



Evolution Curriculum & Lesson Plans

The National Science Foundation-funded [Evolution Readiness](#) project, beginning in 2008, produced an extensive set of online* and hands-on resources targeted at late elementary and early middle school students. The goal of the project was to use interactive simulations to help students learn the basics of Darwin's model of natural selection as the process primarily responsible for evolution. A series of progressively more complex simulations are embedded in scaffolded activities and allow students to explore the connection between variations, adaptations, the interdependence of species, and the results of environmental pressure on populations over time.

Our research results showed that fourth grade students who used our virtual experiments to explore the connection between the interdependence of species and their adaptations recognized the latter as arising gradually from small variations tied to reproductive success. A research group that used our integrated curriculum outscored a baseline cohort of students, demonstrating the feasibility of teaching young students the fundamental concepts behind the theory of evolution. (Learn more about the [research](#).)

This document contains a list of all resources with links to resources, lesson plans, and teacher editions as well as an overview of the online activities. A complete list of learning goals for the evolution curriculum is available in our [Guide to the Big Ideas in Evolution](#). The entire curriculum is freely available at: <https://learn.concord.org/evolution-readiness>

** Note: The original Java-based activities have been converted to run in a web browser.*

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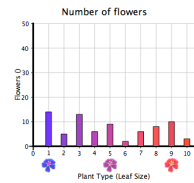
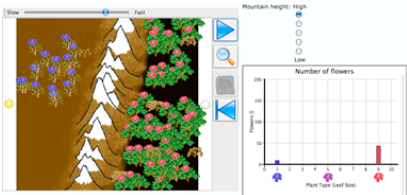
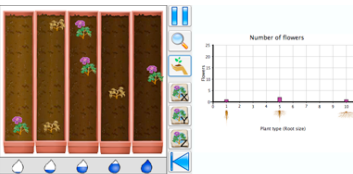
Curriculum Guides and Materials

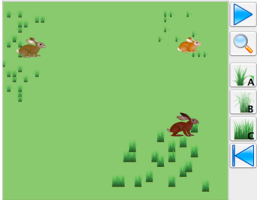
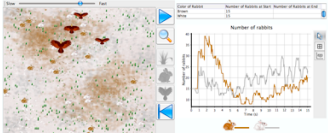
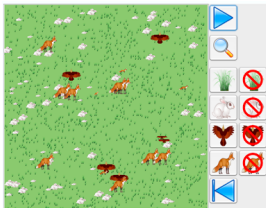
Each activity includes a lesson plan, developed with the 5E framework. The five hands-on activities require additional supplies. Supply lists are included in the lesson plans. The 10 computer-based activities also include a Teacher Edition, which, like a textbook, is an enhanced version of the student activity. It includes tips, discussion questions, and exemplar student answers. ***If you plan to use the activities, we strongly recommend that you run the Teacher Edition first!*** For more details on the organisms used in our models, please see the [Guide to Mystery Plants](#) and the [Guide to the Virtual Ecosystem](#).

	Type	Activity	Resource Links
1	Hands-On	 Life on Earth Story	Lesson Plan
2	Hands-On	 Fast Plants	Lesson Plan Grow Lights Instructions
3	Computer	 Evolution: Variation in Plants	Teacher Edition Lesson Plan
4	Computer	 Evolution: Changes over Generations	Teacher Edition Lesson Plan
5	Computer	 Evolution: Plant Adaptations	Teacher Edition Lesson Plan
6	Hands-On	 Lego Tree of Life	Lesson Plan Game Cards
7	Computer	 Evolution: Changes in the Environment	Teacher Edition Lesson Plan
8	Computer	 Evolution: Variation and Inheritance	Teacher Edition Lesson Plan
9	Hands-On	 Clip Birds	Lesson Plan
10	Computer	 Evolution: A Virtual Ecosystem	Teacher Edition Lesson Plan
11	Computer	 Evolution: Variations and Adaptations	Teacher Edition Lesson Plan
12	Computer	 Evolution: Natural Selection	Teacher Edition Lesson Plan
13	Hands-On	 Food Web	Lesson Plan Animal Cards
14	Computer	 Evolution: Predators and Prey	Teacher Edition Lesson Plan
15	Computer	 Evolution: Experiment with Ecosystems	Teacher Edition Lesson Plan

Overview of Computer Activities

Although these activities were designed to be taught in a sequence, individual activities can stand alone with teacher support.

	Evolution: Variation in Plants—The goal of this activity is to introduce students to how variation in organisms can enable them to live in different environments. For example, plants with different sizes of leaves are adapted to grow under different amounts of light. Students plant three different types of seeds in five different flower boxes and are challenged to determine the light level under which each type of seed grows best.
	Evolution: Changes over Generations—The goal of this activity is to introduce students to the variation that exists in a population of organisms. Students plant different seeds in a field with a gradient of sunlight. Their seeds survive the winter and grow into plants the following spring to reinforce the point that the evolutionary changes the students observe take place over many generations. In a second model, a plant produces seeds, some of which grow into plants that are slightly different from those of the parent plant.
	Evolution: Variation in Plants—In this activity, students review inheritance with variation. A Virtual Field model has light levels that vary smoothly from top to bottom. A single type of seed grows best in the center of the field, but the model includes variation in the offspring seeds. Since each plant scatters seeds randomly, it happens occasionally that some of these different seeds fall in a location where the light level is just right for it. When this happens the seed will grow into a healthy plant that will produce seeds of its own. In this way, the single type of plant eventually evolves into a full spectrum of different varieties.
	Evolution: Changes in the Environment—This activity places the control of the environment under the student's control. A field starts off with a uniform light level, capable of growing plants with medium-sized leaves. Students can alter the environment by “growing” a chain of mountains through the field. Students are challenged to grow the mountains to their maximum height (corresponding to the maximum change in light level on either side of the chain) while maintaining a viable population of plants on each side.
	Evolution: Variation and Inheritance—This transfer activity tests student understanding of variation and inheritance. It starts with five flower boxes, as in “Variation in Plants,” and three types of seeds with variations in their roots. The flower boxes differ in the amount of water they receive, and students discover which seeds thrive in which environment. Students are then challenged to produce a crop of plants that

	can grow everywhere in a field by taking advantage of the small variation in root type from one generation to the next.
	Evolution: A Virtual Ecosystem—This activity introduces students to the idea that all living organisms must compete for food. Students control a rabbit in a field with edible plants, at first alone, and later joined by computer-controlled rabbits. With such competition it becomes harder and harder for the students to keep their rabbit alive. Students shift their thinking from a focus on individual organisms to a concern for the well-being of the population as a whole.
	Evolution: Variations and Adaptations—Students discover that variation in plants allows some varieties to survive in near-drought conditions. Next, students learn that different types of rabbits prefer to eat different varieties of plants. Students make the connection between rainfall amount and the rabbit population's ability to survive by thinking first about rainfall and plants, then about plants and rabbits. Students discover that when certain plants cannot grow and reproduce, the rabbits that eat those plants will not have enough food to survive.
	Evolution: Natural Selection—The concept of interdependence in an ecosystem and its effect on the evolution of populations is further explored through a model of a dam. Students build a dam in the middle of a field, dividing the ecosystem in half to illustrate the effects of geographic isolation. They watch as the grass and then the rabbit populations in that region shift to one variant in the population. When students remove the dam, they observe the ecosystem slowly return to its original state.
	Evolution: Predators and Prey—This activity uses a model of a Virtual Ecosystem with three species in it: grass, rabbits, and hawks, enabling students to explore the effect of predation on the prey population. At first students explore protective coloration as they “become” a hawk and try to catch and eat brown and white rabbits on a snowy field. The latter blend into the background and are harder to see, so they have a selective advantage. Students then explore how the color of the rabbit population changes as the environment changes over time.
	Evolution: Experiment with Ecosystems—The goal of this activity is to give students the opportunity to “think like a scientist,” making hypotheses, doing experiments, making observations, and analyzing data. Students are encouraged to construct and conduct their own experiments with ecosystems comprising grass, rabbits, and up to two predator species: hawks and foxes.