MICROBIAL MATS AND ALIENS

LESSON 3 - TEACHER GUIDE

EYE
Extreme Yellowstone Expedition

LESSON SUMMARY

(Estimated time: one ~ 45-minute class period)

In this lesson, students will discover why scientists looking for life on other planets are so interested in microbial mats. Students will also analyze a sample core they collect from a "microbial mat" (actually a layered cupcake) while learning about these tiny ecosystems including their population dynamics, competition and sharing of resources, and the energy flow through the different layers of the microbial community.

Extension: Creating Microbial Mats

You can grow your own microbial mat in your classroom using this NASA lesson plan. If you do this in conjunction with these lessons, prepare the mat a few weeks in advance so it has time to grow for observation. To find the lesson plan, do an internet search for **"NASA how to grow a microbial mat"** or see the website: ***http://microbes.arc.nasa.gov/download/pdf/how%20to%20make%20a%20microbial%20mat.pdf***

LESSON OBJECTIVES

Students will learn

- Microbial mats contain some of the earliest forms of life on Earth and document changes in that life and the environment that may lead to clues on how life might form on other planets or moons.
- Living things can only survive in environments that have the resources they need.
- All living things require a means to get energy to survive (a metabolism), but there are several different types of metabolisms.
- Microbial mats are complex tiny ecosystems that contain many different kinds of microbes with have different metabolisms.

MONTANA STATE UNIVERSITY | Thermal Biology Institute

NEXT GENERATION SCIENCE STANDARDS

NGSS : Matter and Energy in Organisms and Ecosystems

- **MS-LS-1.** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS1-6.** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
- **MS-LS2-4.** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- **NGSS:** Growth, Development, and Reproduction of Organisms
- **MS-LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MATERIALS NEEDED

- White or yellow cake mix and its ingredients, enough for one cupcake per student or you could bake a sheet cake and pass it around for students to sample different parts of the cake
- Green, red, yellow, blue food coloring
- Cupcake tin liners
- Wide mouth straws, one per student (Ideally straws should be clear. It might be easier for students to keep the samples in the straw instead of removing the samples.)
- Plastic knives for cross cutting mat if needed
- Napkins or paper towels
- Student worksheet, "**Extreme Yellowstone Expedition – Lesson 3: Microbial Mats and Aliens! Student Activity Book"**
- Projector to show online video to the class

TEACHER INSTRUCTIONS

Create a replication of a Microbial Mat. Prepare cupcake mix as directed on box. (Make enough for your class size.)

- Separate the mix into four containers (one for each layer), then add food coloring to make each container of batter a different color: Yellow, Brown*, Red, Green. (*To make brown you will need to mix yellow, red, green and blue food colors.)
- Pour batter of each layer in order—Yellow, Brown, Red, Green—to fill each segment of the muffin tin halfway full. The layers do not have to be even. You might find it easier to prepare a sheet cake rather than cupcakes.
- Bake according to cake instructions.
- Store in sealed container until ready to "sample."
- Prepare video **http://microbes.arc.nasa.gov/movie/movie.html** to show to your class. (If you are unable to show the video to your class for any reason, the class can just work from the transcript of the video that is included in their activity book.)
- Make copies of the worksheets for each student.
- Show the class the video and ask them to answer questions 1-12 on their NASA Explorer Stromatolite Worksheet. When they have completed their worksheets, discuss their answers with them.
- Pass out the cupcakes, straws, napkins and a few plastic knives.
- Have the students core the cupcakes then answer the questions on the Mat Sample Observation Form in their activity book.

LESSON:

1. Go to **http://microbes.arc.nasa.gov/movie/movie.html** and show the video to your students. The video is approximately 6½ minutes long. If you are unable to view the video, the transcript is also included on the student worksheet in order to help the students process and retain the information in the video. Have students complete the NASA Explorer Stromatolite Worksheet.
2. Pass out microbial mat cupcakes with core sampling straw.
3. Students will take samples of their "mat" (cupcake) by gently inserting the core sampler (straw) into the center of the mat. Students will remove the sample by gently squeezing the empty end or cutting the sampler. Additional samples may need to be taken if specimen is damaged.
4. Have students complete the Mat Sample Observation Sheet.
5. Discuss results with students.

EXTENSION: CREATING MICROBIAL MATS

Create a living microbial mat in your classroom.

If you do this activity, prepare the microbial mat a few weeks in advance so it has time to grow. To get the lesson plan, do an internet search for **"NASA how to grow a microbial mat"** or see the website **http://microbes.arc.nasa.gov/download/pdf/how%20to%20make%20a%20microbial%20mat.pdf**