

**Title:** *The Lives of a Cell* by Lewis Thomas

**Introduction:** In this activity students read the essay and hold a Socratic discussion of the contents. A discussion of the essay would be appropriate at various points in a high school biology or honors biology course depending upon the direction in which the teacher decides to place emphasis. The author makes mention of many parts of the cell including the cell membrane, mitochondria, centrioles, chloroplasts, so it lends itself well to introducing the parts of the cell. More advanced students may want to explore Lewis's discussion on chloroplasts and mitochondria and the development of endosymbiotic theory. The essay also contrasts viruses to cells. The essay *The Lives of a Cell* can be found in the book by the same name, authored by Lewis Thomas © 1974 Penguin Books.

**Learning Outcomes:**

1. Students will engage in meaningful inquiry discussion.
2. Students will learn key parts of the cell and the role of these parts by writing metaphoric descriptions of these parts.
3. Students will engage in discussion of endosymbiotic theory.

**Curriculum Alignment:**

National Standards addressed by this lesson include content standards for grades 9-12 for the Life Sciences. Fundamental concepts include the cell as a unit of structure and functions, the molecular basis for heredity and biological evolution.

**North Carolina Standards**

**Biology**

**2.02** Investigate and describe the structure and functions of cells including:

- Cell organelles.

**3.05** Examine the development of the theory of evolution by natural selection including:

- The origin and history of life.

**English III**

**1.03** Demonstrate the ability to read, listen to and view a variety of increasingly complex print and non-print expressive texts appropriate to grade level and course literary focus, by:

- Demonstrate comprehension of main ideas and supporting details.
- Summarizing key events and/or points from the text.
- Making inferences, predicting, and drawing conclusions based on text.
- Analyzing and evaluating the connections or relationships between and among ideas, concepts, characters and/or experiences.
- Identifying and analyzing elements of expressive environment found in text in light of purpose, audience, and context.

**2.03** Demonstrate the ability to read, listen to and view a variety of increasingly complex print and non-print expressive texts appropriate to grade level and course literary focus, by:

- Identifying and analyzing text components (such as organizational structures, story elements, and organizational features) and evaluating their impact on the text.

**4.05** Demonstrate the ability to read, listen to and view a variety of increasingly complex print and non-print critical texts appropriate to grade level and course literary focus, by:

- providing textual evidence to support understanding of and reader's response to text.
- demonstrating comprehension of main idea and supporting details.
- summarizing key events and/or points from text.
- Making inferences, predicting, and drawing conclusions based on text.

**6.01** Demonstrate an understanding of the conventions of language by:

- Decoding vocabulary using knowledge of Anglo-Saxon, Greek, and Latin bases and affixes.
- Using vocabulary strategies such as context clues, resources, and structural analysis (roots, prefixes, etc) to determine meaning of words and phrases.

**Classroom Time Required:** Approximately 1½ class periods (90 min) Essay should be introduced and vocabulary discussed on day one with full class discussion to follow on the next day after students have had the opportunity to read and annotate the essay.

**Materials Needed:**

- *The Lives of a Cell* by Lewis Thomas...copies of the paperback book by the same title can be purchased through Amazon.com; each student should have a copy of the essay for marking.
- **KIM** vocabulary chart for key vocabulary
- Discussion questions for *The Lives of a Cell* handout
- Copy of cell parts flip chart

**Technology Resources:**

Document Camera or Overhead Projector

**Pre-Activities/ Activities:** The teacher should preview the essay for content and to be prepared to address any vocabulary that might be unfamiliar to the students. Also, if the teacher is not accustomed to using Socratic discussion with the class it is recommended that they review this process.

Information/links on Socratic seminars can found on the resources page.

**Engage:** Open the lesson with a discussion of the literary elements of simile and metaphor author makes use of these throughout the essay. Students should be familiar with annotating a piece of text for discussion; highlighting, underlining, margin notes and questions. Background on the article may be given, however students should be allowed to explore their own ideas during reading and discussion so this should be kept to a minimum. Students should be provided a list of key biology vocabulary prior to reading the article. Students may be given the meaning of the terms or asked to look them up on their own as part of preparing for the reading. Use the **KIM** vocabulary chart. Students should be allowed to quickly preview the article and to point out any other unfamiliar vocabulary so that this may be addressed before actually working with the piece as a homework assignment.

**Explore:** Students are asked to read and annotate the article this works best as a homework assignment to reduce the amount of class time used. Students should answer the discussion questions to accompany the article this may also be completed at home.

**Explain:** This portion of the lesson should take the form of a class discussion or Socratic seminar. Students should begin by first discussing their interpretation of the questions provided. Discussion can then progress into the student-generated questions. Sample questions for discussion are provided below in the "Discussion Questions" handout. The role of the teacher at this point should be to ask probing questions or to redirect discussion from the handout. It is OK to ask students to provide evidence for their comments and to ask for agreement to disagreement from the class. This is to be encouraged. However, some preliminary discussion on how to address differences of opinion may be necessary with some students or classes. It is important to the discussion to maintain the atmosphere that students can safely and without fear express their ideas. Remember the discussion is to allow students to develop a deeper understanding of the cell using Thomas's metaphors. Teacher should take notes during this part of the discussion on any misconceptions or areas to revisit at the end of the discussion.

**Elaborate:** Teacher should elaborate on any ideas or address misconceptions that may have arisen during the class discussion. It is important to have a time for teacher input separate from the student discussion to foster the appropriate atmosphere of the free classroom discussion. It is important that students be given the opportunity to work through the article on their own.

**Evaluate:** Students should complete the flip chart of cell organelles and place it in their journals. Metaphors from the reading or student-created metaphors and similes may be shared and used as a form of formative assessment to help determine understanding. Some examples from the reading are listed below.

*"...the earth is pictured as something delicate, like rising bubbles at the surface of a country pond..."*

*"We are shared, rented, occupied"*

*"...viruses; they dart, rather like bees, from organism to organism..."*

**Assessment:** see above

**Modifications:**

- For lower-level readers the teacher may want to read aloud sections of the text and have students discuss the meaning of each portion of the essay.

**Alternative Assessments:**

**Supplemental Information**

**Critical Vocabulary** These are the terms with which students seem to have the most difficulty, since the English standard course of study emphasized etymology of word this information is provided where it could be found.

**membrane** - from the Latin *membrane*, meaning "parchment," in Cell Biology the thin limiting covering of a cell or cell part.

**cilia**-from Latin *cilia*, plural of *cilium* "eyelid, eyelash." In Biology minute hair-like organelles, identical in structure to flagella, that lines the surfaces of certain cells.

**Mitochondria-organelle** where cellular respiration take place here the energy stored in glucose molecules is converted to energy that can be used by the cell.

**prokaryote** – any cellular organism that has no nuclear membrane, no organelles in the cytoplasm except ribosomes, and has its genetic material in the form of single continuous strands forming coils or loops, examples include bacteria and blue-green algae.

**eukaryote** – cells containing a true nucleus and other membrane bound structures, from the Greek *eu-* + *káry* "nut",

**symbiont**- from the Greek *symbiont* "to live together"

**centrioles**- a small, cylindrical cell organelle, seen near the nucleus in the cytoplasm of most eukaryotic cells, which divides in perpendicular fashion during mitosis.

**genome**- a full set of chromosomes; all the inheritable traits of an organism.

**chloroplast**-a cell organelle containing chlorophyll.

**photosynthesis**- the synthesis of complex organic materials, esp. carbohydrates, from carbon dioxide and water, using sunlight as the source of energy and with the aid of chlorophyll and associated pigments.

**DNA**-deoxyribonucleic acid. The molecule of heredity.

**nucleus** – from the Latin *nucla* meaning "kernel," or "little nut" in Biology a specialized, usually spherical mass of protoplasm encased in a double membrane, and found in most living eukaryotic cells, directing their growth, metabolism, and reproduction, and functioning.

**rhizoidal bacteria**-soil **bacteria** that fix nitrogen after becoming established inside root nodules of legumes

**Comments:**

- If at all possible students should be provided their own copy of the essay to allow for annotating and margin notes.
- The accompanying cell parts flip chart is intended to be used if this activity is conducted in a unit on parts of cell, however the teacher could also address the endosymbiotic theory with this lesson.

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**KIM Vocabulary Chart**

<b>K</b> Key Term	<b>I</b> Information	<b>M</b> Memory Clue (picture/drawing)

## Discussion Questions

*The Lives of a Cell* by Lewis Thomas

1. Lewis makes use of metaphor and simile throughout the essay. Give two examples of a biological metaphor (or simile) from the essay, use quotes, and explain the meaning the author is trying to convey.
  
2. How does the author view mitochondria? Explain.
  
3. How does the author view viruses? Explain.
  
4. What message is the author trying to convey when he says:

*“The uniformity of the earth’s life, more astonishing than its diversity, is accountable by the high probability that we derived, originally from some single cell.”*

5. The author ends the essay with a simile: *“if not like an organism, what is it like, what is it most like? Then, satisfactorily for the moment, it came to me: it is most like a single cell.”* To what is the author comparing a single cell? Explain.
  
6. Write one question of your own that you would like to address during the class discussion on the article. Remember your question to be thought provoking and intended to spark discussion among your classmates.

## Cell Parts Flip Chart

Flip charts are easy to create study and review tools that students use much like flash cards. These are affixed to pages of the students' notebooks so that they don't get misplaced. To create a flip chart students will need 1 index card (3 x 5 works best) for each term and tape. Students will need writing instruments to write and/or draw on the note cards. To create the flip chart place a note card with the lines facing upwards on the table in front of you. Write the vocabulary term on the line just above the bottom line on the note card. A picture or diagram illustrating the term may be drawn above the term. Flip the card over (from bottom to top) and place the definition of the term on the back of the note card. Note cards are then attached to pages in the student's notebook as shown in the diagram below.

