Introducing Microcosmos

This film is probably unlike any film your students will have viewed before, with a cast that features a number of insects and guest appearances by some frogs, a climbing vine, flowers and a pheasant. Its spectacular close-up shots are juxtaposed with shots that remind us of the big picture, the interconnectedness and order of life.

The film has minimal narration but manages to captivate audiences through its powerful images and exceptional cinematography. The images are supported by Bruno Coulais' score that at times adds a poetic eeriness to the film, while at other times punctuates or underlies comic or dramatic subtexts. The quality of the cinematography is outstanding and all who view this film will be amazed at how they can become so engrossed in the lives of such small living things. However, with a running time of 77 minutes the film requires careful introduction to enable your students to gain the most from it.

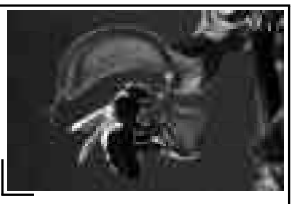
Using Microcosmos in the classroom

Microcosmos is suited to middle and senior primary classes, secondary students and adults. It is helpful if the teacher has had the opportunity to view the film prior to selecting introductory and follow-up learning activities.

Microcosmos provides opportunities for the teacher to encourage student investigation of a range of concepts such as habitat, communities, adaptation, needs, ecosystems, interdependence, natural cycles and systems, reproduction, environment and materials. In particular the film helps to develop the concepts of ecosystems and the interconnectedness of things living within them. Teachers are encouraged to select activities from this guide to meet the needs of their students and to facilitate the development of a range of learning outcomes.

Learning Outcomes

The film has the potential to be used as a resource for all of the eight key curriculum areas, although this guide will concentrate on science. It provides a range of activities suitable for use with upper primary and lower secondary students focusing on the science strands 'Life and Living' and 'Natural and Processed Materials'. Learning outcomes are described in more detail in the National Curriculum Profile. Microcosmos is particularly useful in providing a context in relation to the following outcomes:



Life and Living

- Describe relationships between living things.
- Map relationships between living things in a habitat.
- Identify events that affect balance in an ecosystem.
- Describe the role of living things in cycling energy and matter.
- Study effects of environmental change on living things and ecosystems.
- Identify features of plants and animals that change over time.
- Examine similarities and differences between and within groups of living things.
- Identify features of living things that help them to survive in their environment.

Natural and Processed Materials

- Assess the effectiveness of materials.
- Use scientific tests on materials.

Teachers may build upon the activities suggested in this guide by referring to Metro Education No. 10 available from ATOM (Locked Bag 9, Collins St East, Melbourne Vic 8003 Tel. (03) 96511310) and the special feature poster and articles in the Sunday Age on 18 May 1997.

Before watching the film

Dragonflies are quite large insects that usually live around streams or ponds. They eat insects that humans consider pests, such as flies and mosquitoes.

Imagine you are a dragonfly drifting through the air. Compared to humans a dragonfly is very small, yet the dragonfly can move very fast, up to 58km/hr. How far do you think a dragonfly can see into the distance? What might you be looking out for as you fly about? What features of the environment would cause you to alter your flight? Investigate the size and diet of insects such as the dragonfly. What is a damsel fly? What predators do these insects need to avoid?

The dragonfly is only one of the many insect species found throughout the world. Make a list of insects that you are likely to find near your home. Create a table that enables you to compare the features that insects on your list have in common and also features that are different, for example,

Name	Body parts	Wings	Colour	Appendages
Blowfly	head, body bottom bits	1 pair	black	6 legs, 2 antennae

Form a small group to discuss insects found around your school and home. Compare the insects on your lists. Brainstorm and record on large sheets of paper what you know about these insects. Decide what you are sure about and what you need to investigate further.

Write a summary on the sheets of paper under the following headings:		
Insect name	Information we are sure about	Information we need to check

Meet together as a class and share your knowledge.

Use the table as a basis to draw a concept map relating insects and other living things in the local environment. Consider the following words and try to include these and other relevant words in your concept map: food, water, predator, prey, plant, reproduction, growth, flowers, insects.

Preparing for the film

Examine promotional material from Microcosmos. Discuss what you think the film is about. What makes you think that? What other films or television programs have you seen that might be similar? What is a documentary? How might you expect Microcosmos to be different for you as a viewer since it has minimal narration?

The film title *Microcosmos* is based on two words, micro and cosmos. What do these words mean? If you knew nothing about the film but understood the meanings of the two words how would this help you to predict what the film might be about?

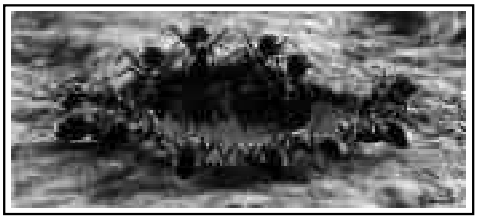
Imagine you were planning to film this documentary. List the types of questions viewers might have about the cast of your film.

Questions might include:

- What type of living thing is it ? eg. plant, animal
- Where does it live?
- How does it move?
- What does it eat?
- How does it eat?
- How does it find its food?
- How does it reproduce?
- Why does it have a particular colour? eg.The ladybird featured in the film has seven spots. If it had a different number of spots (eg. 6 or 8) do you think other ladybirds would mate with it or would they not recognise it as one of their own?

The Film's Cast Members

Insects that appear in the film: ladybird with seven spots, swallow-tail butterfly, climbing caterpillar, bee, sage flower, long tailed blue caterpillar, snails, spider, ants, wasps, sacred beetle, pheasant, a bee in love with an orchid, an insect eating plant, dung beetles, great peacock moth and a wriggler as it changes into a mosquito.



The film covers a day in the life of a small meadow set in the South of France. Discuss with the class what you know about France and the types of insects that could be found in a meadow there. Form groups and prepare murals that represent what you would expect to find in the meadow. What natural features would be in the habitat? Create your mural to represent a likely "setting" for the cast.
Beside the murals write sentences that explain why you have placed the cast as shown, eg., 'I placed the bee on the flower because that's where I see bees at home'.

If you have time you may use a library, CD ROM or the Internet to find out more about the film, its makers (Claude Nuridsany and Marie Perennou), the Aveyron region of France, the entomologist Jean-Henri Fabre or even the composer of the soundtrack, Bruno Coulais.

Microcosmos Microquiz

Work in teams to find answers to these questions and puzzles while you are watching the film:

- What living things made a tasty feast for the pheasant?
- Why does the rare Argyronet spider need a 'diving bell'?
- What does the Sacred beetle do with its pill of sheep droppings?
- Which little creatures are busy 'milking' gnats to collect the sweet liquid they produce?
- How does the thunderstorm affect some of the living things?
- How many spots does the ladybird have?
- Which living thing in the film has the most legs?
- Which slimy creatures mate so romantically?
- What type of beetles battle so heroically?
- Why do you think the Processionary caterpillars have this name?
- Which horned beetle looks remarkably like a large animal?

After watching the film

Discuss the following questions. Did you enjoy the film? How would you describe the film: interesting, funny, sad, fascinating, exciting, mysterious, frightening, informative? Which parts did you like most? Why? Which were your favourite living things? Explain why they were your favourites. Was the film as you expected it would be? What surprised you in the film? How did the musical score make you feel? Which animal or plant did you think was best matched to the accompanying music?

As a class share your responses to the Microcosmos Microquiz.

Refer to the murals created earlier. Was the setting, or the habitats of the animals and plants as you expected? Which animals relied on teamwork? Why do you think some animals do things individually? Which do you think were more successful in their efforts? Why? How many different means of locomotion did you observe? Explain some of the different ways that plants and animals reproduce?

All living things have a life cycle that involves coming into the world, growth and reproduction. Some living things have short life spans, others have longer life spans. For example, a housefly lives only about two weeks. Place in sequence the living things in Microcosmos from the shortest lived to the longest lived. You may need to refer to various reference materials to check ideas. What patterns can you see emerging?

The filmmakers said this about the film: *"Insects don't live long, at most a few weeks. To them one day is more intense than it is for us. The day we describe in Microcosmos is a symbolic day, twenty-four hours treated as if it were a whole year in the life of a man, with all the very intense moments affecting it."*

What do you think they meant? Do you think the film gives you information about how weather and different seasons affect the lives of animals and plants? What does the film tell you about seasons and cycles?

Investigating activities

In order to film Microcosmos the filmmakers required specialist resources to look after the cast, eg., the dung beetles were supplied by a laboratory in Spain. You may wish to keep some small insects of your own. In most states and territories in Australia the keeping of many marine, aquatic or other small animals is strictly controlled. It is usually illegal to even keep frogs and lizards. Check with local authorities before trying to set up your own microscopic cast. You may need to obtain and pay for a special permit.

The texts *Operation Insectwatch* and *More Than Minibeasts* might assist you with observations and keeping small living things for a short time.

Insects

Insects are cold-blooded, invertebrate animals that have a protective covering or exoskeleton. Rather than growing, the exoskeleton is shed when it is too small. They have bodies that comprise three main parts: the head, the thorax, and the abdomen. Most insects have three pairs of jointed legs joined to the thorax. Insects have no lungs, instead they breathe through holes in their bodies known as spiracles. Most insects have compound eyes and antennae to help them sense changes in their environment.

Keeping insects in a small container

The aim of this exercise is to recreate the type of conditions that the insect needs to survive in their natural habitat. Insects are living things just like humans. They need food, water and air and they also produce waste materials. Most insects live in an area where there is night and day and they tend to have very simple systems to handle changes in the environment such as temperature and rainfall fluctuation.

Since many insects either eat other insects or get eaten by others themselves it is best for you to keep only one type of insect in each container.

Materials

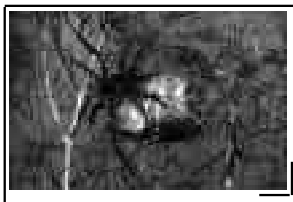
- A small container that has a removable lid. Ice cream tubs, plastic boxes and cardboard boxes are suitable.
- Insects.
- Leaves and seeds or other materials from the natural environment found near the insects, that are likely to affect their chances of survival.

Method

Locate some insects and place in the container along with some of the materials from the place you found it, eg., twigs, grass, flowers.
Many insects are fussy about what they eat and drink so it is important that you supply a range of materials and water and change them every day or two. For example, if you found your insect on a plant leaf, supply it with similar plant leaves on a continuous basis, ensure they are fresh and don't let them dry out. It often helps to place a damp piece of sponge in a saucer in one part of the box. The sponge has two benefits, firstly, it can provide water and secondly, it will help to keep some moisture in the air.

Findings

- Try and keep your insects alive for one or two weeks. Record any changes that you observe, particularly major changes such as shedding an outer body covering.
- What set your insect apart from others collected by classmates?
- What physical parts of the insect might help you to identify it?
- What special needs did your insect have? If it died, why do you think this happened?
- Use data from the table created earlier, your observations and search out any information that is missing to help you prepare a poster that shows what your insect eats, what it looks like and also any changes it went through.
- Use books, posters, CD ROMs and other resources to learn more about insects. As a class organise some oral presentations or create a factual text providing information about the insects in your local environment.



Spiders and spider webs

Spiders are often mistaken for insects. Can you explain the differences between spiders and insects?

In Australia we have more than 20,000 types of spider and in some places it has been suggested that there could be more than 5 million spiders per hectare. All spiders make poison (look up venom in a dictionary) yet most do not harm people and in fact provide a great service to us by eating insects that cause us problems. Spiders such as the Sydney Funnel Web, the White Tailed house spider and the Red-back can be lethal. Others such as the Black-house spider, that weaves tube-like webs near window sills, can give a painful bite so it is important that extreme care is taken when investigating spiders so that you are not bitten.

In the film a spider quickly pounced on some grasshoppers and stopped them escaping by using its web to tie them up. A spider's web is a very special material that can be studied at school. Locate several spider webs and then try the following tasks.

- Draw a picture showing the shape of each web and describe each one. Give some idea of how big each web is, eg., half a metre across. Your description may include responses to questions such as the ones that follow.
- Where is it located?
- How is it held in place?
- What materials are on the web?
- If there is a spider nearby, you may also describe it . Use books and other reference materials to help identify it and find out about its preferred habitat, eating habits and other interesting information.

Write a report that uses a table or map to show where webs were found around your home. Suggest reasons why webs are more likely to be found in places like window sills than on door sills.

Testing spider webs for strength

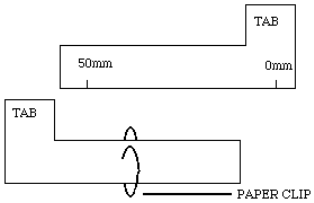
Spider web material is like silk produced by silk worms. In the following activity you can use web silk or silk worm silk to investigate its strength or alternatively you may choose to investigate another natural fibre.

Materials

- scissors
- cardboard
- ruler
- pen
- double sided sticky tape
- paper clip
- notebook

Method

Cut out a template as shown and make it about 50mm long with one side having a scale marked that covers the 50mm length as shown. On your template make a mark at every mm between 0 and 50.



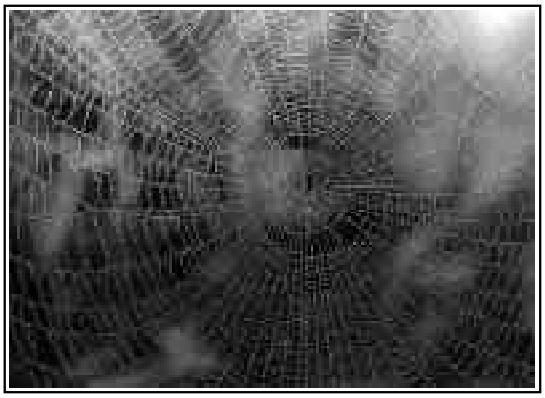
The two pieces join together and are held loosely in place by the paper clip. The two tabs are each covered with double sided sticky tape. The distance between the two tabs should be 50mm.

To capture a sample of silk hold the silk stretcher in one hand behind a strand of web and bring it towards you so that the strand gets stuck on each tab and forms a straight piece between the two tabs. The strand of web is 50mm long. As you move the two pieces of the device apart the silk will be stretched. Keep stretching the silk until it breaks and note the separation reading on your device, eg.,15mm.

The stretch can be worked out using percentage calculations. In the example below the stretch was 15mm so the web stretched from 50mm to 65mm before breaking. Percentage stretch is the extra distance divided by the total multiplied by 100. 15/65 x 100 = 23 %.
Repeat this experiment several times on a similar piece of the web.
It may be helpful to store your results in a computer using a data base or spread sheet.

Looking at your results

Did the web always stretch to about the same percentage, for example 20%? If not was it close, say within a range of 15% to 25%?
Scientists usually repeat their experiments many times. Discuss with three or four other students why they should go to this extra trouble rather than simply accepting every experiment as a perfect result.



Identify and discuss examples from the film that show how important the strength and properties of this material (web silk) are to a spider.

Further Investigations

- Are all bits of the one web of the same strength?
- Do all spiders produce webs of about the same strength?
- How does web silk from different types of spider compare in terms of thickness and appearance? The best way to investigate this is to use a microscope with pieces of thread on a glass slide. It is possible to use a microscope to work out the exact thickness of the web in terms of "Micrometres". The technique will require a little help from a person skilled in the use of a microscope.
- How many micrometres fit into a millimetre?

Safety notes

Avoid handling webs if a spider is visible, wear gloves and above all, take no risks. If in doubt ask for help from an adult. If bitten by a spider it is most important to get it correctly identified, so rather than crushing it, get it in a jar!

The Dung Beetle Challenge

In the film a dung beetle is shown rolling a ball of dung and taking it away to be buried. Dung beetles are an important part of our environment and they are quite choosy about the type of dung they work with! When Europeans changed the Australian landscape from native bush to open pastures with cattle, sheep and horses our native dung beetles were not interested in the new watery dung. It did not take long for other insects to make use of all this new dung and we soon had a problem as a number of different types of fly bred in the dung. In the early sixties the Commonwealth Scientific and Industrial Research Organisation (CSIRO) decided to investigate what would happen if they introduced dung beetles that would use the dung from cattle. A long campaign followed that is still of interest to many of our scientists. What information can you find about this experiment? Work in groups of two or four to present the information you find.

The dung beetle is a strong and quite determined insect yet it does not move too far from its home. Most of the beetles that have been released in Australia survived and reproduced in our environment despite predators such as birds and foxes. However their population moves across the land very slowly and rarely gets more than 100km away from the release site, even after ten years! In Microcosmos it appears that the dung beetle is quite strong and moves with some speed.

How fast does a dung beetle move? If you can find some beetles, preferably dung beetles, try and time how long it takes them to cover a small distance and then work out its speed by dividing the distance travelled by the time it took, eg., one hundred centimetres moved in 10 seconds is a speed of 10cm per second.

CSIRO Double Helix Science Club

In 1994 the CSIRO's Double Helix Science Club decided to use the power of school students to learn more about the spread of dung beetles. They had more than 1500 people from all over Australia dig up dung in cow paddocks. The main challenge was to identify the type of beetle found in the paddocks. The CSIRO published a small booklet called 'Common Dung Beetles in Pastures of South-Eastern Australia' to assist people helping with the survey. Club members then helped spread the beetle to areas of Australia that were low in dung beetles.

The CSIRO's Double Helix Science Club not only has national science experiments for its members but also publishes a colourful magazine packed with interesting articles and competitions. If you are interested in learning more about dung beetles or just having fun with science, contact the club for further information at P.O. Box 225, Dickson, ACT 2602 or find them on the web at the CSIRO site. Do a search!

Introduced Species

There are many introduced species of plants and animals throughout Australia such as the mosquito fish, the European wasp, the black widow spider, cockroaches, Paterson's curse, capeweed, arum lily and kikuyu grass. The species you will find in your local area will depend on your local environment. You may be interested to find out the effects of introduced species on Australia's native wildlife and plants. How do such species affect ecosystems and the balance between survival and extinction of native species? You could make pamphlets explaining what you find out about the relationships between introduced species and other living things within an ecosystem.

Concluding activities

The film Microcosmos takes you into the world of small living things such as insects and spiders. It helps us better understand ecosystems and the interconnectedness of living things. Microcosmos is an example of how scientists can present information to people in a way that can be fun and entertaining.

Present the results of some or all of your investigations into dung beetles and other insects, spiders and spider web silk to another class in an entertaining and interesting way, eg., a radio interview, 'a day in the life of a . . .' narrative, a video of the spider web tests, a Powerpoint presentation or a role play.

Create a class concept map to represent what you now know about the world of small living things and the relationships that exist between living things. Compare this concept map with your earlier concept map. What have you learned? Which activities contributed most to your learning? How did the film Microcosmos help to extend your knowledge? How can you use the knowledge and skills you have gained? Perhaps you could present key aspects of your learning to an interested community group.

References and resources

- Tyndale-Biscoe, M *Common Dung Beetles in Pastures of South Eastern Australia.* (1990)
- The soundtrack of the film *Microcosmos* by Bruno Coulais Editions Auvidis.
- Nuridsany C. and Pérennou, M *Microcosmos: The Invisible World of Insects,* Stewart, Tabori & Chang, New York. (1996) Distributed in Australia by Peribo, 58 Beaumont Rd., Mt Kuring-gai NSW 2080, Tel. (02) 9457 0022 Fax (02) 9457 0011
- *SimAnt* CD-ROM, dataflow
- *Insects - A World of Diversity,* CSIRO
- *Birds of Australia Version 4* CD ROM, Simpson and Daly
- *Rainforest* CD ROM, CSIRO
- *Ecotrekker* CD ROM, CSIRO
- The Gould League have many other excellent resources try: email:gould@schnet.edu.au or P.O. Box 117 Moorabbin 3189 Phone (03) 95320909. Fax (03) 95322860
- Davis, S and Evely C. (1992) *More than Minibeasts*, CollinsDove, Melbourne.
- Loves, June (1992) *Operation Insectwatch*, CollinsDove, Melbourne.
- Pryor, Neil (1993) *Who Brought That In?* CollinsDove, Melbourne.

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