

## Home School Series: 3 - 5

## November: Symbiosis

**Start Up:** (5-10 min) Samples of various fungi, lichens and galls to observe, related posters  
**Lichen Dye bookmark**-Have students initial strips of cotton cloth with a permanent marker and immerse them in a natural dye.

**Welcome/ Introduction:** 1 min. Staff/Volunteer Names  
**Today's Topic-Symbiosis**  
**Question: Why do different species associate with each other?**

**Opener:** 10 min. **Iowa Buddies** (*Project Wild*, below)-  
Give each group of 5 or 6 students one set of symbiotic pair cards.

- Ask a student from each group to deal all cards.
- Each player draws one card from the player on his/her left, then lays down any symbiotic matches.
- Play until someone in the group has no cards left.

Post an enlarged buddy pair chart to help students make matches.

**Background/ Exploration:** 45 min. Ask the students what they know about symbiotic relationships.  
Mention **Competition**, which occurs frequently between species.  
(see *6&Up Plant Interactions*)

Describe the following relationships and discuss with the students:  
**Symbiosis** means different organisms living together in close association.  
This relationship between two species may be helpful to both, neutral for one or both, or harmful to one.

- If it is helpful to both species, it is called **mutualism**.
- If it is neutral to one species, it is **commensalism**.
- If the association between species harms one of them, it is **parasitism**.

**Predators and prey** live in interdependence.

- Predators thin the prey species' population and make it a healthier group.
- The prey provides food for the predator.
- This is a balance of effects, but not a close (dependent) relationship.

Examples: Fox-Rabbit; Hawk-Mouse; Owl-Rodent.

Plant predators/carnivorous plants include pitcher plants, sundews, and venus fly traps.

**Activity:** 15 min. **Iowa Buddies cont':**  
Using one set of cards, give each student a card from the symbiotic pairs.

- ♣ Students match up with their "buddy".
- ♣ Give each pair the background card on their symbiotic relationship to facilitate "research" and answer questions.
- ♣ Student pairs share main points about their buddies' relationship with the group.
- ♣ Reinforce the ideas of commensalisms, mutualism, and parasitism by discussing further.
- ♣ Ask the students to think of more examples of symbiosis found in Iowa (below).

Explain the following examples of symbiosis to students:

**Lichens (Mutualism)**-A symbiotic association of a certain alga and a certain fungi.

- There are many different combinations, which form many lichens.
- The alga can survive without the fungus, but not the fungus without the alga.
- The fungus absorbs water and minerals, and shelters the alga, the alga makes carbs from sunlight.
- Lichens thrive in clean, unpolluted air (a pollution indicator).
- They are pioneer species, colonizing bare soil and rock, tree trunks, and logs.
- Lichens can be crustose (like paint), foliose (2-D leafy shapes), or fruticose (3-D and branched).
- Some are very brightly colored.
- There are some antibiotics made from lichens.

**Mycorrhizae (Mutualism)**-Many (all?) plants have fungal threads associated with them, which makes it easier to absorb nutrients due to the increased surface/volume ratio.

- ♣ The fungus absorbs the food made by the plants (starches, sugars) in return.
- ♣ Without the fungi helping the plant roots, many forest plants would not do as well, especially pine, birch, and beech trees.
- ♣ Native orchids are very dependent on their mycorrhizae, they don't transplant well.
- ♣ Most prairie plants are also thought to depend on mycorrhizae.

**Galls (Commensalism)**-Out of place bumps or swellings on plants are probably galls.

- Galls can be many shapes, sizes, and colors, e.g. round and wooly, flat and spiny.
- They can be caused by injury, fungi, nematodes (round worms), mites, or insects.
- Galls are found on different parts of the plant: flowers, leaves, stems, bark, or roots.
- Gall formation-An insect lays its eggs in a plant. The larvae that hatches secretes a special chemical that causes an unnatural growth pattern in the plant, a gall.
- A gall is like scar tissue that forms when we get a wound that scabs over.
- Galls form from eggs laid while that part of the plant is growing, usually in spring.
- The gall is the growing larvae's food, water, and shelter, they can pupate over the winter and emerge as adults the following spring.
- Galls usually don't harm the plant.
- The most common gall making insects are certain moths, wasps, and flies.  
Each species causes a differently shaped gall.
- You can keep a gall in a screen cage and try to see what insect comes out.  
It may not be the gall-former, other insects lay their eggs in galls, including those whose larvae eat the gall-former's larvae.
- Humans have used galls as folk remedies, dyes and inks, and food (high starch and sugar content). They have also been used in tannic acid production.

**Prepare to  
go Outside:**  
5 min.

Restroom break.

Bring: Water bottles, hats, jackets, clipboard/clip

**Trail Rules** (see The First Program).

**What we will do/What to look for**-Galls, lichens, and fungus

**Predictions**-How many different kinds of galls will we find?

**OUTDOOR EXPLORATION:** Hike through woods, prairie, etc. Look for evidence of plant interactions: shelf fungus, mushrooms, lichens, galls, predators, parasites, & competition.  
90 min.

**Lichen observation-**

- They grow slowly in direct sunlight, and shrink and swell with changes in moisture.
- The shrinking/swelling wears away bits of rock or bark, and the fungus dissolves minerals from the rock or bark with acids.
- The bits of rock and dead lichen eventually form soil.

Mosses can then begin to colonize the area.

Can you tell whether soil is beginning to form under the lichens?

**Activity:** **Gall Hunt**-Look for different shaped galls on goldenrod, tree leaves, etc.  
800/2000 kinds of American galls are found on oaks.

- ♣ Look on oak, willow, hickory, cottonwood, poplar & cherry trees; blackberry & rose bushes.
- ♣ Have the students try to find holes in the gall from emerged insects.
- ♣ Do they find any large holes from predation of the larva/pupa?
- ♣ Cut open some goldenrod or other galls to find the larva or pupa, and the exit tunnel made by the larvae for its escape in the spring.

Record where the galls were found and their shape (see sheet below).

**Game:** **The Thicket Game** (*Project Wild*)-This game is best played in the fall.  
20 min. Choose an area where the vegetation has died down to avoid nettles and poison ivy.

- The student "IT" (predator) closes his/her eyes until the other students (prey) hide.
- The prey must be able to see part of the predator from their hiding place.
- The predator looks around to see which of the prey students he/she can see without moving.
- The predator then closes his/her eyes again so the unfound prey can creep closer. Repeat.
- The first found student "prey" become predators for the next round.

**Activity:** **Fallen Log Hunt** (*Iowa Supplement to Project Learning Tree*)-Roll a decaying log over  
10-15 min. and look for fungus, lichens, etc. Use the investigation sheet if you wish.

**Activity:** Students rinse out the dyed bookmarks, squeeze them out, and put in a plastic bag to take  
5 min. home.

**Closing:** Remember when you look at plants and animals that they are connected to other species in  
many ways!

**Send Off:** Goodbye!

**Next Month-Mammals**

**Take Home:**

Parent Outline

Bookmark

At-home activities

**Vocabulary**

Symbiosis, gall, lichen, mutualism, commensalism, parasitism, mycorrhizae, predator, prey

## Background and Activity References for Naturalists and Parents

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- Project Bluestem: A Curriculum on Prairies and Savannas*. 1995. Walnut Creek National Wildlife Refuge and Prairie Learning Center, Prairie City, IA. Pp. 125-126, 268 Plant pounding
- Project Wild: Activity Guide*. 1992. Ed. Staff. Western Regional Environmental Education Council, Inc., Bethesda, MD. Pp. 104-107 Good Buddies-symbiosis activities and card game
- Ranger Rick's Naturescope: Incredible Insects*. 1989. National Wildlife Federation, Washington, D.C. P. 31 Getting into Galls

## Extensions/Alternate Activities/Rainy Day

The goldenrod gall fly (*Eurosta solidaginis*) makes the round balls on goldenrod stems.

The egg is laid on the stem by the female fly.

The egg hatches in June, and the larva bores into the stem.

The saliva of the feeding larva causes a hormonal reaction in the goldenrod, which forms the gall.

The larva makes a tunnel to the outer layer of the gall so it can escape the next spring, then goes back into the center of the gall to over-winter and pupate.

In the spring, the pupa becomes an adult fly, which crawls through the exit tunnel, uses an inflatable bladder on its head to push out, and flies away.

The 5mm long adult gall fly doesn't eat, (it has no teeth) lives only two weeks, and is a clumsy flier.

A Goldenrod Gall Moth also lives in stems of goldenrod, but their galls are more elliptical.

Two different gall wasps lay their eggs on the gall fly larvae, which hatch into larvae and eat it. Woodpeckers, chickadees, beetles, wild turkey, and hummingbirds also eat the gall flies.

Climate, soil, slope, and other growing conditions shape the **plant communities** in various geographic regions. There are countless interactions between the plants and animals in each area.

Most predator-prey games (*Project Wild*) will help illustrate this relationship.

## Supplies:

Pictures of lichens	Log Hunt Sheet	Lichen/natural dyes
Pictures of parasitic plants	Gall Hunt Sheet	White cotton cloth
Samples of lichen	Pocket knife for opening galls	Permanent marker
Magnifiers	IA/Good Buddies pair cards	Clipboards
Woodland Poster	IA/Good Buddies background cards	Pencils

**Advance Preparation:** Make a reference sheet for the gall hunt by copying the ISU Extension information and the oak gall pictures. Page protectors can be used to extend the life of the sheets.

Collect some galls, lichens, and fungi for students to observe before the hike.

Copy the **Iowa Buddies** (or Good Buddies, *Project Wild*) pair cards and background sections onto cardstock and cut apart.

Copy the gall hunt record sheet.

**Lichen Dye-**Collect some commonly found lichens and/or other intensely colored natural materials (pokeberries, galls). Gently heat in water until color comes out. Store in jars in a cool place until the program. Rip/cut some cotton cloth into bookmark-sized strips. Soaking the dyed cloth in a mordant (alum and water, canning salt & water) first should help keep the color longer.

## Iowa “Good Buddies”:

<u>Animals/Plants</u>	<u>Relationship</u>	<u>Notes</u>
Cowbird/Bison	Commensalism	Insects are stirred up by the bison walking through the grass, which makes them easier for the cowbirds to find and eat. The bison are neither harmed nor benefited.
Cowbird/Other Birds	Parasitism	Cowbirds lay their eggs in other birds nests. The hatched cowbird chicks push the host eggs and chicks out, and eat all the food the host parents bring. The host bird species numbers are lowered.
Morel Mushroom/Elm Tree	Mutualism	The morel fungal threads help the tree roots absorb water and minerals. The sugars and starches made by the tree are used by the fungus. When the tree dies, the fungus produces mushrooms to spread its spores around.
Monarch Butterfly/Milkweed	Mutualism	The monarchs drink nectar from and lay their eggs on the milkweed. The hatched larvae eat the milkweed leaves, and acquire their poisonous chemicals. Predators are less likely to eat monarch larvae and adults. Milkweed gets pollinated by the adult monarch.
Skunk/Opossum/Woodchuck	Commensalism	Skunks and Opossum sometimes live in burrows dug by Woodchucks. They gain a home, the Woodchucks aren't helped or harmed.
Mosquito/Human	Parasitism	Mosquitoes bite and suck blood from humans. They get nutrition for laying eggs from the blood. Humans get no benefit, and a nasty itchy spot as well.
Wild Grape/Ash Tree	Commensalism	The grape vine grows up the tree trunk, getting more sunlight and space. The tree is neither helped nor harmed.
Oak Tree/Gall Insect	Commensalism	The insect lays its egg in the tree leaf or branch, causing a lump to form. The insect larvae gets shelter and food. The tree is not harmed or helped.
West Nile Virus/Crows	Parasitism	The virus infects the crows, weakening or killing them. The crows aren't helped.

**Iowa Buddies Additional Iowa Symbiotic pairs:**

Freshwater Mussel Larvae/Fish	Parasitism
Showy Orchid/Mycorrhizae (root fungus)	Mutualism
White Oak/Bark Fungus	Parasitism
Choke Cherry/Black Knot Gall Fungus	Parasitism
Prairie Legume/Nitrogen-Fixing Bacteria	Mutualism
Dodder/Host Plants	Parasitism
Indian Pipe/Root Fungus	Mutualism
Broomrape/Corn or Alfalfa	Parasite
Skunk Cabbage/Flies	Mutualism
Human digestive system/bacteria	Mutualism
Male songbird/Male songbird	Competition



