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Two Flies With One Pesticide

Examining the brains of the hoverfly pollinator *Eristalis tenax* to understand the interplay between sight and smell and how anthropomorphic insecticides harms these agriculturally, ecologically and economically important insects through off-target action.

Anthropomorphic climate change has been central in the public eye for many years and with that we have seen an increase in interest and funding towards the study of our environment and different ecological systems. Through these studies it has become clear that the systems upholding balance in nature are much more complicated than we once believed and that we yet to this day do not have a whole picture of what makes or breaks ecosystems. One key component in most ecosystems are believed to be insects. The small essential workers perform tasks such as disposing and breaking down organic matter to recirculate nutrients, serving as food for many other animals and serving as pollinators that aid plants to proliferate and produce much of the food we humans consume.

We have chosen to study one such beneficial insect, the hoverfly pollinator *Eristalis tenax* and to examine the effects of sub-lethal doses of pesticides on these essential insects. To study these effects we recorded the spike firing rate of individual neurons within the brains of living insects and observed the changes that occurred when they were exposed to a common pesticide agent known as Imidacloprid. On top of that we wanted to investigate a phenomena that had been observed in other flies that revealed odors to be capable of amplifying the visual perception of flies. Studying the effects of pesticides on the flies we initially did not see a significant change between before or after pesticide treatment. However, further dissection of the data revealed that a staggering 80% of the neurons that were exposed to pesticides presented a significant change in firing rate despite the population average change being insignificant. This revealed to us that the neurons we recorded may have wildly different ways of responding to pesticides with some having increased activity and others a decrease. Odors did also not reveal a significant change in the population averages when comparing before and after presentation of odors. Examining the individual neurons we were however unable to detect a large number of individual neurons displaying significant effect, only observing a significant change in 10% of the neurons. Insects have not originated to serve human interest and thus there exists groups of insects that are deemed harmful to the life of humans and animals, harmful to our food supply and harmful to our economy. Humans have, in response, designed mechanisms to control these pest insects through pesticides but have in the process inadvertently caused harm to the insects that are not harmful to us and that we so rely upon. To avoid serious harm due to these off target effects legislators and people using pesticides need pay serious attention to the science that has been done before a new pesticide is permitted for use. All too often it is only the dose required to achieve a lethal effect which is of concern, but what happens to the insects that receive a dose, yet do not die instantly, is of equal if not even more importance.