CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
S0412

Project Title
Regulation of Plant Growth by Two Antagonistic Transcription Factors in the Brassinosteroid Signal Transduction Pathway

Abstract

Objectives/Goals
The objective was to gain a better understanding of how brassinosteroids (BRs), a class of plant hormones, regulated plant growth in Arabidopsis thaliana through a particular pair of transcription factors, named PRE1 and AtIBH1.

Methods/Materials
Transgenic Arabidopsis thaliana plants with PRE1 over-expression (PRE1-Ox) or AtIBH1 over-expression (AtIBH1-Ox) were grown to visualize the effects each transcription factor had on overall plant phenotype. A F1 cross between a PRE1-Ox plant and AtIBH1-Ox plant was performed to determine how PRE1 and AtIBH1 interacted with each other to produce changes in plant growth. Tests were conducted to measure the effect of different wavelengths of light on stem length in PRE1-Ox and AtIBH1-Ox seedlings. AtIBH1-Ox seedlings were additionally subjected to plant hormone treatments to determine whether other plant hormones besides BR could influence protein level over time.

Results
PRE1-Ox plants grew larger than wild-type plants and AtIBH1-Ox plants grew smaller than wild-type plants. The F1 plant showed robust growth and was physically similar to the PRE1-Ox plant. Red light and blue light exposure caused reduced growth in AtIBH1-Ox seedlings while PRE1-Ox seedling growth was relatively unaffected. Several plant hormone treatments showed increasing AtIBH1 protein levels over time.

Conclusions/Discussion
The results indicated that PRE1 and AtIBH1 function antagonistically in plant cell elongation; PRE1 promoted growth, whereas AtIBH1 inhibited it. In addition, the F1 cross showed that PRE1 inhibited AtIBH1 function. AtIBH1 expression could be enhanced by exposing seedlings to certain plant hormones and light. My results concluded that these two antagonistic transcription factors may integrate various signals in regulating plant cell elongation. My research bridges the gap between reception of the plant hormone signal and the plant cell's response to that signal. Understanding the BR signaling pathway can also lead us to more directly regulate plant growth without applying plant hormones, thereby bypassing potential side effects.

Summary Statement
This project aimed to elucidate the functions of two transcription factors within the brassinosteroid signal transduction pathway, as well as understand how plant hormones and light are implemented in the regulation of cell elongation.

Help Received
Mother, Father, and Uncle provided guidance; Used lab equipment and facilities at the Carnegie Institution for Science, Department of Plant Biology, under the supervision of Dr. Mingyi Bai and Professor Zhiyong Wang