Ohio Standards Connection:

**Life Sciences**

**Benchmark C**
Explain how energy entering the ecosystems as sunlight supports the life of organisms through photosynthesis and the transfer of energy through the interactions of organisms and the environment.

**Indicator 2**
Investigate how organisms or populations may interact with one another through symbiotic relationships and how some species have become so adapted to each other that neither could survive without the other (e.g., predator-prey, parasitism, mutualism and commensalism).

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**Lesson Summary:**
To investigate organisms in symbiotic relationships, students will become detectives or investigative reporters. Students will use outside resources such as library books, Internet searches, wildlife and nature magazines, and animal card sets to identify a number of examples of organisms that coexist in symbiotic relationships. Search results will be shared among groups looking for the same categories of symbioses, and then with the whole class. The post-assessment tests student understanding about how these relationships work, including which organisms benefit and which ones do not. The richness of this lesson rests on the availability of so many examples for each type of symbiotic relationship.

**Estimated Duration:** Two hours and 30 minutes

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**Commentary:**
Symbiosis covers the whole spectrum of relationships between two species. Commensalism and mutualism are most often taught under this umbrella topic, so most people think about these examples only. However, some ecologists consider all stable pair-wise relationships as forms of symbiosis. For example, predation is a symbiotic relationship. When one organism benefits and the other is negatively affected, as in parasitism and predation, it is as much symbiosis as when both organisms benefit, as in mutualism. These symbiotic relationships provide engaging examples of ecological complexity.

This lesson helps students understand the variety and extent of symbioses by having them conduct literature and Internet searches for different examples. Student presentations include verbal and visual communications to help different types of learners. The post-assessment has a novel format with students cutting and pasting sets of animals into groupings based on their types of symbiotic relationships.
Symbiotic Relationships – Grade Seven

Pre-Assessment:
• Have students complete a simple crossword puzzle in which they read the definition of words related to symbiotic relationships and choose the correct answer from the word bank. Use Attachment A, Pre-Assessment for this exercise.

Scoring Guidelines:
See Attachment B, Pre-Assessment Answers, to assess student work. If students have difficulty, intervention could include simple examples of well-known animals or plants to help students recall and understand the terms.

Post-Assessment:
• Copy Attachment C, Post-Assessment.
• Give each student the two grids from Attachment C. The first grid has 20 examples of animal/animal, animal/plant or plant/plant relationships. Have students cut these out to make twenty cards.
• The second grid has four columns for four types of mutualism. Direct students to glue or tape each card onto the appropriate columns.
• Once the cards are attached to the columns, have students put a +, –, or 0 beside each organism to denote if they benefit, are harmed, or are not affected by the relationship.

Scoring Guidelines:
See Attachment D, Post-Assessment Answers. There are 45 responses required for the post-assessment. Students should be able to answer 35 correctly to indicate an understanding of the material in the lesson. Analyze student responses to see if there are particular categories that need further instruction.

Instructional Procedures:
1. Have students complete the pre-assessment.
2. Have students correct their pre-assessment with another color of pencil or pen. Then have them make color-coded flash cards to help each other learn the words and their meanings.
3. Bring several resources to the class or have the class go to the library together.

Instructional Tip
The Internet has so many sites on each of these relationships that it is best if the teacher or tech director focus students on certain ones. In the children’s section of the library there are many resources for a very rich lesson. Just choose books that have predator, prey, mutualism, parasitism and/or commensalism in the index. Remember that plants, animals and bacteria are involved in different ways in these relationships.

4. Ask students to define "investigate" and "investigation." Let them speak in general terms; but they can give some ideas from a scientific point of view. Record the definitions on the board. The point of this exercise is to clarify what students will do when they investigate a topic.
Symbiotic Relationships – Grade Seven

5. Optional: Hang up a WANTED: ORGANISMS IN A SYMBIOTIC RELATIONSHIP poster.
6. Explain to students that they are going to be investigators who are going to go on a search for organisms in symbiotic relationships.
7. Let students work in groups of two or three for the investigation.
8. Assign groups one of the four categories; predator/prey; mutualism, parasitism and commensalism. You might want to give the students props for playing the role of investigator. For example, you may supply magnifying glasses, detective hats or baseball hats to be worn backwards.
9. Have each partnership or investigative team write a checklist for their category. This will help the teams remember exactly what kinds of relationship characteristics they are looking for.
   For example:  Commensalism
   - Symbiotic relationship
   - Living organisms
   - One organism benefits
   - One organism is unaffected
10. As students begin to find resources that will help them with their investigation, make sure they take careful notes and include the names of the sources, authors and pages. Also make sure that students list the partnerships that they discovered to fit the type of symbiosis that they were assigned.
11. Have the investigative groups and partnerships that are on the same "case" (type of symbiosis) meet together and compare notes. Have students cross-check to make sure that each group does not have all the same examples of the symbiotic relationship. The second check is to make sure the characteristics fit the checklist for their category.
12. Have groups from each category share their findings with the whole class. Again the investigative teams should help each other by listening for errors. If any team does not have something new to add to the case, they should be sent out for more “digging.”
13. In preparation for class presentations, have the students gather pictures from old nature magazines or draw pictures to show how the organisms are living together in the symbiotic relationship.
14. Have the groups present their information to the class. Then display the presentations for reinforcement. Challenge the students to identify any relationships in which neither organism could survive without the other (e.g., mycorrhizal fungus and beech trees, leaf-cutter ants and fungus. These relationships are termed “obligate.”)
15. Have students take the post-assessment.

Differentiated Instructional Support:
Instruction is differentiated according to learner needs to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).
- Challenge students to search for unexpected predator-prey relationships, such as chimpanzees and red colobus monkeys.
Symbiotic Relationships – Grade Seven

- Encourage students to design a word-construction game board which uses vocabulary and organisms related to symbiotic relationships.
- Provide a set of animal photographs or cards for students to match one form of symbiosis.
- Set up a scavenger hunt for the organisms in the symbiotic relationships.
- For vocabulary enhancement, have groups or partners role play the operational definitions of symbiotic relationships. They can name their relationship or have a show-and-guess game.

**Extensions:**
- Have students make wanted posters to display a predator or parasite, or have them identify one organism in a symbiotic relationship and present the other organism as “wanted.”
- Have students write a short story using two of the organisms in a symbiotic relationship as the main characters.
- An interdisciplinary ocean study could include symbiotic relationships in the ocean, literature, economics, topography, ecology and others.
- Have students choreograph a symbiotic relationship; let them choose the music and perform the dance for the class. Alternatively, rewrite the lyrics to a favorite song to teach about symbiotic relationships.

**Homework Options and Home Connections:**
- Have students take a field trip to a zoo, a botanical garden, a science center or a natural history museum to search for symbiotic relationships.
- Suggest that students bring nature magazines or favorite wildlife books to help them investigate.
- Have students take a walk around the neighborhood/community to look for symbiotic relationships.

**Materials and Resources:**
*The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site’s main page, therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time, therefore the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.*

*For the teacher:* Several wildlife journals, animal, plant and ecology books from the school or public library, animal or plant cards, computer life science programs, note cards, markers of four different colors to make identifying bands on flash cards.
Symbiotic Relationships – Grade Seven

For the students: Several wildlife journals, animal, plant and ecology books from the school or public library, animal or plant cards, computer life science programs, note cards, markers of four different colors to make identifying bands on flash cards.

Vocabulary:
- commensalisms
- mutualism
- parasitism
- predation
- predator
- prey
- symbiosis

Technology Connections:
Have students use safe Internet sites to research organisms or populations and how they interact with one another through symbiotic relationships.

Research Connections:

Summarizing and note taking are two of the most powerful skills to help students identify and understand the most important aspects of what they are learning.

Cooperative learning groups have a powerful effect on student learning. This type of grouping includes the following elements:
- Positive interdependence;
- Face-to-face promotive interaction;
- Individual and group accountability;
- Interpersonal and small group skills;
- Group processing.

Setting objectives and providing feedback establishes a direction for learning and a way to monitor progress. This provides focus on learning targets and specific information to allow the student to make needed adjustments during the learning process, resulting in increase student learning.

General Tips:
- The post-assessment should match the discoveries made by the students in the class. Each resource has some of the same partnerships, but some have different and unusual ones.
Symbiotic Relationships – Grade Seven

- The vocabulary in the lesson is new to many of the students at this level. Have them make their own flash cards. They could test each other or their group by flashing the most important words.

**Attachments:**
Attachment A, *Pre-Assessment*
Attachment B, *Pre-Assessment Answers*
Attachment C, *Post-Assessment*
Attachment D, *Post-Assessment Answers*
### Symbiotic Relationships – Grade Seven

#### Attachment A

#### Pre-Assessment

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**Across**

4. An animal that a predator kills and eats
5. An animal that eats another animal
7. A close relationship between two organisms in which both organisms benefit
8. A living thing

**Down**

1. A relationship in which two organisms live together; one benefits while the other is unaffected
2. A group of organisms, all of the same species, that live in the same area
3. A relationship between two organisms in which one is harmed and the other benefits
4. An organism that derives nutrition from a host causing harm to the host
6. Living together

**Word Bank**

commensalism, prey, parasitism, population, organism
symbiosis, predator, mutualism, parasite
Symbiotic Relationships – Grade Seven

Attachment B
Pre-Assessment Answers

<table>
<thead>
<tr>
<th>Across</th>
<th>Down</th>
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<tbody>
<tr>
<td>4. An animal that a predator kills and eats</td>
<td>1. A relationship in which two organisms live together; one benefits while the other is unaffected</td>
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<td>3. A relationship between two organisms in which one is harmed and the other benefits</td>
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<td>8. A living thing</td>
<td>4. An organism that derives nutrition from a host causing harm to the host</td>
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<td>6. Living together</td>
<td>5. A relationship in which two organisms live together; one benefits while the other is unaffected</td>
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</tbody>
</table>

| Word commensalism, prey, parasitism, population, organism |
| Bank symbiosis, predator, mutualism, parasite |
Symbiotic Relationships – Grade Seven

Attachment C
Post-Assessment

**Symbiotic Relationships**
Directions for completing the assessment: Read the relationships on each card. Paste it on the sheet under one of the symbiotic relationships: Predator-Prey, Parasitism, Mutualism or Commensalism. On each card put a plus sign next to the name of the species if it is positively affected by the relationship, put a negative sign if the species is negatively affected by the relationship. If the species is neither harmed nor benefited by the relationship, put a 0 next to the name.

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Spanish Moss</th>
<th>Dogs</th>
<th>Squirrels</th>
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<tr>
<td>Human Intestines</td>
<td>Trees</td>
<td>Fleas</td>
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<td>Whales</td>
<td>Butterfly</td>
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<td>Barnacles</td>
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<td>Tawny Owl</td>
<td>Field Digger Wasp</td>
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<td>Rafflesia plant</td>
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<td>Vine</td>
<td>Acacia Trees</td>
<td>Mammal</td>
<td>Orchids</td>
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<td>Human head</td>
<td>Trees</td>
<td>Yucca moth</td>
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<td>Lice</td>
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<td>Commensalism</td>
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Symbiotic Relationships – Grade Seven

Attachment D
Post-Assessment Answers

Commensalism
Spanish Moss +; Trees 0
Squirrels +; Trees 0
Whales 0; Barnacles +
Sharksuckers (remora) +; Sharks 0
Trees 0; Orchids +

Mutualism
Bacteria +; Human intestines +
Butterfly +; Flower +
Ants +; Acacia Tree +
Yucca plant+; Yucca moth +
Figs+; Fig Wasps+
Clown Fish +; Sea Anemone +

Parasitism
Fleas +; Dogs-
Trees-; Mistletoe +
Human -; Lice +
Field Digger Wasp++; Fly –
Tapeworm++; mammal –
Rafflesia plant++; Vine –

Predator/Prey
Tawny Owl +; Mouse –
Venus Fly Trap +; Insect –
Eagle +; Rabbit –