CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

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Project Number
S0499

Project Title
Induction of Drosophila melanogaster Immune Response by a Parasitic Nematode and Its Bacterial Symbiont

Abstract

Objectives/Goals
H. bacteriophora, P. luminescens, and Drosophila constitute a useful system for studying bacterial-nematode symbiosis, bacterial-insect pathogenesis, and nematode-insect parasitism. Because of close correlation between human and Drosophila immune response elements, we may use Drosophila as a model organism to shed light on the mechanisms of immune system activation and suppression in humans. We also hope to provide information with implications in human diseases caused by parasitic nematodes, such as lymphatic filariasis.

Methods/Materials
We have investigated the induction of the insect immune system by assaying GFP and lacZ reporters for diptericin, cecropin, and metchnikowin, genes known to be induced in antimicrobial immune response.

Results
This research has shown that H. bacteriophora is capable of infecting Drosophila melanogaster. By infecting fly strains with bacteria, we have determined that P. luminescens does not induce cecropin response whereas E. coli does, suggesting that P. luminescens is able to either evade or suppress Drosophila immune response.

Conclusions/Discussion
Our research shows that P. luminescens is capable of suppressing or evading the cecropin antimicrobial peptide of the Drosophila immune response. We hypothesize this lack of activation occurs either because upstream receptors in the Toll pathway cannot detect P. luminescens or because P. luminescens is able to suppress elements in the Toll pathway upstream of Dif. With this result, in conjunction with results on antimicrobial elements that P. luminescens does activate, we have established a model system with H. bacteriophora, P. luminescens and Drosophila. Our model has applications in immunology, parasitology, and microbiology studies. We can apply our results to studies of bacterial infection, because of the many homologous elements that exist between Drosophila and mammalian immune response. Additionally, our model may be used to investigate diseases such as lymphatic filariasis that are caused by human parasitic nematodes. It is possible that our model may be applied to complex systems of immune suppression, such as the parasitic Venturia wasps and human immunodeficiency virus.

Summary Statement
By infecting fruit flies with a parasitic nematode and its symbiotic bacterium, I established that the bacterium evades or suppresses the flies immune response; this system can be used as a model for human immune response.

Help Received
Used lab equipment at Caltech under the supervision of Dr. Paul Sternberg and Dr. Takao Inoue; Dr. David Schneider and Dr. Dan Tracey provided fly strains.