Think plants are just a bunch of wallflowers? Think again: They network, communicate, and even care for their families.

**ESSENTIAL QUESTION:** How do plants interact with each other and their environments?

**SENSES BEINGS**

Appel first became interested in whether plants could hear while talking with her colleague Rex Cocroft, who studies insect communication. He complained that the noisy chomping of a caterpillar was drowning out other bug sounds he wanted to record. “It was an ‘Aha!’ moment for us,” she says. They wondered if plants could also hear and respond to the chewing.

To find out, the scientists recorded vibrations of a caterpillar eating leaves and played the recording back to some plants but not others. Plants exposed to the munching sound produced more chemical defenses, substances that taste bad to bugs. Many plants use these chemicals to avoid being eaten. Other sounds, such as wind blowing, had no effect. “Plants respond selectively to sounds that are important to them,” says Appel. They ignore sounds that don’t pose a threat.

Plants are able to sense other things besides sound. “They don’t have noses or tongues, but they’re very tuned in to chemicals in their environment,” says Rick Karban, an ecologist at the University of California, Davis. “And they don’t have eyes, but they’re very sensitive to light.” Plant tissues contain photoreceptors. These molecules allow them to tell how bright the light is and which direction it’s coming from.

**PREPARE FOR ATTACK!**

We may not think of plants as chatty, but they communicate in a complex language of chemicals. Karban studies what happens when hungry insects injure sagebrush plants. “When a plant is attacked, it emits chemical cues into the air,” he says. “Its neighbors detect those cues and increase their defenses.”

Plants can prepare for an onslaught of bugs with not only chemical

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Through the fungus, plants can transfer chemicals to one another from their roots.

**NETWORK LINKS**

Strands of fungus link the roots of different plants to one another.

**ROOT CONNECTION**

Through the fungus, plants can transfer chemicals to one another from their roots.
defenses but physical ones as well. Their tissue becomes tougher, making it harder to chew. And they can grow stiff hairs that thwart insects.

Some plants can even tell what kind of insect is eating them based on chemicals in the bugs’ saliva. Depending on the attacker, plants release different alarm signals and adjust their defenses.

**THE WOOD WIDE WEB**

Trees may seem like the most solitary and unchanging plants of all. But they busily interact with their environment and their neighbors.

Scientists in Austria and Finland recently used lasers to map the position of tree branches (see Tired Trees?, below). At night, branches drooped, as if the trees were sleeping. At sunrise, the branches perked up again as trees angled their leaves to catch sunlight.

Some of trees’ most interesting behavior happens underground. In the soil, tree roots partner with fungi called mycorrhizae (my-koh-rye-zee). The fungi provide nutrients, like nitrogen (N) and phosphorus (P), to trees in exchange for chemicals containing carbon (C).

Strands of fungi form a dense network beneath the forest floor, which researchers have nicknamed the Wood Wide Web. It provides a physical connection linking trees and other plants to one another. “It’s a highway for all kinds of chemicals,” says Suzanne Simard, an ecologist at the University of British Columbia in Canada.

Trees can use the network to share nutrients or water with neighbors in need. Species whose roots extend deep into the ground, like Douglas firs, collect water for shallow-rooted companions during droughts. In exchange, the firs may receive nutrients or compounds that protect against disease.

The biggest, oldest trees have the most network connections. Simard calls them “mother trees.” They help youngsters grow, and they take special care of their families. Networked trees can chemically identify relatives, such as siblings or offspring. They send those seedlings extra food, nutrients, and water. If a tree in distress signals for help, nutrients or defensive chemicals arrive within hours.

“We’ve barely scratched the surface of the language of trees,” says Simard. “Their conversations and exchanges are so complex.”

**PLANT SMARTS?**

Some researchers even think plants may be intelligent, in a way. “They’re collecting information about their environment and using it to make decisions that benefit them,” says Karban. “If that process counts as intelligence, there’s more and more evidence that plants are exhibiting it.”

Some studies even suggest that plants may have a kind of memory of past events—such as bug attacks or cold snaps—that helps prepare them for future challenges. Plant scientists are still debating whether it makes sense to use terms like memory and intelligence for organisms without a brain. But there’s one thing they agree on, says Appel: “Don’t underestimate plants!”

—Jennifer Barone

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**TREE TALK: Suzanne Simard studies chemical communication among trees.**