet
- Scissors, glue, coloured pencils/textas
- Access to computers and the internet
- Froguts website: www.froguts.com (follow links to the demonstration)
- Virtual frog dissection worksheets

Notes for teachers

- This virtual dissection can be completed in conjunction with or instead of a real dissection, but may assist in overcoming some ethical issues faced by students.
- The dissection worksheet is specifically focused on a cane toad which is a feral species in Australia and one which is causing considerable destruction, particularly in the northern parts of Australia, so is a suitable species to be used for a dissection.
- Froguts is a subscription service, but there is a free demo of a basic frog dissection available. To explore other aspects of the frog, you may need to subscribe.
- This lesson could be extended to examine amphibian reproduction and evolution.

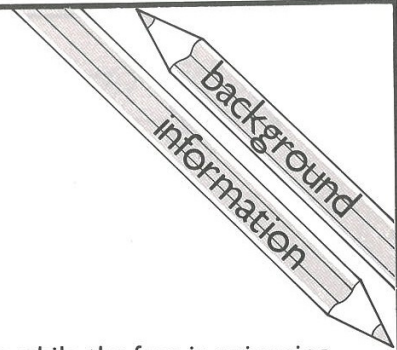
Estimated Duration

- Introduction: 10 mins
- Frog model: 20-30 mins
- Froguts dissection: 15-20 mins

Lesson

- Introduce topic using Power Point presentation and revise previous Frogs lessons.
- Colour, cut out and assemble the Frog Model.
- Load Froguts website, follow the link to the demonstration and begin external examination and recording of information on first dissection worksheet.
- Complete the virtual dissection, recording information on the second dissection worksheet.

Frog



Frogs belong to a group of animals called Amphibia of which there are about two thousand different species living in the world today. They tend to live in confined habitats and most of them cannot exist far from water. Some desert toads survive in tropical regions by burrowing in the ground and by special adaptations which allow them to live in dry conditions. There are three main groups of amphibia: the newts and salamanders, the frogs and toads and a small group of tropical, limbless types which burrow in the soil rather like worms.

Frogs are common in most parts of the world except the southern part of South America, New Zealand and on oceanic islands. All frogs have the same basic shape, although they vary in size from the giant Goliath frog of tropical Africa to the tiny arrowpoison frog from Cuba. They tend to inhabit moist, damp conditions such as marshes, swamps and ditches, where they spend most of their time in the undergrowth. They have powerful hind limbs adapted for both swimming and leaping. The webs on the hind feet provide a large surface area for pushing against the water. Frogs crawl on rough ground. The eyes, which are on top of the head, protrude above the water while swimming. Each has a protective, moveable lid and this can be withdrawn into the skull for further protection. The eardrums can be seen on the side of the head behind and below the eyes.

All frogs are carnivorous, feeding on insects including beetles and flies. They also feed on worms when they can find them. They have an especially adapted tongue which can be shot out in a half circle and the prey is trapped in the sticky saliva covering its surface. As the tongue is pulled back, the prey is crushed against the roof of the mouth. The skull of the frog also has a row of tiny, closely set teeth on its upper jaw with which it crushes its food.

Frogs have a loose-fitting, thin, moist skin which is supplied with a network of blood vessels. The skin is used for breathing and oxygen is absorbed through its surface into the blood from the water. The nostrils are situated in such a way that air can be breathed

into the lungs even while the frog is swimming under the surface of the water. Valves inside the nostrils stop water entering.

The frog's colours often act as camouflage in its natural surroundings. These colours can be made darker or lighter by expanding and contracting the pigment spots in the skin. Many tree frogs living amongst tropical vegetation take on a bright green colour which becomes much duller when the animals move into shaded areas. Some tropical species are very brightly coloured and their skins produce poisons which are fatal to humans and other animals. In this case, these bright colours act as warnings designed to advertise the dangerous nature of the animals. South American Indians have taken advantage of this and certain tribes still extract these poisons for their hunting arrows.

All frogs depend upon water for breeding and this is even true of the specialised desert toads which reproduce quickly at the beginning of the rainy season. During mating, the male joins the larger female, climbing onto her back and clasping her firmly around the middle. The two sexes remain together for several days while the female lays eggs at regular intervals. Immediately after the eggs are fertilised externally by the male shedding sperm over them in the water, a thin layer of protective jelly swells around them. During the next few days, the yolk in each egg develops into a tadpole, with external gills. The tadpoles wriggle free of the jelly after a few days and they usually attach themselves to pieces of pond weed by a small sucker. After a period of time, the external gills change into internal ones, protected by a structure called an operculum. Now the tadpoles start feeding on vegetation using a pair of horny, toothed-jaws. Over the next few weeks hind limbs form followed by front limbs. Lungs form and the tadpole changes from being herbivorous to carnivorous. It now starts to feed on insect larvae and crustaceans. The tail is reabsorbed and the small frog climbs out of the water onto the land. This now feeds amongst the grass and undergrowth close to the water's edge and develops into an adult frog.

Frog

and colour
and assembly

Colour the frog's underside, chin, arms, sides of the **internal body section** and legs pale yellow and then go over the chin, arms, and legs very lightly with green.

Key and colours to numbered parts

- 1 oesophagus (gullet) (green)
- 2 stomach (green)
- 3 small intestine (green)
- 4 rectum (green)
- 5 cloaca (green)
- 6 pancreas (yellow)
- 7 spleen (red)
- 8 bladder (yellow)
- 9 kidneys (brown)
- 10 testes (yellow)
- 11 liver lobes (brown)
- 12 gall bladder (green)
- 13 lungs (orange)
- 14 heart (red)
- 15 orbits (eye socket) (pale green)
- 16 tongue (red)
- 17 lower jaw (yellow)
- 18 upper jaw (yellow)
- 19 nuptial pad of male thumb (yellow/green)
- 20 inferior vena cava (blue)
- 21 veins (blue)
- 22 arteries (red)
- 23 dorsal aorta (red)
- 24 veins (blue)

Assembly instructions

Colour the parts **1–24** using the colours suggested above. Cut out the parts and then fix into your book or onto a piece of card or paper in the following order:—

Stick down the **internal body section** in the centre of your paper.

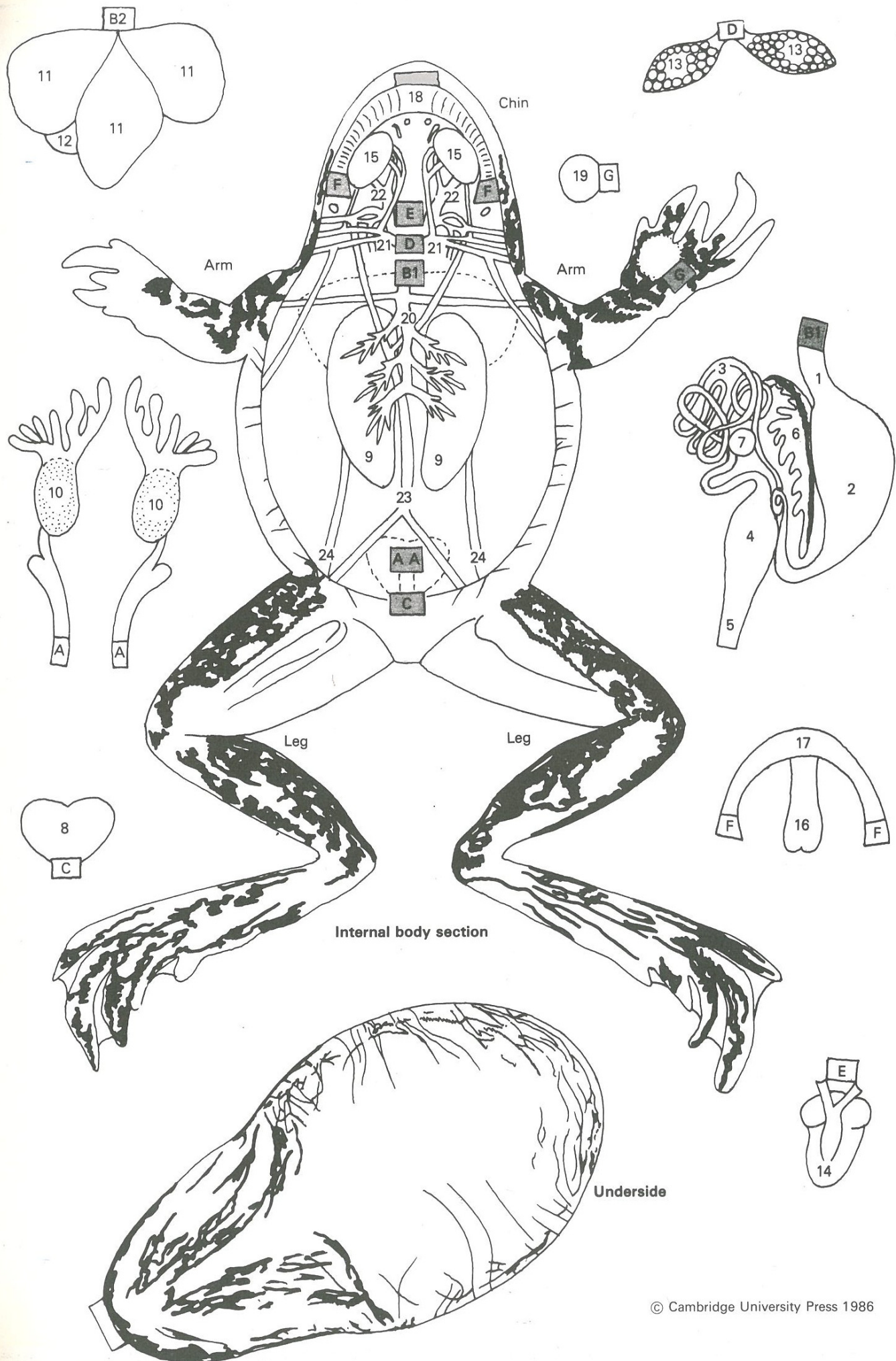
Now stick the various body organs onto the lettered, shaded areas marked on the **internal body section** in the following order:

- the testes by tab **A**
- the alimentary canal by tab **B1**
- the bladder by tab **C**
- the lungs by tab **D**
- the liver lobes by tab **B2** over the tab for the alimentary canal **B1**
- the heart by tab **E**
- the lower jaw by tab **F**

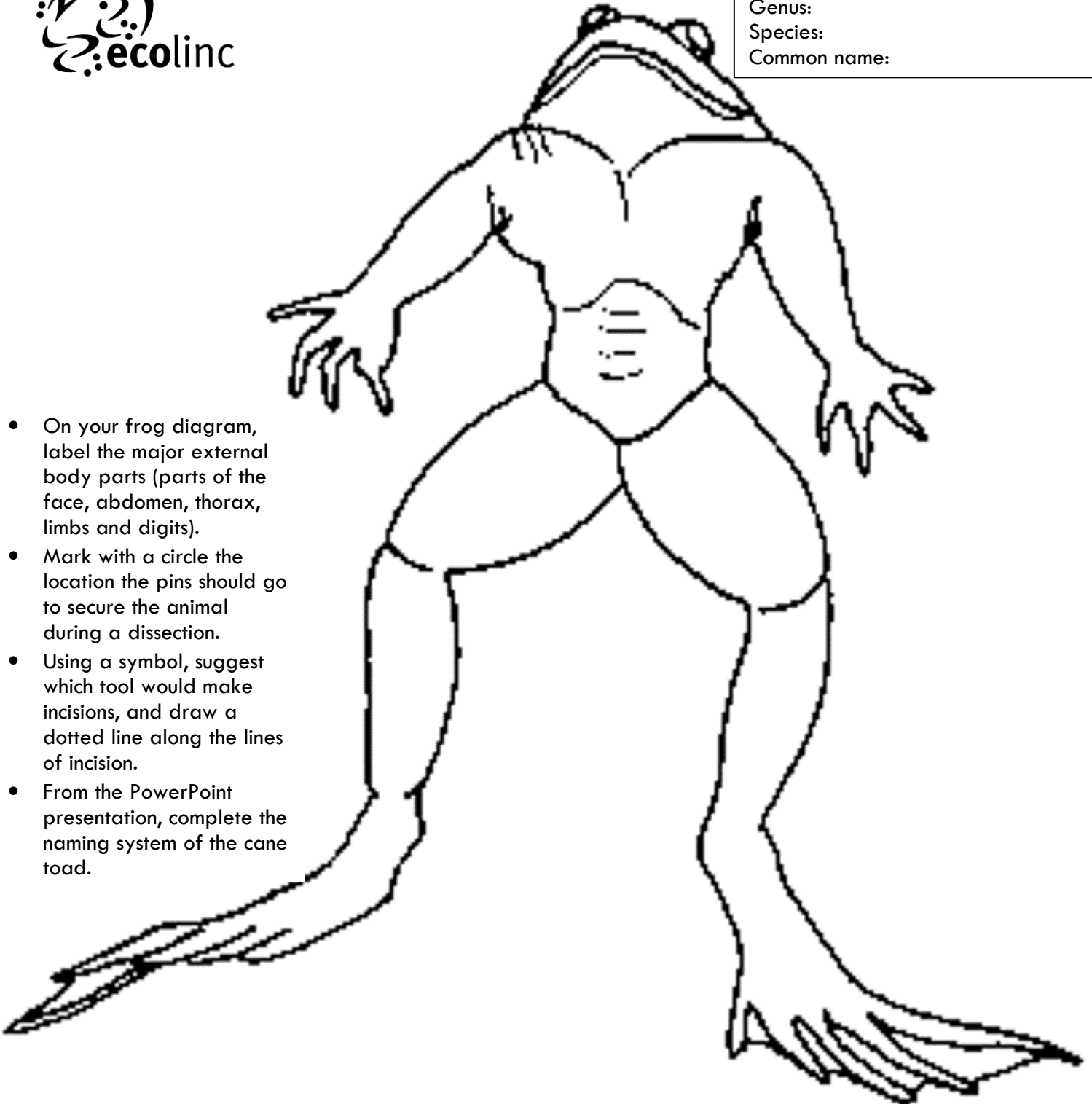
Now stick on the **nuptial pad** over the lettered, shaded area by the tab **G**.

Stick the **underside** in position by its tab so that all the internal organs are covered.

Write the title and date above the completed cut out.



Kingdom:
Phylum:
Class:
Order:
Family:
Genus:
Species:
Common name:



- On your frog diagram, label the major external body parts (parts of the face, abdomen, thorax, limbs and digits).
- Mark with a circle the location the pins should go to secure the animal during a dissection.
- Using a symbol, suggest which tool would make incisions, and draw a dotted line along the lines of incision.
- From the PowerPoint presentation, complete the naming system of the cane toad.



- On your frog diagram, label the major internal organs identified in your online dissection, and briefly state the role of each organ.