



From Eggs to Adults

Grade: 2

Subject Areas:

Life Science, Art,
Investigation and
Experimentation

Skills: predicting,
modeling, observing,
sequencing, writing

Duration: 1 hour

Connections:
natural history, growth and
development, writing, drama,
animals

Vocabulary

growth

reproduction

fertilization

metamorphosis

amphibians

tadpole

froglet

larva

pupa

adult

Objective:

Students will learn about the process called metamorphosis and the growth and development of frogs and butterflies.

Materials

- sounds of frogs
- paper plates
- green and blue tempura paint and brushes (optional)
- colored markers
- pictures of frogs and butterflies in various stages
- live tadpoles (optional)
- handout: stages of a frog
- handout: stages of a butterfly
- handout: Venn diagram
- glue and scissors

Standards

Strands: Excellence in Environmental Education Guidelines

Strand 1 — Questioning and Analysis: E) Organizing information:

Learners are able to classify and order data, and to organize and display information in ways that help analysis and interpretation.

Strand 2 — Env. Processes and Systems: 2.2 The Living Environment:

C) Systems and connections: Learners understand major kinds of interactions among organisms or populations of organisms. **2.4**

Environment and Society: A) Human/environment interactions:

Learners understand that human caused changes have consequences for the immediate environment as well as for other places and future times.

Strand 3 — Skills for Understanding and Addressing Environmental

Issues: 3.1 Skills for Analyzing and Investigating Environmental

Issues: B) Sorting out the consequences of issues: Learners are able to apply their knowledge of ecological and human processes and systems to identify the consequences of specific environmental issues.

California State Educational Standards:

Life Sciences (Ecology) 5c. Students know populations of organisms can be categorized by the functions they serve in an ecosystem.

5d. Students know different kinds of organisms may play similar ecological roles in similar biomes.

5e. Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

Investigation and Experimentation: 7g. Students will interpret events by sequence and time from natural phenomena.

Background

Mixing Genes

One of the characteristics of life is the ability to reproduce. Some parents bear live young, while others don't. Animals like amphibians, corals, fish and worms hatch from eggs. Other animals, especially birds and mammals give birth to live young. No matter how an offspring originates, it will go through stages of its life. These stages include: growth, development, maturity and eventually death.

All multi-cellular (more than one cell) organisms grow through cell division, a process called mitosis. Through cellular growth, specialization begins. During early **growth**, cells arrange themselves into layers. One layer becomes external features like skin, while another layer becomes internal features like organs and nerve cells, and so on. Generally speaking, the more complex an organism is, the longer it takes for development to occur.

Reproduction is a process whereby genes are duplicated and then passed down to the next generation. This process can be asexual or sexual. In asexual reproduction, only one adult is needed. The parent duplicates itself through budding or fragmentation, which is when a section of the parent breaks off. In this case, identical genes are passed down to offspring. Sexual reproduction includes fertilization.

Fertilization is when a female's egg unites with a male's sperm creating a zygote or fertilized egg. The fertilized egg then has the genetic information from both parents but not exactly like either. This process allows for a

diverse mix of genes through a union of two sets of genes.

How an animal develops prior to becoming an adult varies. Some animals like humans, dogs, and elephants are born looking like a miniature version of their parents. Others like chickens, mice and pigs are born nearly naked, but they still resemble their parents. Still others, like insects and amphibians, go through a drastic change called metamorphosis. This word literally means to change form. When these animals are born they look very different from their parents.

Amphibians, like frogs and salamanders, hatch from eggs that were laid in or very near water. As adults, amphibians can live on land. As a matter of fact, this group was the first to venture on to land nearly 300 million years ago.

Changing Shapes

This lesson will focus mostly on frogs. Once a frog hatches from an egg, it becomes a tadpole, which is a fish-like form. As a young **tadpole**, frogs are legless and have gills and a tail. They

Local Connection

Pacific Giant Salamander

Salamanders are amphibians that are associated with moist shady places. The largest in North America is the Pacific Giant Salamander (*Dicamptodon tenebrosus*). These salamanders are known to inhabit the moist North Coast mountains of California, including the King Range. Adults can reach 14 inches (41 cm) and juveniles nearly that long. Young salamanders are adapted for life in water. They have feathery gills, a "fin" along the top and bottom of their tails, and a streamlined body. This species is best identified by a distinct pattern of dark blotches on a lighter brownish tan body.

It takes five or six years for a female to reach sexual maturity. She will lay eggs in a "nest" which is a mass of 80-200 eggs. This "nest" is usually located underwater or in a moist shady hole. The female will aggressively protect her eggs from predators, including the adult male salamander, for up to seven months. After hatching, the larvae will live off their yolk for another two to four months. Because of this long reproductive period, females only reproduce once every two years. Both adult and juveniles are predators and will eat just about anything including small rodents, lizards, frogs, beetles, slugs and snakes.

need to live in water and use their gills to breathe. As they develop further, back legs develop. Eventually, front legs, elbows first, emerge. Once the frog has four legs and a reduced tail, it is called a **froglet**. When the legs are fully developed, so are the lungs. At this time, the frog can move onto land and can breathe through its lungs. It is an adult. The length of time this life cycle takes, depends on the species of frog.

Insects also go through metamorphosis. However, within this large group, there are two kinds: incomplete metamorphosis and complete metamorphosis. Insects like grasshoppers, butterflies and beetles, go through complete metamorphosis. There are four main stages to this process: egg, larva, pupa and adult. The egg is the unborn stage. Once the egg hatches, a young stage occurs called a **larva**. Larvae usually look a little like worms. In the case of butterflies and moths, this stage is called a caterpillar. During this stage, most of the feeding happens. Eggs are usually laid on or near a plant that the larva eats. After the larva has reached maturity, it changes or morphs into a pupa. The **pupa** stage is an inactive stage where no eating occurs and is well camouflaged. Often the pupa is surrounded in a silk-like wrap called a cocoon that the larva has made. Once the pupa hatches, it is an adult. Other types of insects, such as dragonflies, damselflies and caddisflies, hatch from an egg becoming a larva. The larval stage develops directly into an adult. There is no pupa stage which is why it is incomplete metamorphosis. During any adult stage, most insects grow wings.

The King Range National Conservation Area is home to a variety of frogs and butterflies. Some of the more common native species of frog are the tree frog and the red legged frog. The tailed frog and yellow legged frog are two species that are becoming rare. Common butterflies include California Sister, Painted Lady, and the Tiger

Swallowtail. Other butterflies are becoming harder to find including the Common Buckeye and the Wood Nymph. (check on these)

Frogs are particularly susceptible to environmental change. There are alarming statistics concerning the disappearance of frogs around the world today. Frogs are important members of many food webs. They eat a lot of insects. There are many reasons why frogs are disappearing around the world including pesticides, habitat destruction, fungal diseases, parasites, and the increase of UV light penetrating to Earth's surface. Many frogs have above average deformities as well. One of the first groups to bring attention to this issue was a group of middle school students from Minnesota. There are several organizations whose purpose is to educate people about frogs.

It is important that people learn about the environment and the many processes that occur within it. Metamorphosis is one process that is both fascinating and interesting. By learning about metamorphosis, children can begin to appreciate the wonders of wildlife a little bit more.

Activity 1: Life Cycles of a Frog and a Butterfly

Preparation

Collect tadpoles at various stages from a local pond or stream.

Procedure

1. Have the students walk into the classroom after a break with sounds of frogs playing in the background. Once they settle down, ask them if they know what they are listening to. Begin to ask questions about frogs.

2. Explain to the students that as plants and animals grow and develop, they have different stages. Show a picture of a life cycle and point out the stages. Next show the living tadpoles to the students. Make sure they can all get a good look at them. Depending on the size of the group, you may want to break them up into smaller groups. Ask the students what they notice about the tadpoles.

3. Explain to the students that some animals go through a big change from when they are young to when they are adults. In this case, the young animal does not look anything like their parents. This big change is called metamorphosis. Write metamorphosis on the board and have them say the word. Ask them if they know of any other animals that go through a big change during their life cycle.

4. Explain to them that they are going to learn about the different stages of metamorphosis for two different animals: frogs and butterflies. Begin by reviewing the different stages of a frog and

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- handout: Venn diagram
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write the terms on the board (egg, tadpole, froglet, adult). Depending on the abilities and prior knowledge of the students, you may want to have them predict the sequence of the stages first. Next, introduce butterflies. Show a few pictures of butterflies as caterpillars, pupa and adults. Explain, to the students that butterflies go through a bigger change compared to frogs. Write the 4 stages to a butterfly's life cycle on the board: egg, larva, pupa and adult. Again, have them predict what sequence these stages go in. Show a picture of a pupa and compare it to a larva. See if the students can guess which stage is active and which stage is inactive and during which of these eating occurs. Briefly discuss the difference between these two stages.

5. Begin the student activity, by passing out the handouts, paper plates, and paints. Have the students begin by painting the "frog plate" green and the "butterfly plate" blue (optional).

- *Do humans hatch from eggs? (egg develops inside a female's womb)*
- *What kinds of animals hatch from eggs?*
- *Where do frogs live?*
- *What is a likely place to find frogs?*
- *Do young frogs look like adult frogs?*
- *What do young frogs look like?*
- *What do we call young frogs?*
- *What do we call a very young human?*
- *Do human babies look sort of like their parents?*
- *Can you think of any other animals that don't look at all like their parents? (butterflies and flies)*

The paper plates will need to dry for a few minutes.

6. While the plates are drying, have them cut out the different stages for both the frog and

Activity 1: (cont)

butterfly life cycles. You may want to separate the students into two groups: one working on butterflies while the other works on frogs. Once the paper plates are dry, have them glue the stages down in the correct order in a clockwise direction. All students should do both unless they are handicapped. They should draw arrows in between each stage. The students

names should go on the back of each plate.

7. To review, have the students compare the two animals in a Venn diagram. (see attached). This can be used as an assessment tool. They should compare the two sets of terms on the board. Any words that are the same should go in the intersecting area, showing a

commonality between frogs and butterflies (eggs and adults). In the non-intersecting portion, they should write down what is unique about each. For instance, frogs hatch into tadpoles and butterflies do not. Butterflies hatch into caterpillars, etc. The Venn diagram can be done before or after Activity 2.

Activity 2: Modeling Metamorphosis:

Preparation

Draw a shape using chalk outside, or string up string around the room, representing an area big enough for all of the students to fit inside of. This area represents a make-believe pond.

Procedure

Have the students act out the different stages of frog metamorphosis in the pond.

1. Egg mass: Have the students huddle together inside the make-believe pond. This will represent an egg mass.

2. Early tadpole: Have the students stand up straight, keeping their feet together and their hands by their sides. Have them pretend to move through water. They should spread out a little bit.

3. Late tadpole: Have the students slowly free their arms. Students should wiggle their elbows out, then their hands. Have them pretend to swim through water using their arms. Their feet need to stay together.

4. Froglet: Have the students begin to move their legs. They can now move freely and they have big bulging eyes. Have the students move to the side of the make-believe pond.

5. Adult Frog: Now the students are free to jump around in many different directions and croak like a frog.

You may want to modify this exercise, to model a butterfly as well.

Extensions

- Have students observe and sketch the changes of metamorphosis in a tadpole over the course of many weeks.
- Raise native butterflies in the classroom for release outside.
- Provide a display of resources including books about frogs, toads, and salamanders.
- Have the students compare the differences between frogs and toads.
- Play different local frog calls and have the students try and identify the frogs by their calls.
- Go outside on a nature walk in the spring looking for various stages of insects.

References

Animal Life Cycles, <http://www.kidzone.ws/animals/lifecycle.htm>, 2010

Frog Lesson Plans and Activities: <http://www.kiddyhouse.com/Themes/frogs/frteach.html>, 2010

Dobson, Martha, Monds, Margaret, An Integrated Lesson Comparing the butterfly and frog life cycles, <http://www.learnnc.org/>, 2010

History of Frog Deformities Suggests Emerging Disease, <http://www.sciencedaily.com/>, 2003

Life Cycle of a Frog, <http://allaboutfrogs.org/weird/general/cycle.html>, 2010

Turturice, Lisa, Frogs: A Thematic Unit Plan, <http://www.eduref.org/Virtual/Lessons/Interdisciplinary/1996>



Additional Resources

From Tadpole to Frog by David Stewart and Carolyn Franklin

Butterfly and Frog by Robert Lieber, Vivian Young and the Golden Gate National Parks Conservancy.

From Caterpillar to Butterfly by Dr Gerald Legg

Butterfly Express by Jane Belk Moncure

Monarch Butterfly by Gail Gibbons

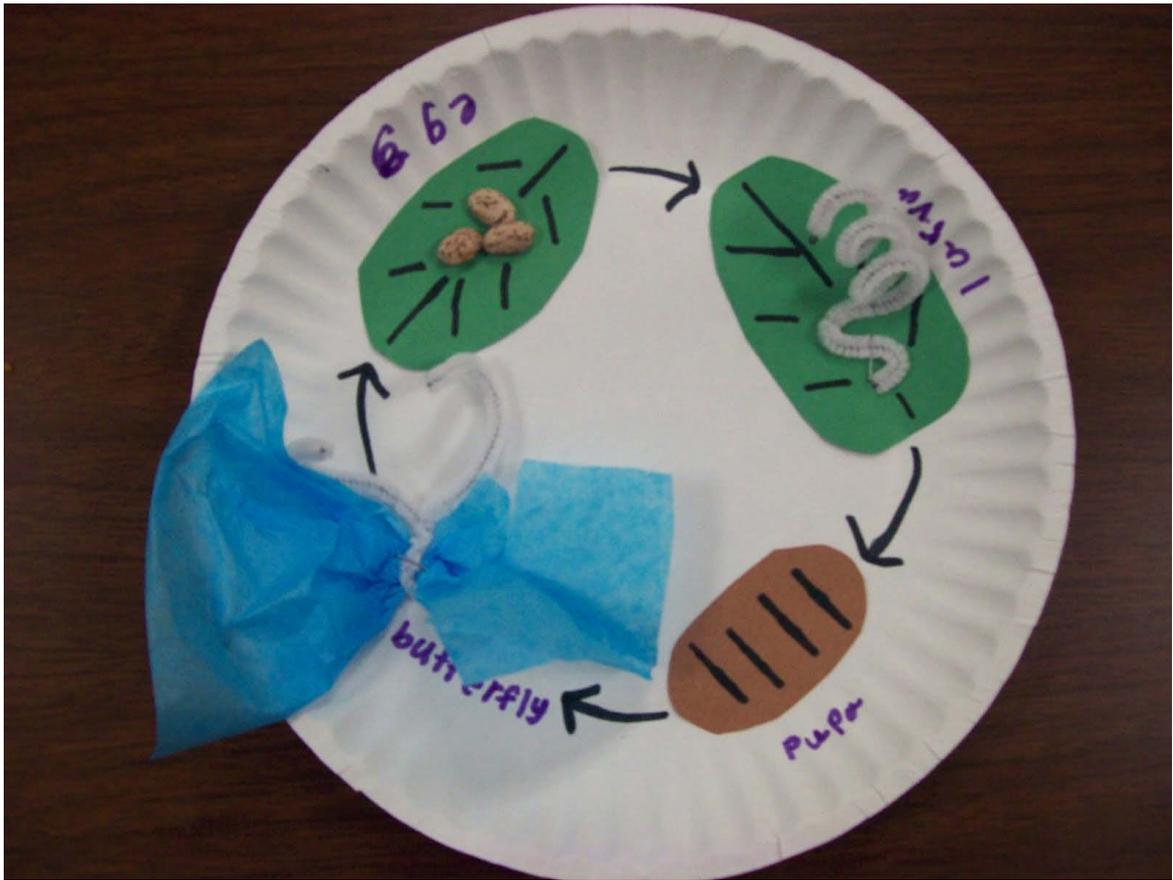
Munch, Munch, Munch by Norma L. Gentner

Caterpillar Diary by David Drew

The Very Hungry Caterpillar by Eric Carle

Internet graphics for kids: Life cycle of a frog

http://www.harcourtschool.com/menus/science/grade2_nl.html

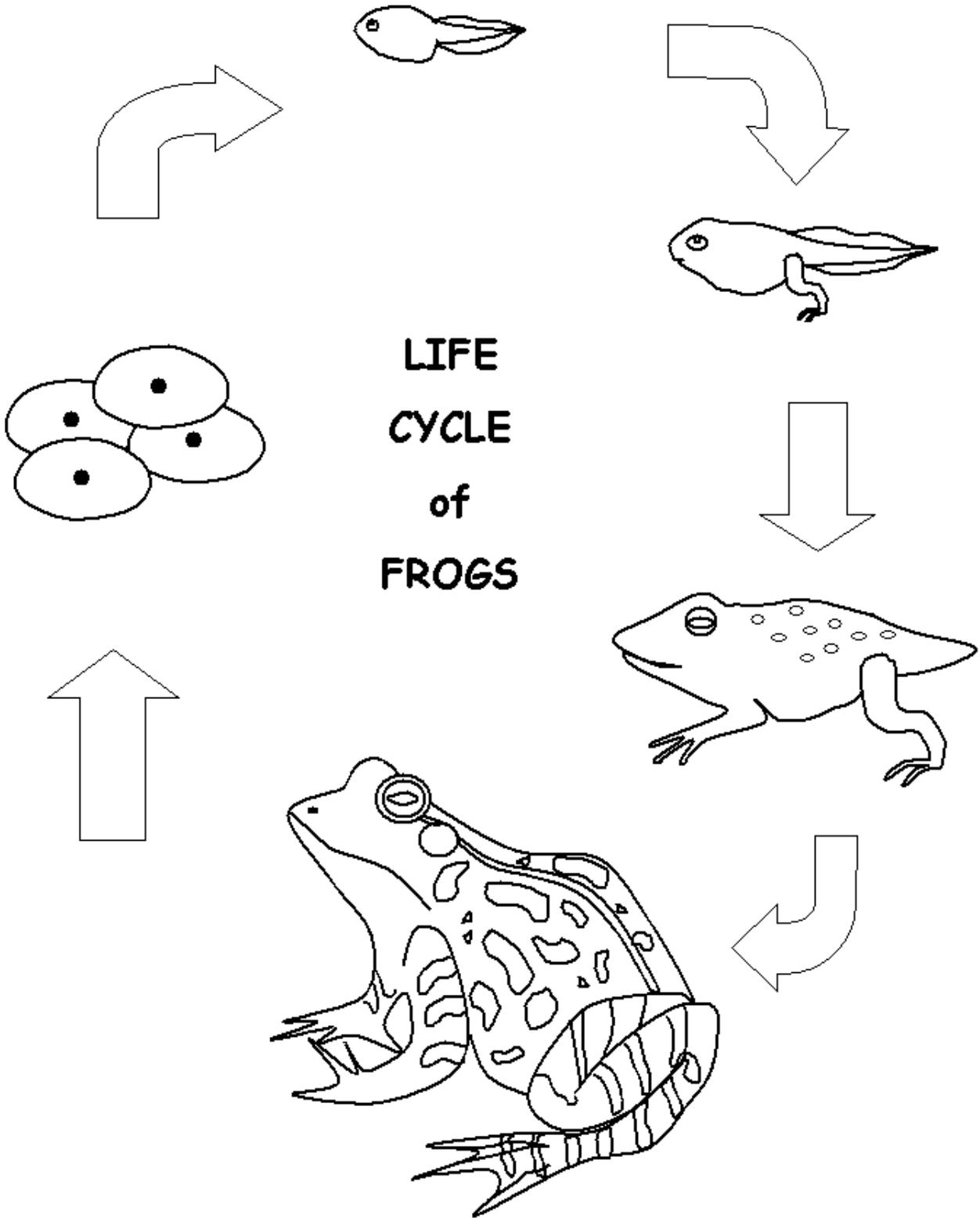


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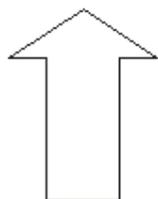
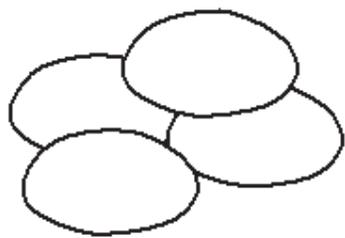


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LIFE
CYCLE
of the
MONARCH
BUTTERFLY

