# Brain Eating Amoeba

## Contributors

**Marshall West**  
Graduate Student  
Georgia Southern University, GA

**Laura Ike**  
Partner Teacher  
Effingham County High School, Springfield, GA

## Intended Audience

<table>
<thead>
<tr>
<th>Grade Range</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-4</td>
<td></td>
</tr>
<tr>
<td>5-8</td>
<td>X</td>
</tr>
<tr>
<td>9-12</td>
<td>X</td>
</tr>
</tbody>
</table>

## Intended Audience

<table>
<thead>
<tr>
<th>Classroom Setting</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requires special equipment</td>
<td></td>
</tr>
<tr>
<td>Uses hands-on manipulatives</td>
<td></td>
</tr>
<tr>
<td>Requires mathematical skills</td>
<td></td>
</tr>
<tr>
<td>Can be performed individually</td>
<td>X</td>
</tr>
<tr>
<td>Requires group work</td>
<td>X</td>
</tr>
<tr>
<td>Requires more than one (90 min class) period</td>
<td></td>
</tr>
<tr>
<td>Appropriate for special needs student</td>
<td></td>
</tr>
</tbody>
</table>
Introduction

Description

Students investigate the kingdom protista by reading an article in groups, answering worksheet questions, and engaging in classroom discussion.

Abstract

This activity will introduce students to the kingdom protista. The kingdom protista is one of the most diverse kingdoms and can be difficult for students to understand. Organisms are often grouped into this kingdom simply because they don’t fit into any other one. The goal of this activity is show how protists affect students’ daily lives. This activity will also emphasize the diversity of the protista kingdom. Students will read an article about a brain eating amoeba (*Naegleria fowleri*), that has killed a handful of people in the USA. Students will then answer worksheet questions and engage in a classroom discussion about disease causing protists.

Core Themes Addressed

<table>
<thead>
<tr>
<th>Core Themes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbial Cell Biology</td>
<td>x</td>
</tr>
<tr>
<td>Microbial Genetics</td>
<td>x</td>
</tr>
<tr>
<td>Microorganisms and Humans</td>
<td>x</td>
</tr>
<tr>
<td>Microorganisms and the Environment</td>
<td>x</td>
</tr>
<tr>
<td>Microbial Evolution and Diversity</td>
<td></td>
</tr>
</tbody>
</table>

Keywords

Protist, species diversity, micro-organism, encephalitis, amoeba

Learning Objectives

At completion of this activity, learner will

1. Read a scientific article
2. Synthesize reading by answering worksheet questions
3. Engage in classroom discussion about protist caused diseases
National Science Education Standards Addressed

STANDARD A: Science as inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

STANDARD C: Life science

- The cell
- Behavior of organisms

STANDARD F: Science in personal and social perspectives

- Personal and community health
- Environmental quality
- Natural and human induced hazards
Brain Eating Amoeba

Student Prior Knowledge

Students need to be introduced to the 6 kingdoms of life concept.

Class Time

This activity will require a minimum of one 90 minute class period.

1. Reading of article/completion of worksheet – 45 minutes
2. Classroom discussion – 30 minutes

Teacher Preparation Time

This lesson will require approximately 30 minutes of preparation time.

1. Print out articles/worksheets – 15 minutes
2. Organization – 15 minutes

Materials and Equipment

1. Article and worksheet printout – 1 per student

References

Answers to Student Handouts

Short Answer Question

1. What is the species name of the brain eating amoeba? *Naegleria fowleri*

2. What do you think encephalitis means? It’s basically when your brain deteriorates and turns into a sponge.

3. Can you think of any diseases that causes encephalitis in cows or deer? *Mad Cow Disease, Chronic Wasting Disease*

4. What type of environment does the amoeba live in? *Ponds that are warm and stagnate*

5. How does the amoeba get into the brain? It crawls through the nose into the brain.

6. What are three symptoms of having this amoeba? A high fever, disorientation, seizures, confusion

7. How long does it take to kill you? 3-7 days

8. How do scientists detect the amoeba in the environment? Visual identification but recently they have begun using molecular barcoding techniques.
9. What does homology mean? Similar structures in different organisms that differ in function.

10. Why do you think this disease is almost always fatal? Because it is so rare, doctors fail to diagnose it. In addition the protist turns your brain into a sponge.
Introduction

The kingdom protista is one of the most diverse kingdoms and can be difficult for students to understand. Organisms are often grouped into this kingdom simply because they don’t fit into any other one. The goal of this activity is to show how protists affect your daily lives. This activity will also emphasize the diversity of the protista kingdom. Students will read an article about a brain eating amoeba that has killed a handful of people in the USA. Students will then answer worksheet questions and engage in a classroom discussion about diseases caused by protists.

Student Background Knowledge

*Naegleria fowleri* is a free-living amoeba known to infect the human brain and turn it into a SPONGE!! *Naegleria fowleri* causes acute fatal encephalitis, which, fortunately, is rare. These amoebae live freely in soil and in fresh and coastal waters. The resistant cysts can be transported even in dust.

*Naegleria fowleri*, or the brain eating amoeba, is found in most lakes, hot springs, and even dirty swimming pools. It is thought that the amoebae are stirred up when swimmers wade in shallow waters and kick up the bottom. That water gets up their noses and amoebae begin to eat the brain. This amoeba loves hot places which makes the human brain a perfect home. The warmer the environment, the better it thrives. The amoeba also feeds on bacteria and algae in bottom sediments.

Environments:

*N. fowleri* is a free-living protist typically found in warm bodies of fresh water, such as ponds, lakes, rivers, and hot springs. It is also found in soil, near discharges of industrial plants, and poorly chlorinated swimming pools.

Symptoms:

Infection with *N. fowleri* occurs when the amoeba enters the body through the nose. Onset symptoms of infection start 1 to 14 days after exposure. The initial symptoms include, but are not limited to, changes in taste and smell, headache, fever, nausea, vomiting, and stiff neck. Secondary symptoms include confusion, hallucinations, lack of attention, and seizures. After the start of symptoms, the disease progresses rapidly over 3 to 7 days, with death usually occurring in 7 to 14 days. This amoeba has killed 23 people in the U.S. from 1995 to 2004.

Immunooassays and antibodies:

The *N.fowleri* species has been isolated from swimming pools, freshwater lakes, thermal springs, freshwater habitats, and polluted waters. Therefore, in a public health point of view, it is
important to identify areas containing *N. fowleri*. DNA barcoding methods are required to identify this species because it is largely homologous to other non-pathogenic protists.

**Vocabulary**

**Protist**: A diverse group of eukaryotic microorganisms. Historically, protists were treated as the kingdom Protista, which includes mostly unicellular organisms that do not fit into the other kingdoms.

**Species diversity**: The number of different species present in an ecosystem

**Encephalitis**: A degenerative disease of the brain

**Amoeba**: A shapeless unicellular protist

**Materials Checklist**

| Brain Eating Amoeba Article and worksheet |

**Procedure**

1. Read the article in groups
2. Answer worksheet questions in groups
3. Have a classroom discussion about worksheet questions and disease causing protists
Short Answer Question

11. What is the species name of the brain eating amoeba?

12. What do you think encephalitis means?

13. Can you think of any diseases that causes encephalitis in cows or deer?

14. In what type of environment does the amoeba live?

15. How does the amoeba get into the brain?

16. What are three symptoms of being infected by this amoeba?

17. How long does it take to kill you?

18. How do scientists detect the amoebae in the environment?

19. What does homology mean?

20. Why do you think this disease is almost always fatal?