2014 REU Poster: Measuring Tryptophan Metabolism Using Analogs of Tryptophan

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Why we use Arabidopsis

- Cheap/easy to maintain
- Self fertile
- Fast life cycle
- Transformable
- 5 chromosomes (diploid)
- Small genome: approx. 26,000

In Arabidopsis, tryptophan is the precursor of several secondary metabolites

- Glucosinolates are a class of defense compound used to protect the plant from insect attack. Those derived from tryptophan (Trp) are called indolic glucosinolates (IGs).
- Camalexin (CAM) is another defense compound produced from Trp and it protects the plant from fungal attack.
- Indole-3-acetic acid (IAA) is a plant growth hormone called auxin.

Measuring Tryptophan Metabolism Using Analogs of Tryptophan

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Introduction

- Secondary metabolites are organic compounds produced through the modification of primary metabolites. Secondary metabolites typically do not play essential roles in growth as primary metabolites do.
- In plant, most secondary metabolites play roles in defense against insects and microbial pathogens.
- Many plant secondary chemicals have important uses for humans. For example, many pharmaceuticals are based on plant chemical structures, and secondary metabolites are widely used for recreation and stimulation.
- Arabidopsis thaliana is a small flowering plant that is widely used as a model organism in plant biology. Arabidopsis is a member of the mustard (Brassicaceae) family, which includes cultivated species such as cabbage and radish.

Indolic glucosinolates made by Arabidopsis

(circled compounds accumulate to measurable quantities)

Hypothesis 1

5-methyl-tryptophan (or 5-methylantranilate) creates a new IG

Hypothesis 2

Mutants with altered endogenous Trp pools to be tested for incorporation of Trp analogs

- Our first hypothesis is that analogs of tryptophan (Trp) can be converted into novel indolic glucosinolates (IGs) in vivo.
- Our second hypothesis is that the ratio of the incorporation of endogenous Trp into IGs compared to Trp analog incorporation into IGs will depend on the size of the endogenous Trp pool.

The ratio of I3M/5MT-I3M is consistent with mutant phenotypes

<1 means a reduced endogenous Trp pool
>1 means an increased endogenous Trp pool

Conclusions

- Analogs of Trp (or precursors) can be incorporated into indolic glucosinolate in vivo.
- The incorporation of the analogs into indole glucosinolate relative to the incorporation of endogenous Trp, reflects the size of the endogenous Trp pool.

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References


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