CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

36734

Project Title

In Search of a Better Fever Drug: Effect of Heat-Sensing Mutations on Behavioral Fevering in Drosophila melanogaster

Abstract

Objectives/Goals

Fevering occurs when chemicals produced by the body interfere with the proteins in the brain which regulate body temperature. Current fever-reducing drugs work by preventing formation of these chemicals - however, they are also important in digestive homeostasis, which is why heavy users of such drugs are prone to getting peptic ulcers. A better approach to prevent fevering would be to directly inhibit these thermoregulatory proteins. I investigated fevering behavior in Drosophila melanogaster to find out whether specific proteins are necessary for fevering. My aim was to identify protein targets for a more fever-specific drug.

Methods/Materials

Flies without the heat-sensing proteins TRPA1, pyx, and GR28B.D were obtained from various labs, along with wild-type flies as controls. Flies were infected with the fungus Beauveria bassiana. Each sample of flies was then put into a self-made enclosure sequentially. The enclosure included a circular heat gradient (26-31 degC). Images of flies sitting on the gradient were taken every 15 minutes for one day. These images were analyzed using open-source government ImageJ software to record the number of flies on the gradient and their locations, which were translated into the temperature selected.

Results

On average, infected, wild-type Drosophila preferred a higher temperature than healthy wild-type flies (P=0.0074). GR28B.D-mutant flies selected temperatures similar to the wild-type flies. Infected TRPA1-mutants preferred a similar (slightly higher) temperature to infected wild-type flies (P=0.116). However, infected pyx-mutant flies chose much lower temperatures than infected wild-type flies (P=0.0001).

Conclusions/Discussion

Flies were shown to get a fever by selecting higher temperatures when infected, making them a good model organism for fever research. Additionally, infected TRPA1-mutant flies preferred a slightly higher temperature than infected wild-type flies, indicating that a drug limiting TRPA1 function would not significantly affect an infected fly's fever. However, infected pyx-mutants selected much lower temperatures than infected wild-type flies, meaning that the flies did not fever. Thus, the pyx protein in flies does in fact modulate fevering in Drosophila. Therefore, human brain proteins should be studied to determine which proteins play a similarly important role, and whether they could be targets for a future fever drug.

Summary Statement

In the first experiment to date about the fevering reaction in Drosophila, I demonstrated that infected flies do select higher temperatures than healthy flies and identified that the heat-sensing protein pyx was crucial to fevering.

Help Received

Mentor/teacher Renee Fallon. Drosophila flies from Dr. David Schneider (Stanford), Dr. Lina Ni (Brandeis), and Dr. Craig Montell (UCSB), B. bassiana fungus sample from Laverlam Intl. Discussed parts of project with Dr. Schneider and Dr. Nina Jenkins (Penn State).