What do ants and your brain have in common?

Each of the brain’s 86 billion neurons can be connected to many thousands of others. When a neuron fires, it sends a signal to nearby neurons that changes the probability that they will also fire. Some neurons are excitatory, and increase the chances that other neurons will fire. Others are inhibitory, and reduce this chance.

“The only way the upstream neuron knows that the second neuron fired is that it produces a feedback spike. This helps the synapse make the decision to get stronger,” says Dmitri Chklovskii, a neuroscientist at the Howard Hughes Medical Institute. Feedback is where the similarity with ants begins. “Feedback loops are everywhere on every level. They allow the system to realize that what it used to be doing isn’t working any more, and to try something new.”

Both ants and brains actually rely on two types of feedback, held in a delicate balance: negative (or inhibitory) feedback, and positive (or excitatory) feedback. “Negative feedback tends to cause stability. Positive feedback tends to cause runaway behavior,” said Tomer Czaczkes, an ant biologist at the University of Regensburg in Germany. “These two simple rules make something very powerful.”

The foraging response to food is an example of a positive feedback loop, and familiar to anyone who has had a picnic ruined by a line of ants marching in single file toward their meal. But knowing when not to leave the nest and risk predation and dehydration may be just as important as knowing when to take advantage of a windfall of seeds.