



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Richard Hoffmann	Project Number J2205
Project Title Pheromone-Based Ant Navigation	
<p style="text-align: center;">Abstract</p> <p>Objectives Ant pheromones are the chemical scents that ants release from glands all over their bodies to communicate with other ants. With the use of pheromones, ants can give directions to a location, signal if there is danger towards the colony, mark their territory, recognize nestmates, or attract mates. The question being answered is how ants use pheromones to navigate trails, if the amount of pheromones affect the frequency of ants crossing a certain trail, and if there is any directional information in the pheromones. My hypothesis was that ants would be more likely to follow the path with more pheromones and that there is some directional information in the pheromones.</p> <p>Methods A Y-shaped trail was built with swappable sections on it. 3 different kinds of swappable sections were placed on trail. One with lots of pheromone, one with little pheromones, one with no pheromones. 5 trials where different sections of the trails were swapped around and switched with other kinds of trails. A camera recorded the ants behavior.</p> <p>Results On the trail with the strongest amount of pheromones, there were about 9.5 ants crossing the trail each minute. On the trail with the weakest amount of pheromones, there were about 0.3 ants crossing the trail per minute. This shows that the more pheromones there are on a trail, the higher the number of ants crossing the trail. Additionally, there was no significant dependence on the direction of the pheromone trail.</p> <p>Conclusions The goal of this experiment was to find out if ants would be more likely to follow a trail with more pheromones and if the direction of a trail affects the ants decisions. The more pheromones on a trail, the higher the frequency was of ants crossing the trail per minute. Moreover, the direction of the pheromone trail did not have a significant influence on the frequency of ants crossing trails per minute. The differences in frequency between the trail directions was small compared to the change in frequency between the strong and weak pheromone trail condition. In the experiment, the independent variable was the amount of pheromones on a trail and the dependent variable was the frequency of ants crossing a trail in a minute. Two new questions arose from the experiment: does terrain affect ant behavior? How does an ant behave when the trail it is on turns while its walking on it? All in all, this experiment demonstrates that ants are more likely to follow a path with more pheromones and there is no directional information in the pheromone trails.</p>	
Summary Statement I discovered that pheromones on trails do not provide ants with any directional information, but ants follow the path with the most pheromones.	
Help Received I came with the idea of my experiment. I also designed and built the system in which the ants traveled across and analyzed the results. I received some advice from my dad, Heiko Hoffmann.	