

Astrobiology Unit Outline

Unit Overarching Question: How is Biological research used to understand the challenges of space exploration?

1. Intro to *C. elegans* (~1-2, 45 minute class period)

The students will explore *C. elegans* under the microscope.

Goals:

Students will have a better understanding of the characteristics of *C. elegans* (Xenomals).

Students will be able to describe *C. elegans* (Xenomals).

Materials:

C. elegans samples in petri dishes

(Order information: <http://www.carolina.com>,

Caenorhabditis elegans Culture Kit with Prepaid Coupon #173525 \$80.70)

Dissecting microscopes

New "Life"? worksheet (1 per student)

Xenomals Class Characteristics Sheet (1 per class)

Procedure:

1. Have the students look at the Xenomals (*C. elegans*) under the microscope while answering the questions on the New "Life"? worksheet.
2. At the end of the class or half way through day 2 create a class characteristics sheet for Xenomals or discuss their results as a class.

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2. The Characteristics of Life (~1, 45 minute class period)
The students will use their experiences with the Xenomals to form the definition of living and decide if the Xenomals are alive.

Goals:

Students will have a better understanding of the definition of living and what it means to be living.
Students will have a better understanding of what a species is.

Materials:

Class Characteristics Sheet for Xenomals - from yesterday (1 per class)

Procedure:

As a class or in small groups:

1. Make a list of living and non-living things.
2. List characteristics that all of the living things have in common. (Make sure that your list includes: have cells, obtain energy, have DNA, respond to its environment, reproduce, grow.)
3. List characteristics that all of the non-living things have in common.
4. Go through the list of characteristics of living things and let the students determine if each characteristic would be needed on a different planet, ex: Mars.
5. Compare your new list with the Xenomals Class Characteristics Sheet.

Ask: What characteristics do you see to prove that Xenomals are living? (What did you see them doing to prove they are living?)

Use each characteristic to do this.

6. Formally introduce the students to *C. elegans*. Explaining that they are living “worms” found in the soil.

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3. *C. elegans* Research(~2, 45 minute class period)

The students will research about different aspects of *C. elegans* including their life cycle, movement, feeding requirements, anatomy, habitat, experiments that *C. elegans* have been used for, when they have been in space and why they are used in space research.

Goals:

Students will be able to explain why *C. elegans* are used in space and that they have been used in a variety of experiments in space.

Students will be able to explain the *C. elegans* life cycle.

Students will be able to explain how *C. elegans* move, what they feed on, their general anatomy and how to distinguish between the different sexes.

Materials:

Computers with internet or articles for the students to use to find information about *C. elegans* (1 per student)

C. elegans research w.s. (1 per student)

Poster board (1 per group)

C. elegans Information sheet (1 per student)

C. elegans Information Power Point

Procedure:

Day 1

1. Hand out the *C. elegans* Research w.s. and go over the questions they will answer
2. In groups have the students research their groups' question(s) on the w.s.
3. When the students have answered their question(s) have them put their information on a poster board

Day 2

4. Have the students "present" their groups' findings to the class. The other groups will take notes on their worksheet. Hang the posters in the room so that the other students can refer to them as needed.
5. When the students are done, hand out the *C. elegans* Information sheet and go over the information using the *C. elegans* Information Power Point.

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4. *C. elegans* Space Vehicle (~3, 45 minute class periods - This can be more the more involved you have the students get with creating the space vehicle.)

The students will design a space vehicle for *C. elegans* to complete their Mars mission (12 months- reach Mars orbit it and return) within the constraints, and explain their solutions for meeting the various needs of the *C. elegans* on the mission.

Goals:

Students will have a better understanding of the biological needs of *C. elegans*.

Students will have a better understanding of the process of Space Exploration engineering and design.

Students will have a better understanding of how to identify, prioritize, and accommodate for constraints.

Materials:

C. elegans Space Vehicle w.s. (1 per student)

Rulers (1 per student)

Colored pencils

Procedure:

Day 1

1. Hand out the *C. elegans* Space Vehicle w.s. and go over it with the class
2. In groups have the students prioritize their constraints on the worksheet
3. The students should decide on solutions to the constraints and fill in the table on the worksheet

Day 2

4. Have the students continue working on the *C. elegans* Space Vehicle w.s.- sketching and labeling their vehicle on the worksheet

Day 3

5. Have the students continue working on the *C. elegans* Space Vehicle w.s.- draw a scale drawing of their space vehicle from the top, side and front.

** You can continue with the students building their space vehicle to scale. The model should be a moveable model.

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5. The Search for Extraterrestrial Life (~1, 45 minute class period)

The students will read and share articles about the current search for extraterrestrial life to gain a better understanding of the search for extraterrestrial life.

Goals:

Students will be able to describe what extraterrestrial life is, what we hope to gain and what we are looking for.
Students will be able to explain a few discoveries that have been made through the search for extraterrestrial life.

Materials:

Search for Extraterrestrial Life Power Pointe
Copies of the four Articles (1 per group)

Procedure:

1. Go through the Search for Extraterrestrial Life Power Pointe
 - a. Go through slides 1 and 2.
 - b. Slide 3 introduce the topic - What does NASA Hope to Gain from Searching Extraterrestrial Life? - and have the students discuss the possible answers.
 - c. Slide 4 introduce the topic- What are We Looking For?- and have the students discuss the possible answers.
 - d. Slide 5 - Have the students get into groups of four, hand out one copy of each of the four articles to each group, have the students each read 1 article and write a short summary of the main points. When they are done with the article everyone in the group should share their summary to the group.
 - e. Go through slides 6 and 7