Science Unit: ***Animals, Matter, and Mankind in the Environment***

Lesson 3: ***Timeline of Life***

Summary:	Students learn about the **evolution and diversity of life** using a length of paper (calculator tape) stretched across the gym marked with **major biological events** in **Earth's history**.
School Year:	2013/2014
Developed for:	Renfrew Elementary School, Vancouver School District
Developed by:	Sheila Thornton (scientist); Jessica Wersta-Duncan and Lucia Bildstein (teachers)
Grade level:	Presented to grade K/1/2; appropriate for grades K-4 with age appropriate modifications
Duration of lesson:	1 hour
Notes:	May be used in conjunction with Montessori "Ribbon of Life" lesson, and should follow a Universe Story/Big Bang theory lesson. Student should have been introduced to basic classification and related vocabulary (mammals, fish, plants, invertebrates).

Objectives

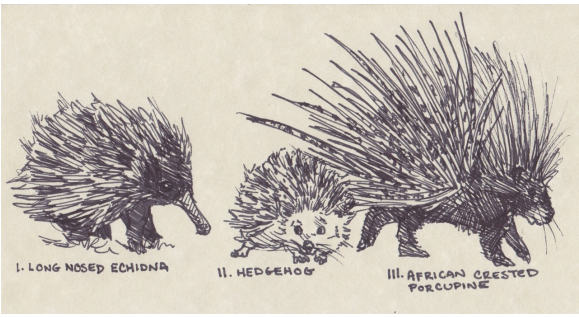
Students will be able to:

1. Understand that different environments affect animals
2. Reinforce the concepts of environment and adaptation
3. Follow up on the Universe Story – beginning of time and evolution of life
4. Place certain animals in the timeline of life – Leatherback Sea Turtles, Dinosaurs, Whales, Humans

Background Information

Classifying Animals

Scientists have long been fascinated with all the different life forms on earth, and have developed ways to classify them. Just as you may sort a pile of beads by shape (some are round, others oval, while still others may be square), you could also sort them by colour, or texture (blue, green, red, smooth, rough, wavy), or size (length, width, weight). A system to name, sort, and classify all living things was developed over 300 years ago by a man named Carl Linnaeus, and is still used today. A basic unit for this system of classification is the ***species***.



A **species** is a group of animals or plants that are similar in features and can produce offspring. Some animals may look alike, but are unable to produce young together. For example, if we look at echidnas, hedgehogs and porcupines, they all look similar. However, they all live in different environments and are

very different **species** of mammals (they cannot produce young with each other).

In fact, the Echidna is a *monotreme,* which lays eggs and is in the most primitive group of mammals. Hedgehogs and porcupines both give birth to live young, but live in very different environments and come from different groups – hedgehogs are insectivores (eat insects), while porcupines are rodents, and are more closely related to mice, rats and beavers.

In contrast, although all of these different breeds of dogs look quite different, they are in fact the same species! The sorting out and classifying all the species in the world is a difficult undertaking.

Just like different types of dogs, we can all see that there are differences between the features of each of your classmates, but we can also see similarities, and recognize each other as humans.

Think about how you would describe a human - two eyes, two ears, two arms, two legs, the limits to height and weight, air breathing, walking, running, etc. We use the same observations to identify other species of animals or plants, and describe certain features that they share, as well as ones that make them different from each other. Although we are all humans, we have different variations in these features that make us unique and distinct. We inherited these features from our parents and grandparents, and great-grandparents, and the information is passed down in the form of a *genetic code*. Each of us has a unique code that makes us who we are.

Vocabulary

Species	A group of animals or plants that are similar in features and can produce young animals or plants
Genetic code	The genetic code is the set of rules or information contained in each cell that defines the role of each cell, and the function and appearance of a plant or animal. Half of this code comes from the male parent, and the other half from the female parent.
Evolution	The sequence of events involved in the change or development of a species or group of organisms.

Materials

- Calculator tape (paper)
- Measuring tape
- Crayons or pencil crayons
- List of important evolutionary events
- Felt pens
- Scotch tape (in case the timeline is torn during the lesson)

In the Classroom

Introductory Discussion

Evolution

- In the animal world, animals *evolve* (change their features over time). However, biological evolution is not simply a matter of change. Lots of things change – trees may lose their leaves, you may get a haircut or grow taller, or your sister may decide to dye her hair purple. These are *not* examples of biological evolution because they don't involve change in the genetic code.
- The central idea of biological evolution is that all life on Earth shares a common ancestor, just as you and your cousins share a common grandmother. Over time, the features that some animals inherit make them better able to survive than others.
- For example, imagine a species of birds which eats nuts, insects, small green plants. Within a community of birds, some will have larger, thick beaks, while others have thinner, delicate beaks (look around your classroom to see differences in features such as height, hand or foot size, etc.).

  Imagine that one summer, the sun beat down every day, and it NEVER rained. All the small green plants died and seeds were not produced, so the only food available was insects. Since the birds with the small beaks were able to capture insects in the cracks between the rocks and in the bark of the trees, they were healthier and produced more babies than the large beaked birds. Imagine this happening for a few more years, and think about what that community of birds might look like in the future.
- Through this process of biological evolution (the concept of descent with modification or natural selection may be inserted here for older children), the common ancestor of life on Earth gave rise to the fantastic diversity that we see documented in the fossil record and around us today.
- Evolution means that we're all distant cousins: humans and oak trees, hummingbirds and whales.
- Can anyone think of some examples of features that would give an animal an advantage over another? (E.g., Why is it advantageous for a polar bear to have white fur? (Camouflage allows them to sneak up on their prey). What might happen to the polar bear's hunting ability if the snow and ice melted and it had to hunt on land? (Decrease, because the prey would be able to see it coming).
- For billions of years, evolution has shaped life on Earth into what we see today. Let's take a journey from the first life form to where we are today, and map out the evolution of animals from the beginning of the earth.

Activity Title: Evolution and the Timeline of Life

Purpose of Activity: To illustrate the progression of life forms on Earth, and to provide context for the evolutionary time scale. Students will be exposed to major events in the development of the biota since the earth's beginning.

Methods:

1. Prior to bringing in the students, roll out the calculator tape across the gym and mark down some important time points that correspond to the list of species' appearance (see attached information, below).

2. (With older children, you may be able to guide them into smaller scale evolution – for example, single celled algae to more complex forms; or adding the appearance of dinosaur species at the correct epochs.)

3. Beginning at one end, describe the events that occur and assign students to each major point (e.g., "In the beginning… 4.56 billion years ago, the earth was formed. Gases, liquids, solids and the energy of the sun were all combined and recombined over millions of years to eventually form LIFE".

4. Assign a number of students to draw molecules, sun, gases, clouds, etc. (to represent the primordial soup). Move along the tape, describing the events and assigning students to draw species or events associated with each time period.

5. After ~30 minutes of drawing, gather the students at the beginning of the timeline and walk them through the story of evolution.

6. Stop along the way to have them speculate as to what environmental factors would affect evolution, or what evolutionary events might occur in response to environmental change (e.g., the ice age; or the asteroid impact at 65 million years ago - this vast fireball swept debris into the atmosphere and within hours day turned to permanent night across the globe. As temperatures plummeted, all the large coldblooded reptiles like T-Rex rapidly died. But that gave small, better adapted warm-blooded mammals a chance to thrive, eventually leading to the evolution of mankind).

Closure Discussion

Encourage children to appreciate the diversity of life, but to also realize that evolution occurs slowly, so any rapid changes to the environment can be very stressful to species. If the change is drastic or rapid, or the population of a species is small, it will be more challenging for it to survive the change and evolve (e.g., polar bears and loss of sea ice).

We as humans undertake many actions that rapidly change the environment, and our behavior has led to declines in many species.