Explore: Friend, Foe, or Freeloader? Discovering Symbiosis

INSTRUCTOR:
no_reply@example.com

Objective: Explore and analyze symbiotic relationships by interpreting scientific data, constructing bar graphs, and identifying patterns of interaction between organisms.

Background In nature, living things often depend on each other to survive and thrive. These relationships between two different species are called symbiotic relationships. There are three main types of symbiosis:

- **Mutualism**: Both organisms benefit. For example, bees get food from flowers while helping the flowers reproduce by spreading their pollen.
- **Commensalism**: One organism benefits, and the other is not affected. For instance, barnacles attach to a whale's skin and get a free ride through the water to find food, but the whale isn't harmed or helped.
- **Parasitism**: One organism benefits while the other is harmed. An example is a tick feeding on a dog's blood, which benefits the tick but hurts the dog.

In this activity, you will examine real-world examples of these relationships by interpreting data and creating visual representations to show how different organisms interact.

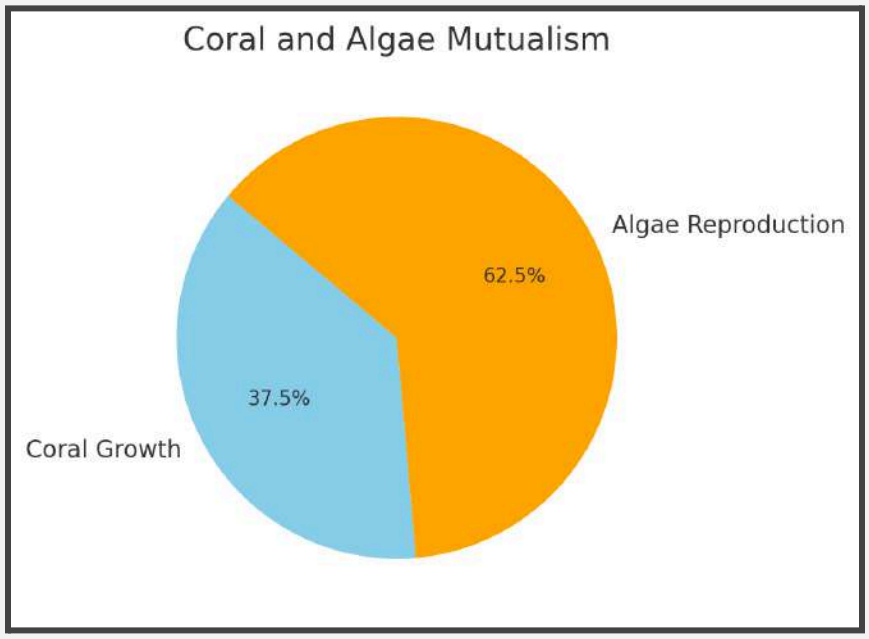
Activity Instructions

1. **Examine Graphs**: Each group will receive a graph (column, line, or pie) based on data about population changes or growth rates for two organisms.
2. **Interpret the Graph**:
    - Look at the axes, labels, and trends in the graph.
    - Determine how each organism's population changes over time or in relation to the other.
3. **Identify the type of symbiosis and explain it in a written response.**
    - **Sentence Frame**: *"The relationship between [Organism A] and [Organism B] is an example of [type of symbiosis] because…"*
4. Write a short paragraph summarizing the findings from their graph.
    - **Sentence Frame**: *"The graph shows that [Organism A] was affected by the relationship in this way: …. Meanwhile, [Organism B] was affected by…. This supports the idea that the relationship is…"*

5. **Support Your Answer**: Explain your reasoning by referencing specific trends or data points from the graph.

Scenarios and Graphs

1. **Scenario**: **The Coral and the Algae**
    - **Background**: A coral reef is thriving in warm, shallow waters. Tiny algae live inside the coral's tissues, providing it with energy through photosynthesis while gaining protection and access to sunlight.
    - **Graph Type**: Pie Graph
        - **Data**: **Beginning**
            - Coral: 30% Growth
            - Algae: 50% Reproduction
            - **After**:



Reflection Questions

1. What patterns did you notice in the graph that helped you determine the type of symbiosis?
2. How do symbiotic relationships impact the survival of organisms in an ecosystem?
3. If the relationship you studied changed over time, how might that affect the populations involved?

4. How do human actions influence symbiotic relationships in nature?

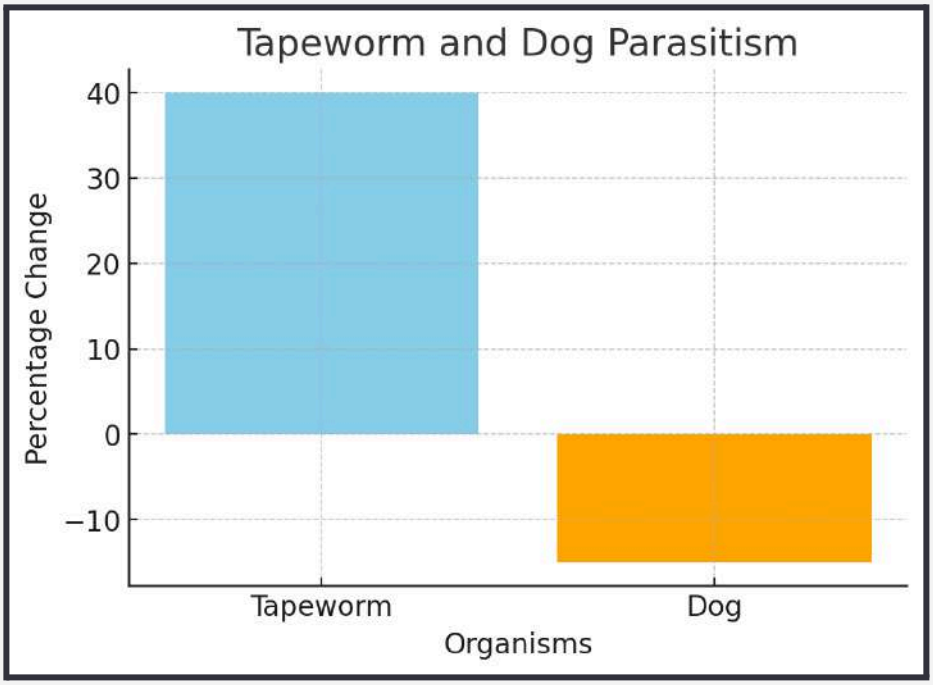
Sentence Stems for Reflection:

- I noticed that the graph showed…
- This pattern suggests that the relationship is… because…
- Symbiotic relationships are important because…
- If the relationship changed, I think it would… because…
- Humans might impact symbiotic relationships by…

---

2. **Scenario**: **Tapeworm and Dog**
    - **Background**: A stray dog becomes infected with a tapeworm after eating contaminated food. The tapeworm absorbs nutrients from the dog's intestines.
    - **Graph Type**: Column Graph
        - **Data**: **Before**
            - Tapeworm: 20% Growth Rate
            - Dog: 5% Weight Loss
            - **After**:

Name: _____ Date: _____



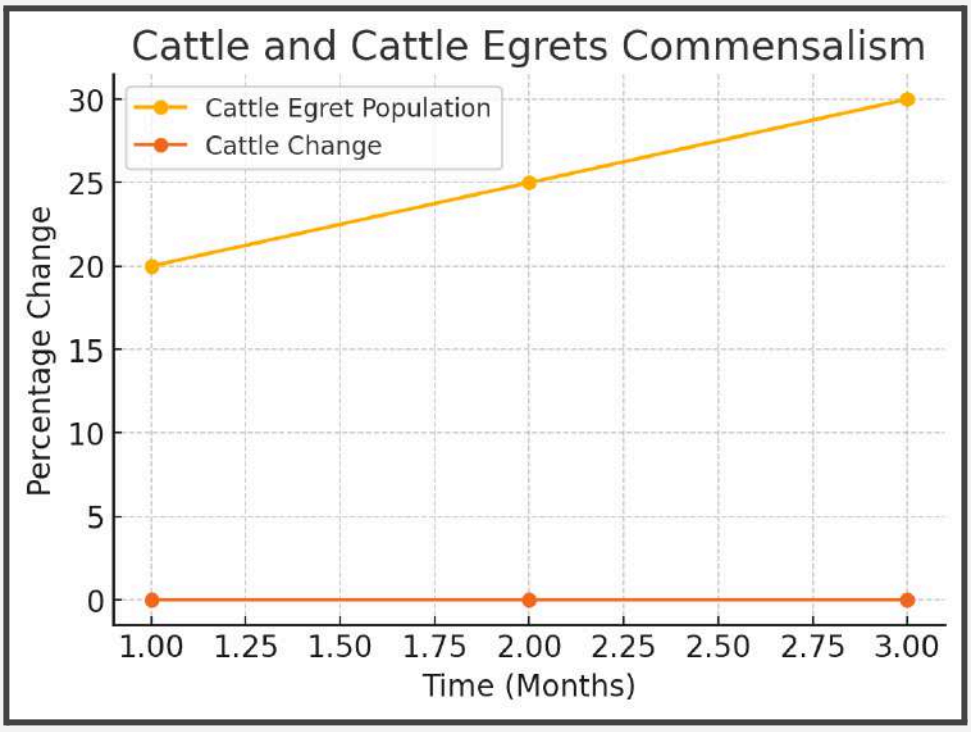
Reflection Questions

5. What patterns did you notice in the graph that helped you determine the type of symbiosis?
6. How do symbiotic relationships impact the survival of organisms in an ecosystem?
7. If the relationship you studied changed over time, how might that affect the populations involved?
8. How do human actions influence symbiotic relationships in nature?

Sentence Stems for Reflection:

- I noticed that the graph showed…
- This pattern suggests that the relationship is… because…
- Symbiotic relationships are important because…
- If the relationship changed, I think it would… because…
- Humans might impact symbiotic relationships by…

3. **Scenario**: **Cattle and Cattle Egrets**
    - **Background**: In a grassy savanna, cattle stir up insects while grazing. Cattle egrets follow behind, eating the insects without affecting the cattle.
    - **Graph Type**: Line Graph
        - **Data**: **Before**
            - Cattle Egrets: 30% Population Density Increase Over Time
            - Cattle: No Change
            - **After**:



Name: _____ Date: _____

Reflection Questions

9. What patterns did you notice in the graph that helped you determine the type of symbiosis?
10. How do symbiotic relationships impact the survival of organisms in an ecosystem?
11. If the relationship you studied changed over time, how might that affect the populations involved?
12. How do human actions influence symbiotic relationships in nature?

Sentence Stems for Reflection:

- I noticed that the graph showed...
- This pattern suggests that the relationship is... because...
- Symbiotic relationships are important because...
- If the relationship changed, I think it would... because...
- Humans might impact symbiotic relationships by...

Name: _____ Date: _____

Teacher Instructions for Symbiotic Relationships Activity

Objective:

Students will explore and analyze symbiotic relationships by interpreting scientific data, constructing bar graphs, and identifying patterns of interaction between organisms.

Background Information:

In this activity, students will explore three types of symbiotic relationships in nature:

1. **Mutualism**: Both organisms benefit (e.g., bees and flowers).
2. **Commensalism**: One organism benefits, and the other is unaffected (e.g., barnacles on a whale).
3. **Parasitism**: One organism benefits at the expense of the other (e.g., mosquitoes and humans).

Students will work in groups to interpret scientific data related to these relationships and graphically represent how populations of different organisms change in response to one another.

Materials Needed:

- Graphs (pie, column, and line graphs) for each group (printed or on a digital device).
- Student worksheets (with reflection questions and sentence stems).
- Writing materials for short paragraph reflections.

Group Setup:

- Divide students into small groups (preferably 4-5 students per group).
- Distribute the graphs based on the three types of symbiotic relationships (Mutualism, Commensalism, and Parasitism).
- Provide each group with a worksheet that includes reflection questions and sentence stems.

Activity Instructions:

Step 1: Introduce the Topic (10 minutes)

1. Explain the concept of symbiosis: Briefly review the three types of symbiotic relationships with the class:
    - Mutualism: Both organisms benefit.
    - Commensalism: One organism benefits, and the other is unaffected.
    - Parasitism: One organism benefits at the expense of the other.

2. Provide examples: Offer real-life examples for each type (e.g., bees and flowers for mutualism, barnacles and whales for commensalism, mosquitoes and humans for parasitism).

Step 2: Examine the Graphs (20 minutes)

1. Distribute graphs: Give each group a graph that corresponds to one of the symbiotic relationships.
2. Graph analysis:
    - Have students carefully observe the graph and pay attention to the axes, labels, and trends over time.
    - Encourage them to ask the following questions:
        - What do the x- and y-axes represent?
        - What patterns do I see in the data? Are there trends or fluctuations?
        - How do the two organisms' populations change in relation to each other?

Step 3: Identify the Relationship (20 minutes)

1. Determine the type of symbiosis: Based on the data, students should identify whether the relationship between the organisms is mutualism, commensalism, or parasitism.
2. Support with data: Have each group justify their answer by citing specific data points from the graph. Use the sentence stem:
   "*This pattern suggests that the relationship is [type of symbiosis] because [provide data-based justification]."*

Step 4: Reflection (10 minutes)

1. **Complete reflection questions:** After creating the graph and summarizing their findings, students should answer the reflection questions on their worksheet. Questions include:
    - What patterns did you notice in the graph that helped you determine the type of symbiosis?
    - How do symbiotic relationships impact the survival of organisms in an ecosystem?
    - How might changes in the relationship affect the populations involved?
    - How might human actions influence symbiotic relationships in nature?
2. **Sentence stems for reflection:** Encourage students to use the sentence stems to structure their responses:
    - *"I noticed that the graph showed… "*
    - *"This pattern suggests that the relationship is… because…"*
    - *"Symbiotic relationships are important because…"*
    - *"If the relationship changed, I think it would… because…"*

- *"Humans might impact symbiotic relationships by..."*

Step 5: Sharing Results (10 minutes)

- Have each group share their graphs and written responses with the class. Encourage students to explain how they interpreted the data and how it led them to determine the type of symbiosis.

Step 6: Conclusion and Discussion (5 minutes)

- Conclude the activity with a class discussion about the importance of symbiotic relationships in ecosystems. Discuss how changes in one population can have far-reaching effects on other species and the environment.
- Encourage students to think critically about how human activities (like deforestation, pollution, and climate change) might impact these relationships.

Assessment:

1. **Written Response**: Each student should provide a written explanation identifying the type of symbiosis, supported by specific data from the graph.
2. **Reflection**: Student responses to the reflection questions will demonstrate their understanding of symbiotic relationships and their ability to analyze data trends.

Tips for Success:

- Remind students that some relationships may not always show clear trends and that it's okay to use data points to support their reasoning.
- Encourage collaboration and discussion within groups to facilitate deeper analysis.

Differentiation Strategies

1. Differentiating by Content:

- **For Advanced Learners**:
  - Provide more complex graphs with additional variables (e.g., multiple organisms in the relationship, longer time periods) for deeper analysis.
  - Challenge students to consider multiple potential explanations for the data (e.g., what could cause a drop in population if both organisms benefit in a mutualistic relationship?).
  - Ask students to create a comparison chart or Venn diagram that compares symbiotic relationships based on data trends.

- **For Struggling Learners**:
    - Provide simplified graphs with clear trends and fewer data points to make interpretation easier.
    - Offer additional background information or visuals (e.g., diagrams or pictures) about each relationship to enhance understanding of the context.
    - Allow students to work in pairs or small groups for peer support, where a stronger student can help explain the data and guide the interpretation.

2. Differentiating by Process:

- **For Visual Learners**:
    - Encourage students to use color coding in their graphs to represent different organisms or types of data (e.g., using one color for each organism's population and another for the type of relationship).
    - Use pictures or videos of the organisms involved in the symbiotic relationships to visually anchor their understanding.
    - Incorporate interactive graphing tools on tablets or computers, so students can manipulate the data more easily and immediately see changes in trends.
- **For Auditory Learners**:
    - Provide verbal explanations and small-group discussions for interpreting data. Allow students to explain the data and their reasoning aloud before drawing conclusions.
    - Allow students to record short voice memos summarizing their reflections and analysis instead of writing them down.
- **For Kinesthetic Learners**:
    - Use physical objects (e.g., small figurines or cutouts of the organisms) to demonstrate the interactions and graphing process. This can help make the abstract data more tangible.
    - Have students physically move between stations to analyze different graphs. For example, one station for mutualism, another for commensalism, and a third for parasitism.

3. Differentiating by Product:

- **For Advanced Learners**:
    - Ask students to create a more detailed project, such as a short presentation or poster about their symbiotic relationship, where they include additional data sources, external research, or predict future changes.

- Challenge students to identify potential changes in the relationship over a long period of time or suggest solutions for maintaining balance in a delicate symbiotic relationship.

- **For Struggling Learners**:
  - Provide sentence starters or templates to help guide the written response, particularly for the reflection and explanation sections.
  - Have students work with a pre-drawn or partially completed graph where they just need to interpret the data and add labels, reducing the challenge of creating the graph from scratch.

4. Differentiating by Environment:

- **For Students with Learning Disabilities or English Language Learners**:
  - Offer a glossary of terms related to symbiosis (e.g., mutualism, commensalism, parasitism) and include visual representations of the organisms and their relationships.
  - Pair ELL students with peers who are proficient in English to provide language support as they interpret the data.
  - Provide instructions both in written and oral form, ensuring that students can access the information in the way that best suits their needs.
- **For Students Needing Extra Support**:
  - Give extra time for completing graphs and reflection questions.
  - Offer sentence stems and graphic organizers to help structure their analysis and responses.
  - Use peer tutoring where students can collaborate with others to enhance understanding and clarify complex ideas.

5. Differentiating by Interest:

- **Interest-Based Learning**:
  - Allow students to choose from a variety of symbiotic relationships that they are particularly interested in (e.g., they could choose between researching bees and flowers or sharks and remoras).
  - Provide additional optional enrichment activities for students who finish early, such as researching how climate change might impact one of the relationships they've studied.
  - Incorporate real-world examples related to student interests, such as the relationship between dogs and ticks for students interested in animals, or the connection between plants and insects for those interested in ecosystems.