Scrambled Eggs Card Game - Teacher Guide

Background Information

Different organisms reproduce and develop in a variety of ways. This activity looks at the life cycles of six organisms namely fruitfly, chicken, fish, frog, mouse and human. It examines the ways that these organisms produce eggs and how these eggs relate to the environment in which they develop. It also explores what these organisms look like as the egg develops into something called an embryo, which will go on to form the adult animal. It is much harder to tell different embryos apart than it is to tell adult animals apart.

Eggs and their environments

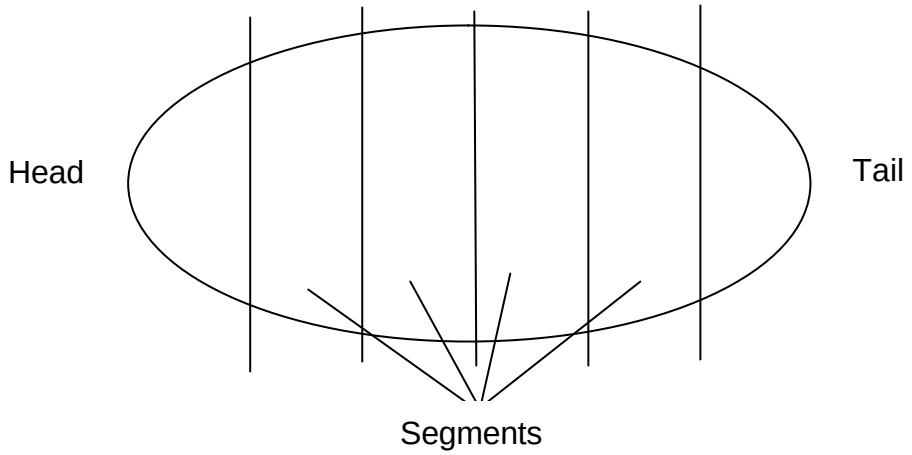
The appearance of eggs depends on the environment in which they will develop. Eggs can be laid on land, in water or can be held inside a mother. They can be with or without shells. Generally, land developing eggs need protection therefore they often have hard shells. Eggs which are laid in water will often have jelly to protect them. Eggs which develop inside a mother are well protected by the mother's body and therefore do not need hard shells or jelly to protect them.

The size of eggs is also related to their developmental environment, and whether they have a yolk or not. Interestingly, the size of the egg does not relate to the size of the adult that will develop from it. Some eggs, like chicken eggs, have nutrient rich yolks. These eggs are large because they must also contain the yolk which the developing chick feeds on. The smallest eggs are mammalian eggs, they don't need a yolk because they get all their nutrition from the mother.

Body plans

As embryos develop they all have what is called a 'head to tail axis', which basically means that at some stage the embryo decides which cells are going to become it's head and which cells will become it's tail end. After this, the embryo is said to have set up a body plan. Embryos from very different organisms have similar body plans. For example, every developing embryo sets up a head to tail axis. It is, however, still very hard to tell which adult will come from which embryo at this stage. Many scientists are interested in how similar human embryos look to a mouse or even a chicken embryo.

Another way in which a developing embryo sets up its body plan is by dividing the head to tail axis up into segments.



Each section (or segment) ensures that structures are formed in the right place. In mammals, for example, this partitioning (or segmentation) allows the developing embryo to determine which section must develop vertebrae for the neck and which section must develop vertebrae for further down the back. The segments also determine where the arms and legs etc. should be.

Control of development

The instructions which control the development of a fertilised egg to an adult are contained within that organism's genes. If a developing egg contains the correct instructions it develops correctly, if it contains incorrect instructions then it will develop according to those incorrect instructions. Sometimes a developing egg contains the correct instructions but there are problems with the environment therefore the egg does not develop normally. For example in the case of laid eggs, the environment could be too hot or too dry or contain chemical pollutants or, in the case of mammals, poor nutrition or drugs.

Intermediate stages

Some organisms undergo intermediate stages in their life cycle,that is, once the egg has developed they do not hatch immediately into an adult. For example, a frog egg develops into a tadpole before it develops into a frog. The tadpole has gills to allow it breath underwater and a long tail which helps it swim. The adult frog has no gills and no tail but has four legs and can live on land. A fruit fly egg develops into a larva, the larva undergoes metamorphosis (literally means 'change shape') before it becomes an adult fly. This is the same for all butterflies and moths, it is the caterpillar which changes into the adult, not the egg. In humans, childhood could be seen as an intermediate developmental stage. The child is not

yet fully developed and can not reproduce. In this context, adolescence it a bit like a metamorphosis.

In conclusion, eggs are uniquely suited to the environment in which they develop. The cells within a developing embryo contain genes. These genes are inherited from the parents of the embryo and contain the instructions that allow the embryo to develop to an adult.

Curriculum Links

Below are some suggestions where this activity could support the 5-14 'Living Things and the Processes of Life' guidelines.

The processes of life

Level B– recognise the stages of the human life cycle

– recognise the stages in the life cycle of familiar plants and animals.

Interaction of living things with their environment

Level D – Give examples of how plants and animals are suited to their environment.

– Explain how responses to changes in the environment might increase the chances of survival.

Aims of the activity

- To get children excited about life cycles and development
- To link the environment to development
- To show that the appearance of eggs depends on the environment in which they develop.
- To show that the size of eggs is related to their developmental environment and not directly to the size of the adult.
- To show that as embryos develop, they all have a head to tail axis and segments (for the vertebra or external skeleton).

Workshop activities in sequence – time approximately 45 minutes.

1. Deal out a set of egg photos and a set of corresponding adult photos to each group. Ask each group to try to match eggs and adults. All the eggs will be the same size in the photos.
   They will be: Fruit fly
   Chicken
   Zebra fish
   Frog
   Mouse
   Human
   They will probably get the chicken right as they are used to seeing chicken eggs.

DISCUSS why is it so hard to tell which animal comes from which egg?
DISCUSS reasons for mammalian eggs being so small.
DISCUSS that the bigger eggs have yolk – a nutritional supply, which is essential as they develop outside the mother. Eggs can't eat.

CLUES - Use fruit to demonstrate the relative sizes of the eggs. Two eggs are tiny. They should be able to work out these are mammalian eggs. The mother provides nutrition in mammals.

Melon	– Chicken
Apple	– Frog
Lemon	– Fish
Grape	– Fruit fly
Peanut	– Mouse
Raisin	– Human

DISCUSS that different eggs have different forms of protection depending on where they develop.

CLUES - Give some hints as to which eggs are protected by shells, jelly or neither.

They should now be able to match up the

Fly/chicken	(shells)
Fish/frog	(jelly)
Mouse/human	(very small)

2. Ask each group to now complete the matching up of the eggs to the adults. Go through it together to correct any mismatches.

3. Show them an equivalent set of embryos part-way through development. Can they match these to the egg/adults pairs?

DISCUSS how this is even harder than with the egg.

4. Get the pupils to decide on the tail/head axis for each embryo.

DISCUSS the fact that all organisms have such similar body plans.

5. Get each group to complete the life cycles for each of the organisms.
6. In conclusion, reinforce the idea that eggs are uniquely suited to the environment in which they develop. Can the groups think of any other eggs? Which environment do they develop in? How is the egg suited to that environment?

Extension material - Developmental beetle drive

Aims

- To show genes are the instructions that guide development.
- To show mutations in genes can lead to developmental abnormalities – i.e. the instructions are defective.
- To show that even with perfect instructions, development can go wrong if there are problems with the environment – e.g. too hot, too dry, mechanical change, chemical pollutants etc., for laid eggs and poor nutrition, drugs etc., for mammals.

Activities:

1. Learning how to play beetle drive

Divide the children into groups of three, give each group three 'blank' beetles, three pencils, a dice and a 'correct' set of instructions (as is described for 'Person A' below). Play the beetle drive until all beetles are finished.

This initial game can be left out for older children. For younger children it may be necessary to first reinforce what a beetle looks like, e.g. the antennae are on the head, there are six legs on the body etc.

2. Developmental beetle drive

Divide the children into groups of three, give each group three 'blank' beetles, three pencils, a dice and the three sets of instructions. Each person must not show their instructions to the others.

Person A – will have correct instructions and will be able to read them. They will assemble the perfect beetle with all the limbs, eyes antennae in the right places.

Person B – will have the wrong instructions and produce a beetle with limbs in the place of eyes. They must follow these instructions even though it seems wrong.

Person C – will have instructions that have been damaged by environmental damage. The numbers on the instructions have got jumbled up. They must follow these instructions even though it seems wrong.

1. Play the beetle drive until all the beetles are finished.
2. Ask each group to have a look at the different beetles discuss what they observe.
3. Now look at the instructions, what do they observe now?

DISCUSS the difference between the beetles and the instructions.

With correct instructions that are properly read, you get the right adult. If the instructions are wrong or have been damaged, you get defects in the adult beetle. Make the link between the beetle drive instructions and genes. Genes contain the instructions to make all living things, including beetles, plants, flies and us. Look at pictures of *Drosophila* fruit flies which have various mistakes in specific genes. These mistakes result in abnormal adults e.g. one fly has legs in place of antennae. This website has some good pictures and description of genes and mutations: http://www.exploratorium.edu/exhibits/mutant_flies/mutant_flies.html

DISCUSS how the instructions have to be correctly interpreted and how the environment can influence this.

Different kinds of animals must deal with different kinds of problems. On land, eggs could get too hot or damaged or get polluted by chemicals or overexposure to UV light. In water, eggs could dry out or get hormones from farmland run-off that would interfere with control of development. In humans what the mother does is crucial for embryonic development – talk about alcohol and smoking etc.

DISCUSS where we get our genes from.

4. In conclusion, reinforce the concept that genes contain the instructions to make all living things and that genes are passed down from parent animals/plants/insects to their offspring. Genes do not just control our hair and eye colour and if we are tall or not, but also how we get to be an adult with all of our bits (such as legs, arms and fingers) in the right places.