Plants and Their Defense Mechanisms
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Unlike animals, plants cannot move to avoid predators. They can’t run away or hide from the wide array of mammals, birds, and insects that want to eat them. As a result, they have evolved ways to protect themselves from being eaten. Biologists call these adaptations “defense mechanisms.”

Plant defense mechanisms can be divided into two types: structural and chemical. A structural defense mechanism is simply part of the plant’s form. Chemical defense mechanisms are more complex adaptations and include the production of chemical compounds and toxins. Chemicals may just make the plant taste foul to the animal, or even better from the plant’s perspective, it may make digestion difficult, alter animal behavior and activity, or even cause death.

Have you ever noticed any of these adaptations while looking at plants on a hike at your local conservation area? They are everywhere around you. There are approximately 950 native plants that call McHenry County home, along with another 250 non-native plants. At the Conservation District, we are fortunate to have sites with a rich flora, and with this diversity comes an assortment of defense mechanisms.

Thorns, spines, and prickles are all types of structural adaptations. They occur on the leaves or stems of the plant, and are painful to any herbivore that tries to ingest the plant. The herbivore may tolerate the presence of these structures for a few bites, but after a while, will move on to something more edible. Hawthorns (Crataegus spp.) are small trees that exhibit stout thorns, while black raspberry (Rubus occidentalis) and pasture rose (Rosa carolina) have coarse prickles.

Some plants have structural and chemical defenses working together. Tall nettle (Urtica procera) and other species in the nettle plant family (Urticaceae) have stinging hairs. With this particular species, thin hollow hairs are present on the lower leaf surfaces and stems. Upon contact, the tip of the hair breaks off as it enters the skin. This releases chemicals including histamine and formic acid, which cause a burning sensation followed by a rash.

Another example of the two types of defenses working together is in the round-leaved sundew (Drosera rotundifolia). This conservative species of bogs has its leaves covered in long hairs. At the tip of each hair are glands that secrete a sticky substance called mucilage, which is sweet and actually attracts small predators. Once an insect lands on the leaf, it is likely trapped for good, getting tangled up in the mucilage. It most often dies from the exhaustion of trying to escape. The sundew doesn’t stop with the death of its predator; it actually eats the insect! The hairs and leaf slowly wrap around the prey and release enzymes that start to digest it. This provides much-needed nutrition to a plant that typically lives in a nutrient poor environment.

Probably the most common example of a chemical defense is the milky sap of milkweeds (Asclepias spp.). The sap contains latex (natural rubber) and toxic cardiac glycosides, both of which are detrimental to large mammals and birds. Interestingly, the caterpillars of the monarch butterfly have counter adapted to the chemical composition of the latex and toxins. Rather than
being harmed, they store the toxin, which gives the caterpillars and resulting monarch butterflies protection from their own predators.

Jack-in-the-pulpit (*Arisaema triphyllum*) is also very rarely eaten by mammals. All parts of this favorite woodland species, known for its unique flower head structure and bright red berries in the fall, are toxic. It contains the chemical compound calcium oxalate, which occurs as needle-shaped crystals. Ingestion results in a painful burning sensation to the mouth, tongue, throat and digestive system. In some cases, it can cause a severe allergic reaction leading to anaphylactic shock, in which the mouth and throat swell and produce a loss of breathing.

Allelopathy is another chemical defense mechanism, in which a plant produces chemicals to affect the growth of nearby competing plants. This is actually quite common, especially with non-native, invasive species and contributes to their success in dominating a habitat. Garlic mustard (*Alliaria petiolata*), for instance, releases chemicals into the soil that interfere with soil fungi that are, in turn, essential to the growth of native trees and plants. How many of you have ever been warned not to grow a tomato plant under the common and native black walnut tree (*Juglans nigra*)? The reason is that walnut produces the allelochemical juglone, a growth inhibitor released by the roots, leaves, husks, nuts, and bark. This chemical slows the growth and reproduction of competing plants. Juglone is also very toxic to some insects, reducing the threat of insect damage to the plant.

These are just a few examples of structural and chemical defense mechanisms in the native plants of McHenry County. Many more variations are out there, something to be expected given the 1,200 species of plants that live around us. These adaptations are vital to the growth, reproduction, and survival of these species ultimately helping to preserve the botanical diversity of our surroundings.

A: Common milkweed (*Asclepias syriaca*); B: Garlic mustard (*Alliaria petiolata*); C: Nuts and leaves; D: leaves and catkins of the common and native black walnut tree (*Juglans nigra*)