ACTIVITY 4

WHY DON'T ALL ANIMALS' EGGS LOOK THE SAME?

EXPERIMENT OBJECTIVES AND CONTENT

The primary goal of this activity is to give students an opportunity to compare and understand the reasons for variations in eggs' appearance, along with the adaptive strategies of certain egg-laying animals.

ALLERGY WARNING: INFORM ALL STUDENTS THAT IT IS STRICTLY FORBIDDEN TO EAT THE EGGS USED IN THE EXPERIMENTS.

ESSENTIAL KNOWLEDGE

Matter:
- Characteristics of living things: reproduction of animals
- Transformations of living things: metamorphoses

Systems and interaction:
- Interaction between living organisms and their environment: adaptation

Techniques and instrumentation:
- Use of simple observational instruments
- Use of simple measuring instruments
- Design and manufacture of environments

Appropriate language:
- Terminology related to an understanding of living things
- Drawings, sketches

SUGGESTED MATERIALS

Scientific equipment:
- Scales
- Magnifying glasses
- Scalpels
- Vivarium (optional)
- Bird egg identification guides

Perishable non-scientific materials:
- Items from nature (dead leaves, branches, feathers, etc.)
- Eggs of hens, quails or fish
- Water

Note: It is important to store eggs in a cool place so they do not go bad.

Household materials:
- Small jars
- Food coloring
- Latex gloves
- Rocks

School supplies:
- Paper
- Colored pencils

School equipment:
- Refrigerator (or cooler)

CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

You went on a walk with your parents and you were surprised to see that eggs can have different shapes and colors: there were white ones, brown ones and speckled ones. You thought all eggs were white, and you wonder why eggs don't all look the same.

SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

The teacher asks the students to name animals that lay eggs. The teacher discusses the difference between viviparous animals (which give birth to live young) and oviparous animals (which lay eggs). Images of eggs or real eggshells could be shown to enrich the discussion. The teacher could then have the students think about the reasons that not all eggs look the same.

INITIAL IDEAS AND HYPOTHESES

Here are a few examples of hypotheses the students might formulate based on their initial ideas:

Example 1
I predict that eggshells from birds protect the embryos from rain and microbes. I predict this because shells are hard, and I think they must be waterproof, because bird nests are exposed to the rain.

Example 2
I predict that the color of eggs is a type of camouflage. I predict this because I once saw quail eggs and they reminded me of little rocks.

Example 3
I predict that eggs laid in water are soft and eggs laid on land have a shell that prevents them from drying out. I predict this because the eggs that my fish lay are soft, while the hen eggs that my parents buy at the grocery store are hard.

WORK PLAN AND EXPERIMENTATION

Here are a few examples of experiments the students can carry out to verify their hypotheses:

Example A
The students verify whether the shell of a hen's egg protects the inside of the egg. They weigh two hen's eggs before the experiment and fill two small jars with clear water. They add food coloring to one of the jars and then place an egg in each container and wait 24 hours. They remove the eggs from the water, dry the shell and weigh them again to see if any water got inside the shell. They then break the eggs and make color sketches of their observations. Is the internal and external appearance of the eggs the same?

Note: After breaking the egg, it would be interesting for the students to observe the air cell, which is a small cavity in the large end of the egg.

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.

Example B

The students check to see if there is a link between the appearance of birds' eggs and where they are laid. They try to imagine what the eggs look like of birds such as the downy woodpecker, the ring-billed gull or the red-winged blackbird by observing the environment in which these species live. The students can disguise hen's eggs by adding marks and colors, use quail eggs, or draw the eggs on paper. Next, they reproduce the environments where these birds lay their eggs: tree cavities, stony shorelines, nests in low-growing wetland vegetation. They can recreate these environments using items from nature or by drawing them. Then they validate their results by doing research.

Note: The students can do the same experiment with insect eggs such as those of lady bugs, which are larger than most insect eggs.

Example C

The students compare bird eggs, which have hard shells, with fish eggs, which have a soft membrane. They observe the two types of eggs under a microscope, drawing sketches to record their external appearance, texture and color, then dissect the eggs to observe their internal parts. They allow a hen's egg and several fish eggs to dry out for 24 hours and record the changes in appearance.

Note: The students should use latex gloves in order to avoid any possible contact with bacteria.

EXPERIMENTAL FACTORS

To ensure scientific rigor, the students should evaluate the experimental factors that might influence the experimental results.

- Amount of food coloring used
- Amount of water used
- Quality of eggs (cracks)
- Precision of measurements
- Variety of specimens
- Level of humidity
- Water temperature

DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

The teacher has the students present their experimental results and their sketches in the form of egg-shaped posters. The activity can be enriched by showing diagrams of the eggs of hens, reptiles, amphibians, fish, and insects. The students could work together on a summary table of the different survival strategies of egg-laying animals.

SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

The teacher asks the students to create a *Guinness Book of Records* type book entitled *Eggcelent Eggs*, in which each student presents a record concerning eggs (e.g., largest bird egg, fish that lays the most eggs, strange insect eggs, and other surprising facts). To conclude, the students could start a project to hatch eggs of an egg-laying animal in order to observe its life cycle.

SCIENTIFIC CONCEPTUAL CONTENT

Oviparous versus viviparous

Many groups of animals such as insects, fish, amphibians, reptiles, and birds reproduce by laying eggs. These are called oviparous animals. Eggs protect the embryos and provide nutrition required for development. Eggs are fertilized ovules that are formed in female reproductive organs called ovaries. The fertilization of ovules can be internal or external, depending on the species. The hen's eggs we eat are in fact ovules, since they have not been fertilized. Mammals, on the other hand, are viviparous, i.e., their embryos develop inside the mother's body. There are also animals, called ovoviviparous, whose reproductive systems share elements of both oviparity and viviparity, i.e., the eggs are incubated and hatch within the females' reproductive tract. This uncommon strategy is employed by certain reptiles, insects and fish. Sharks are also ovoviviparous.

Egg adaptations

Animals that are well adapted to their environment have better chances of survival. Survival strategies for oviparous animals include laying a large number of eggs (insects, fish, amphibians), laying simultaneously (all females of the species lay at the same time, e.g., sea turtles), camouflaging the eggs (burying them, hiding them in vegetation, etc.), camouflaging the nest, and laying eggs that blend into the environment.

Insects

Most insects lay eggs. These eggs are surrounded by a shell that prevents them from drying out. The eggs hatch into larvae that become adults after various transformations. Some species pass through one or several stages of metamorphosis, which may be complete (egg, larva, pupa, adult [also called imago]) or incomplete (egg, nymph, adult). Insects that undergo incomplete metamorphosis are said to reach the adult, or "imago" stage, when they are able to reproduce. Insects lay their eggs in diverse environments, ranging from on the ground, in water, on plants or tree bark, or on decomposing matter. They are tiny and usually numerous, ranging from hundreds to thousands, depending on the species. However there are several exceptions, such as aphids. When "baby" aphids are born, they already resemble adults.

Fish

Most female fish lay a great number of eggs in the water—up to millions per laying. The eggs have a soft membrane, which contains the vitellus (yolk), the dark part of the egg that serves as a nutritional reserve, and the blastodisc, which becomes the fish larva. Only a few eggs will develop to the adult stage, since many will be eaten by predators or will die because of inadequate environmental conditions such as temperature or oxygen concentration.

Amphibians

Amphibian eggs are laid in water or wetlands. They are gelatinous and lack a shell, making them very permeable. Because of this, they are very sensitive to pollution, which explains in part why amphibian populations are declining worldwide. When they hatch, the larva survives on the food reserves of the vitellus. They undergo metamorphosis before becoming adults (e.g., tadpoles).

Reptiles

Reptile eggs have a semi-rigid shell that protects them from drying out, giving them an advantage over amphibians and fish, which is what allowed them to colonize terrestrial habitats. These animals often shelter their eggs buy burying them or hiding them in vegetation.

Parts of a bird egg

Bird eggs have a shell, a white (albumen) and a yolk (vitellus). The shell is made up of a rigid, porous layer made of calcium carbonate and supple internal membranes. Just beneath the shell, at the large end of the egg, is an air cell. The white, or albumen, surrounds the yolk and keeps it in the middle of the egg with a spiral band called the chalaza, which is anchored to the shell. The albumen provides the embryo with water and proteins. The yolk, or vitellus, includes the germinal disk, which may be fertilized by sperm, and food for the future embryo (fats and proteins).

Characteristics of bird eggs

The shell of bird eggs is impermeable to water and keeps out micro-organisms. However, it does allow air through its pores. In general, the bigger the bird, the bigger the egg. While they appear fragile, eggs are shaped like an arch and can support the weight of the parent during brooding. Colors or patterns on eggshells are the result of a mixture of two pigments, one derived from hemoglobin and the other from bile. The external appearance of eggshells helps to camouflage them and help them survive. Some birds such as woodpeckers and owls, which nest in cavities away from predators' eyes, lay white eggs, which are more easily visible in the dark.

CULTURAL REFERENCES

Market eggs

The eggs we buy at the grocery store are unfertilized eggs. Their color depends on the race of chicken that laid them and has nothing to do with the egg's nutritional value.

Egg-laying mammals

The platypus and the echidna are members of an order of mammals called monotremes, which lay eggs. They are the only egg-laying mammals in the world. The young hatch after incubation and are suckled by way of small openings in the mother's skin. These animals thus have genes in common with both mammals and birds!

Birds that lay eggs in the nests of others

Cuckoos are kleptoparasites, which means that they get their nourishment from the work of another species. In fact, cuckoos lay their eggs in the nests of other birds, saving themselves all the work of brooding and raising their young. Young cuckoos almost always hatch before the young of the parasitized species. As soon as it hatches, the young cuckoo pushes all the other eggs or young out of the nest, thereby monopolizing the attention of its adoptive parents, which continue to feed it, even if it is often larger than they are!

Unusual fact: parasitoids

Certain insects lay their eggs on or inside a host organism. When the egg hatches, the larva develops by eating the host and, in some cases, eventually killing it. Entomologists have catalogued about 100,000 species of parasitoids to date.

FOR MORE CULTURAL REFERENCES, VISIT THE ÉCLAIRS DE SCIENCES WEBSITE:

www.eclairsdesciences.qc.ca

REFERENCES

Burnie, David. *Le nid, l'oeuf et l'oiseau*. Paris: Gallimard, 1988.

Desroches, Jean-François and David Rodrigue. *Amphibiens et reptiles du Québec et des Maritimes*. Waterloo: Éditions Michel Quintin, 2004.

Harrison, Hal H. *A Field Guide to Birds' Nests of the Eastern United States*. Boston: Houghton Mifflin Company, 1975.

Metcalf, Jonathan. *Le règne animal*. Saint-Laurent: ERPI, 2002.

Walters, Michael. *Les oeufs d'oiseaux*. Paris: Bordas, 1995.

Blaising, Gilbert. "Le coucou." In *Ligue pour la protection des oiseaux en Moselle: dossiers*. [Website: 2004] http://lpomoselle.oiseaux.net/dossiers/coucou.gris.html. Consulted December 6, 2007.

Déry, Bernard. "Vue intérieure d'un oeuf d'oiseau." In *Le dictionnaire visuel*. [Website: 2007] www.infovisual.info/02/062_fr.html. Consulted December 4, 2007.

Ornithomedia. "Les oeufs." In *Ornithomedia: pratique*. [Website: 2000] www.ornithomedia.com/pratique/debuter/debut_art27_1.htm. Consulted December 6, 2007.

Pêches et océans Canada. "Les salmonidés dans la salle de classe: au primaire." In *Pêches et océans Canada: au fil de l'eau*. [Website: 2007] www-heb.pac.dfo-mpo.gc.ca/community/education/lessonplans/sicprimary/sicprimary_f.htm. Consulted December 6, 2007.

Roberge, Patrick. "Les métamorphoses des insectes: de l'oeuf à l'adulte." In *La toile des insectes du Québec de l'Insectarium de Montréal*. [Website: 2003] www2.ville.montreal.qc.ca/insectarium/toile/nouveau/preview.php?section=entos&page=4. Consulted December 6, 2007

Conception
Montréal Science Centre

A project of

Produced by

Major financial partners

PROCESS OF ACTIVE DISCOVERY

GENERAL LEARNING PROCESS IN SCIENCE AND TECHNOLOGY (IN ELEMENTARY SCHOOL)

Context related to everyday life

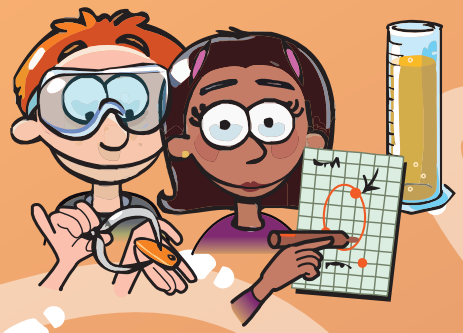
- **Situation problem** or
- **Discovery question** or
- **Need to be fulfilled**
- **Question related to the operation of an object** (how does it work?)

Initial ideas and hypothesis

My initial ideas:
- I share my own ideas.

My hypothesis:
- I predict that... I think that because…
- I imagine my prototype.
- I think it works like this…

Planning and carrying out



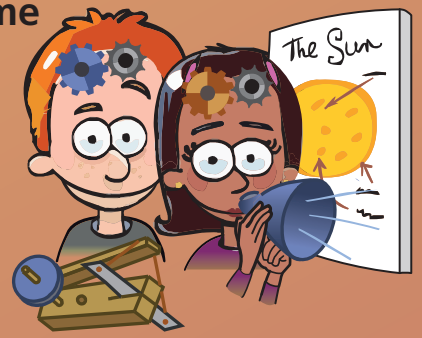
My equipment:
- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

Carrying out my process:
- What will the steps be?
- What precautions should I take?

My actions:
- I carry out the steps of my protocol.
- I note or draw what I observe, what I do and what I discover.

My results:
- What is my answer to the problem, question or need?

Outcome



My outcome:
- Do my results confirm my hypothesis or not?
- Are my results similar to those of the other teams?
- Can the other teams' results help me to find answers to my problem, my question or my initial need?
- What could I communicate concerning my discoveries?

New question?

What I learned:
- What do I retain from this activity?
- What could I communicate concerning my results or my discoveries?

Éclairs de sciences
OUTILLE LE PERSONNEL DU PRIMAIRE
centre de développement pédagogique
didaclip
© 2011 /REV0202EN