CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
J0419

Project Title
Seeking a Cure for Hay Fever: A Study of Inhibitors of the Histidine Decarboxylase Reaction

Abstract

Objectives/Goals
Human mast cells produce histidine decarboxylase, which catalyzes the histidine decarboxylation reaction, converting histidine to histamine. This reaction causes histamine to attach to receptors in the immune system, resulting in allergy symptoms. Current treatments for hay fever include antihistamines, a class of chemicals that prevent histamine from attaching to these receptors. However, the effectiveness of these treatments decreases over time. Alternative treatments that address the allergic response in a completely different manner could possibly be more effective. One such treatment could be devised by inhibiting the histidine decarboxylation reaction. The objective of this project was to determine the optimal inhibitors of the histidine decarboxylation reaction. It was hypothesized that the inhibitor epigallocatechin-3-gallate, a member of the catechin group, would be the most effective in inhibiting the histidine decarboxylation reaction. The catechins are a group of chemicals known to inhibit the histidine decarboxylation reaction, and epigallocatechin-3-gallate is known to be the strongest inhibitor of its group.

Methods/Materials
To carry out a simulation of the histidine decarboxylation reaction, the catalyst bacteria Escherichia coli was used to release histidine decarboxylase into a Petri dish. The decarboxylase reacted with the histidine to produce histamine. To measure the reaction rate, pH was used, since histidine is slightly more acidic than histamine. As a result, a strong inhibitor would result in a low pH, while a weak inhibitor would show a high pH.

Results
The control group consistently showed pH readings of 9.5. The epigallocatechin-3-gallate showed pH ranging from 8 to 8.5, a pH change from the control of 1 to 1.5. Epigallocatechin had pH of 8.5, a pH change from the control of 1. The other two inhibitors, epicatechin and epicatechin-3-gallate consistently showed pH readings of 9, a mere pH change from the control of 0.5.

Conclusions/Discussion
Epigallocatechin-3-gallate supported the hypothesis by being the most successful in inhibiting the reaction. Epigallocatechin was a close second, while the other inhibitors, epicatechin and epicatechin-3-gallate demonstrated a weaker inhibition of the reaction. The next step is to measure the effectiveness of a combination of epigallocatechin-3-gallate and epigallocatechin in inhibiting the histidine decarboxylation reaction.

Summary Statement
This project found a possible alternative treatment to hay fever by determining the optimal inhibitor to the histidine decarboxylation reaction.

Help Received
Used school's laboratory equipment; Mentor provided feedback on board and abstract