



Project Director

Jeffrey F. Lockwood, Ed.D.

Authors

Jodi E. Asbell-Clarke

Daniel W. Barstow

Teon E. Edwards

James L. Larsen

Jeffrey F. Lockwood

Christopher H. Randall

Contributing Author

Brian Drayton

Principal Investigators

Dan Barstow – TERC

David DesMarais – NASA Ames

Paul Andres – Jet Propulsion Laboratory

This curriculum was developed by TERC, Cambridge, Massachusetts.
Funded in part by a grant from the National Science Foundation.



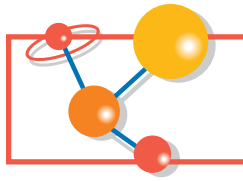
Copyright © 2005 TERC, 2067 Massachusetts Avenue, Cambridge, MA 02140,
617.547.0430

ISBN 1-929877-00-5

Printed by Ambit Press, 5 Cambridge Center, Cambridge, MA 02142 617.876.3688



This material is based upon work supported by the National Science Foundation under Grant No. ESI9730728. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect views of the National Science Foundation.



Activity Four

Extraordinary Claims

Purpose

To discuss ideas about the existence of extraterrestrial life and explore the nature of evidence as it applies to both science and pseudoscience

Overview

Students read and analyze two articles, a tabloid article and a science news article which were written about the “Face on Mars.” They then write a summary and opinions about the arguments and evidence presented in each.

Students then compose their own tabloid story, basing it upon their current views about extraterrestrial life, and predict what they think life on another world might really look like.

Time: 100 minutes

Context

In the previous activity, students pondered some images related to our search for life in the universe. They investigated the value of such images and were introduced to the idea that images can be misinterpreted.

In this activity they see how to apply skeptical thinking as they read and interpret extraordinary claims, related to astrobiology, that may or may not be real.

In the next activity, students will learn about the Drake Equation and what it tells scientists about the possibility of intelligent life in the universe.

Key Concepts

- Scientific explanations must adhere to certain criteria.
- All scientific knowledge is subject to change as new evidence becomes available.
- We have not yet found evidence for extraterrestrial life.

Key Skills

- *Articulating and supporting* opinions
- *Contributing* thoughtfully to group and class discussions
- *Understanding* the differences between science and pseudoscience
- *Understanding* the nature of scientific evidence
- *Recognizing and analyzing* alternative explanations and models of evidence

Materials

- Examples of pseudoscience articles from tabloids (optional)

Background

Do we have proof of the existence of extraterrestrial life? At this time, most scientists would answer “no”. However, there are some individuals who believe that strong evidence of extraterrestrial life exists in the form of a picture of an artificial structure—a “face”—found on the surface of Mars. As mentioned in the last activity, the Viking Orbiter I in 1976 took the controversial image. It has spawned a wealth of extraordinary claims by writers who declare that the image is a monument constructed on Mars by an intelligent civilization. It is evidence, the authors say, of extraterrestrial life. But what constitutes evidence? Do different people perceive evidence in different ways?

Statements in the National Science Education Standards read, “Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. In areas where data or understanding are incomplete, new data may well lead to changes in current ideas or resolve current conflicts such as those associated with the Face on Mars debate. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.” (Content Standards: 9-12; History and Nature of Science)

The Face on Mars is a good case study that shows how images can be misinterpreted. Such misinterpretations tend to be perpetuated if fresh evidence is not found or if it is ignored. Pseudoscience, the belief in extraordinary claims without scientific proof, is a growing problem in our society. Pseudoscience can be fun, but in a world that is dependent on its population being scientifically literate, the growth of pseudoscience is a concern.

Discoveries in astrobiology are subject to misinterpretation and misrepresentation by anyone who wants to take advantage of an uninformed public. Since the search for life in the universe is central to astrobiology, any discovery of life would instantly become an extraordinary claim that would reshape our society. Therefore, we need to exhibit a sensible skepticism to ensure that we do not misinterpret data that we find. When it comes to claims of extraterrestrial life, “extraordinary claims require extraordinary proof!”

Preparation

1. Read through the pieces in the Student Guide: the tabloid article, the science news article, and *What's the Story? — Pseudoscience and Skeptical Thinking*.
2. Collect examples of pseudoscience articles to show to the class. Many of the tabloids available at check-out counters in grocery stores contain articles on aliens on a regular basis.

Recommended Procedures

1. Introduce students to the concepts of pseudoscience and skeptical thinking.
 - Have students read *What's the Story? — Pseudoscience and Skeptical Thinking* and answer the *Checking In* questions.
 - Discuss what is meant by scientific evidence vs. opinion and hearsay.

2. Analyze the tabloid article and the science news article about the Face on Mars.
 - Remind students of the last activity in which they read about how metadata helped scientists form a hypothesis that they tested by taking additional images to disprove the existence of a Face on Mars.
 - Tell students that, even with this additional data, some tabloids and other Web sites still report that the Face is real.
 - Explain that even though some of the reports seem real, an informed reader can pick out where the reports are stretching the truth.
 - Have students read the two articles and look for evidence that can be proven or verified. They should be wary of scientific-sounding information and “unidentified sources” that appear legitimate but are hard to validate. They should also be wary of claims of official conspiracy or cover-up commonly found in pseudoscientific articles.
3. Have students write, draw, and revise their own tabloid-like story about life on other worlds.
 - Use the *Pseudoscience Tabloid Format* in their student guide and outline your expectations for completion of the project.
 - Use a rubric of your own design or have the class agree on grading criteria that will be used to evaluate their work.
 - Encourage students to be creative but to try to base their life form on what they currently believe we will find in our search for extraterrestrial life. You can regard this activity as a type of pre-test to see what preconceived ideas students have relative to life on other worlds.
 - When students have completed their tabloids, have them present them to the class or exhibit them in a place like the library.
 - Make sure students list how they violated the guidelines for valid scientific reporting as outlined in *What’s the Story? - Pseudoscience and Skeptical Thinking*.
4. Have students do the *Think About It* questions.

Think About It

1. In each article, what is the theory or hypothesis used to explain the *Viking* image of the Face on Mars?

The first article states that the Face on Mars is artificial and was built by intelligent beings as a message to space-traveling civilizations. The second article states that the Face is the result of natural processes.

2. What experiment did scientists use to collect data to prove or disprove each theory?

They took additional pictures of the Face with other probes sent after Viking.

3. Compare how the two articles used data in their contradictory reports on the “Face” on Mars.

The first article reported that images were doctored and faked for the purpose of convincing people that the Face was not the result of intelligent life. It reports that information supporting the intelligent-life hypothesis was being suppressed and covered up. The article uses conspiracy and cover-up as a way to dismiss conflicting data that do not support the hypothesis.

The second article stated that new images were released as soon as they were received. The images were said to be 10 times the resolution of the original Viking images and show that the face is the result of natural features.

4. How would you check out the statements made in each article to verify the claims?

Research scientific journals, newspapers, and the Web to see if information in the articles can be verified. Also look for the images and names cited in the articles to see if they are real.

For example, even a casual search of the Web turns up evidence that can be used to verify the images and the sources cited in the articles. The scientists mentioned in the first article don't seem to exist, but those mentioned in the second are cited many times on the Web and are identified as having been related to NASA missions to Mars.

5. Which article would you classify as pseudoscience? Explain your answer.

The first article is the pseudoscience article. It cites sources of information that can't be verified. It also relies on cover-up and conspiracy to help explain why the data that would support the claim are not readily available. The theory that it states—the Face on Mars is the result of intelligent life—is testable, but the experiment used to test it and the data collected disproving it are rejected.