

Ant Foraging

When an ant finds a piece of food, it carries the food back to its nest, dropping a chemical as it moves. The chemical is most concentrated along the exact path, and is less prevalent away from the path. Also, the chemical dissipates with time. When other ants of the same colony wander close enough to the chemical, they notice the chemical and move to higher concentrations of the chemical. This motion increases the likelihood a new ant will locate the food source and take some more back to the nest. As more ants carry food to their nest, they drop more of the chemical and reinforce the trail. Ants make their way back to their nest through navigation via visual landmarks, and step counting. Though each ant follows a set of simple rules, the colonies act in a unified and a sophisticated way.



Problem

You are an entomologist, and you want to know which is more important for the ant, the sensitivity with which it detects the chemical, or producing a chemical that dissipates more slowly. Model two colonies of ants foraging for the same food sources. The two colonies of ants will differ in that one colony will be very good sniffers, and the other colony will produce longer-lasting chemical trails. Your task is to determine which is better? Or rather, how does the ability to detect even faint chemical trails compare to the ability to leave longer-lasting trails? How does this affect their ability to get more of the available food?