Middle School

VIRTUAL VISITS
FROM THE FIELD

Teacher's Guide

MICROPLANTS

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The Field Museum

Introduction

As technology continues to rapidly evolve, scientists are able to collect and store more data. Some scientists find themselves with more data than they can realistically analyze. Now, with the help of the Internet and other technologies, they can collaborate with the public to help sift through and make sense of their data. This is called citizen science.

A citizen scientist is someone who contributes to science without necessarily being a formally trained scientist. A citizen scientist can contribute by analyzing data through an online game or submitting geotagged photos of flora and fauna with a cell phone app. With this help, scientists can analyze their data more quickly and help us understand more about the natural world.

Scientists from The Field Museum and other research institutions have developed a citizen science project called MicroPlants. This project aims to document and describe new species of early land plants from a database of thousands of imaged specimen. Museum Botany researcher, Laura Briscoe, will talk to your class about her job as a taxonomist of liverworts, and how citizen science is helping her and scientists around the world to make advancements in their field like never before.

Background

Plants appeared on land between 400 and 500 million years ago. This evolutionary event is critically important to the history of life on Earth as they helped create a breathable atmosphere and provided new niches for animal life to flourish. Without these plants, life as we know it would not exist.

Photosynthetic organisms, such as cyanobacteria, have been living in water for nearly 4.5 billion years. During the time before land plants, there wasn't much life on terrestrial Earth with the exception of bacteria. The transition of photosynthetic organisms to land took approximately 4 billion years to evolve. Conversely, most of what life we see today, in addition the 99% of species that once lived but are now extinct, arose since the evolution of land plants some 500 million years ago.

Figure 1. Microplants Learning Activities and their Descriptors.

PRE-BROADCAST ACTIVITY	BROADCAST	POST-BROADCAST ACTIVITY
Activity 1 - The Name Game	Activity 2 - Broadcast	Activity 3 - Microplants
Students will sort through "specimen" using size, shape, geographic, and genetic data in order to classify liverworts as a taxonomist would.	Students will meet Museum scientist Laura Briscoe through a live web broadcast. Students will have the opportunity to ask her questions about her job and research.	Students will contribute to science through one of the Museum's citizen science applications relating to Laura's research. Your class can set contribution goals and compete with other classes.

NGSS Alignment

These lessons align with the following *Next Generation Science Standards*, among others.

Students who demonstrate understanding can:

MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

SCIENCE AND ENGINEERING PRACTICES	DISCIPLINARY CORE IDEAS	CROSSCUTTING CONCEPTS
CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)	**LS4.A: EVIDENCE OF COMMON ANCESTRY AND DIVERSITY** • Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)	**PATTERNS** • Patterns can be used to identify cause and effect relationships. (MS-LS4-2) **SYSTEMS AND SYSTEM MODELS** • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3) *Connections to Nature of Science* **SCIENTIFIC KNOWLEDGE ASSUMES AN ORDER AND CONSISTENCY IN NATURAL SYSTEMS** • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

Common Core State Standards Connections:
ELA/Literacy -
SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS4-2)

Adapted from *NGSS Lead States. 2013. Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press.*

Activity 1

THE NAME GAME

After this lesson your students will be able to:

- Use multiple types of data to infer the evolutionary relationship between different species of plants.

MAIN IDEAS

- Taxonomy is the naming, describing, and classifying of organism.
- Taxonomists, people who study taxonomy, take several pieces of information into account when classifying organisms such as: anatomy or morphology, location of the specimen, and DNA.
- Sometimes species can be classified by their leaf shape, a morphological character, but taxonomists often need supplemental data such as geographical location and DNA to infer the relationship between different species.

PREREQUISITE KNOWLEDGE

- Students should have some background knowledge on the biological hierarchy.
- Students should also know that organisms are classified by their anatomical similarities and differences by Middle School. This lesson advances students to understand that other factors play a role such as geographical location and DNA when identifying species. If necessary, review the Main Ideas with your class.

MATERIALS AND PREP

Prior to this lesson determine if students should work in pairs or groups of four.

You will need to prepare the following materials prior to this lesson:

- Handout 1.1 Leaf Cards (enough for pairs of 2-4)
  - NOTE: These cards need to be double-sided
- Handout 1.2 Tree of Bryophytes (enough for pairs of 2-4)
- Teacher Key (one for each teacher in the class)

You will need the following materials:

- Handouts 1.1 and 1.2 for groups of 2-4
- Scissors
- Optional: Glue

Activity 2

BROADCAST

After this lesson your students will be able to:

- Understand how a specimen is collected, prepared, and entered into a museum collection.
- What it is like to go on a field expedition.
- Understand how to contribute to science without being a professional through citizen science.

MAIN IDEAS

Laura Briscoe is a Museum research assistant of Bryophytes and Pteridophytes. Her research interests are in the studies of phylogeny, morphology, and taxonomy of liverworts in the southern hemisphere. She is currently working on a four-year project that aims to document all of the Bryophytes in a region of southern Chile. This documentation of species will provide an inventory of Bryophytes in that region, which we can use to track population changes in the future. In addition, it allows us to better understand the tree of life for early land plants.

PREREQUISITE KNOWLEDGE

- Knowledge of taxonomy and the biological hierarchy. Familiarity with what citizen science is.

MATERIALS AND PREP

It is recommended that you do the following prior to this lesson:

- Watch with your class http://expeditions.fieldmuseum.org/media/journal-1-expedition-overview-early-land-plants-chile as in introduction to the scientist and what she does.
- We encourage you to watch the rest of the videos on the site to gain a deeper understanding of the process of field expeditions.
- Read the *Virtual Visits* Technical Guide
- Attend the broadcast test-run, a link and directions will be provided one week prior to your visit.
- Check with your IT specialist to make sure you will have available bandwidth on the day of your visit.

You will need the following materials:

- Computer with Ethernet cable connected to the Internet
- Projector
- Optional: Scrap paper or note cards

To see the complete Teacher's Guide: Microplants, please register for a Virtual Visit from The Field

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