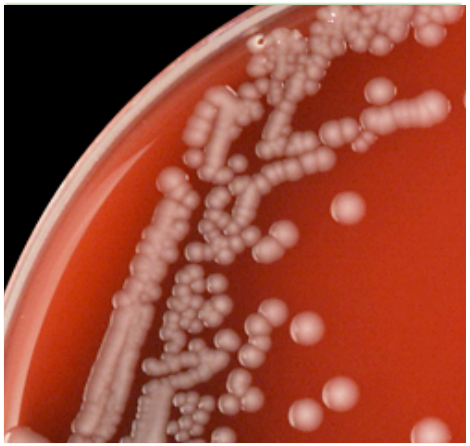
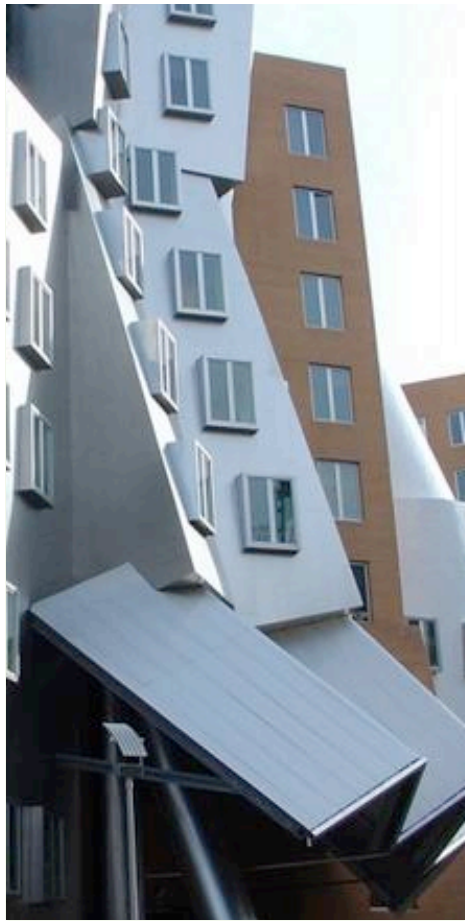




eau d'e coli igem 2006: mit

meet the team

The Undergrads:

Kate Broadbent
Biological Engineering

Andre Green
Biology / Physics

Stephen Payne
Biological Engineering

Veena Venkatachalam
Chemistry / Physics

Boyuan Zhu
Electrical Engineering and Computer Science

The Grad Students:

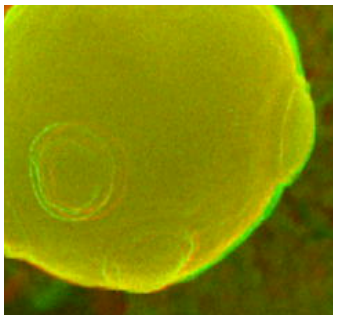
Barry Canton
Austin Che
Jason Kelly
Reshma Shetty
Samantha Sutton

The Faculty:

Drew Endy
Tom Knight

motivations

background

A. thaliana	*O. basilicum*	*A. majus*	*C. breweri*	*S. cerevisiae*
				
JMT	CCMT	BAMT	BSMT	ATF1
jasmine	cinnamon	fresh / floral	wintergreen	banana

background

O. basilicum

CCMT

cinnamon

A. majus

BAMT

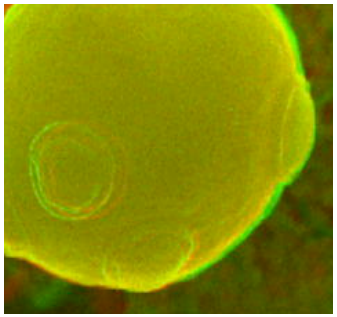
fresh / floral

C. breweri

BSMT

wintergreen

S. cerevisiae



ATF1

banana

background

A. majus

BAMT

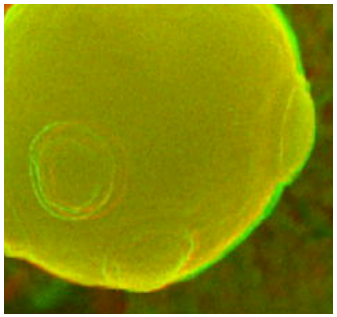
fresh / floral

C. breweri

BSMT

wintergreen

S. cerevisiae



ATF1

banana

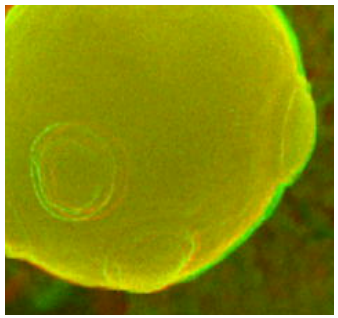
background

C. breweri

BSMT

wintergreen

S. cerevisiae

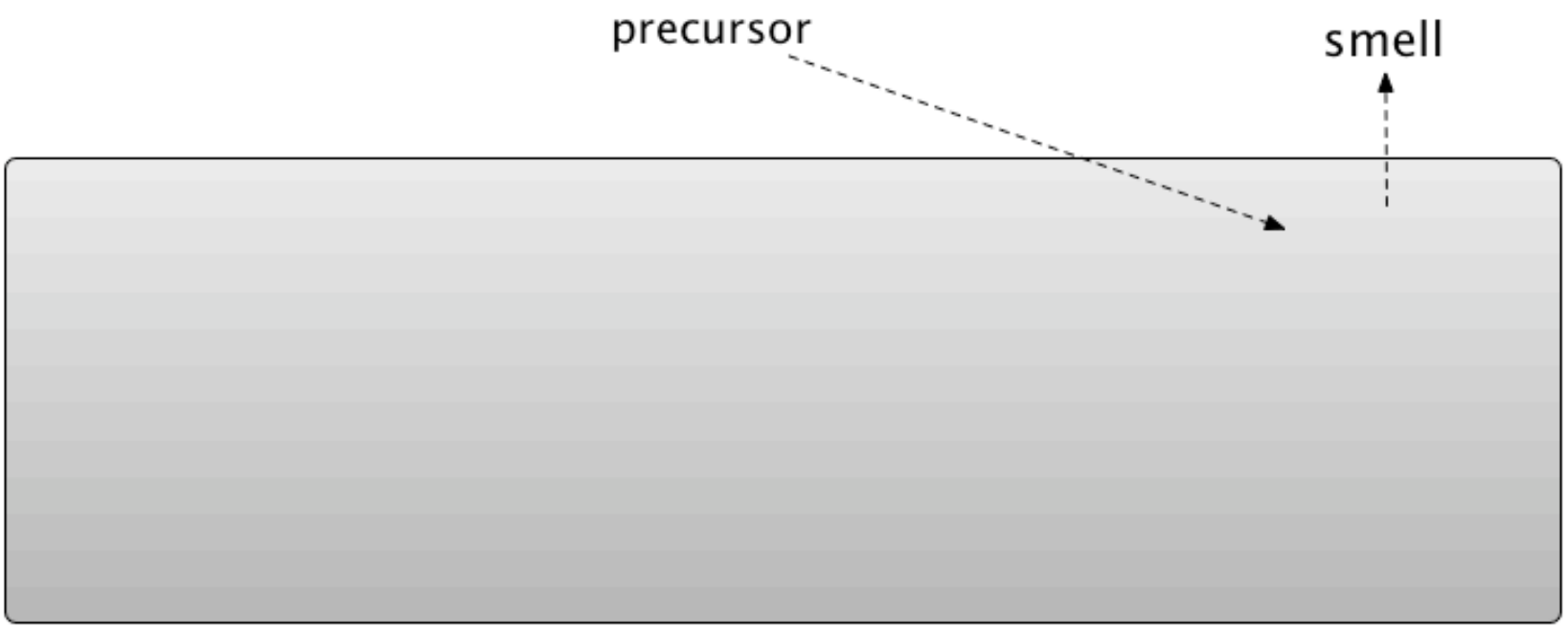


ATF1

banana

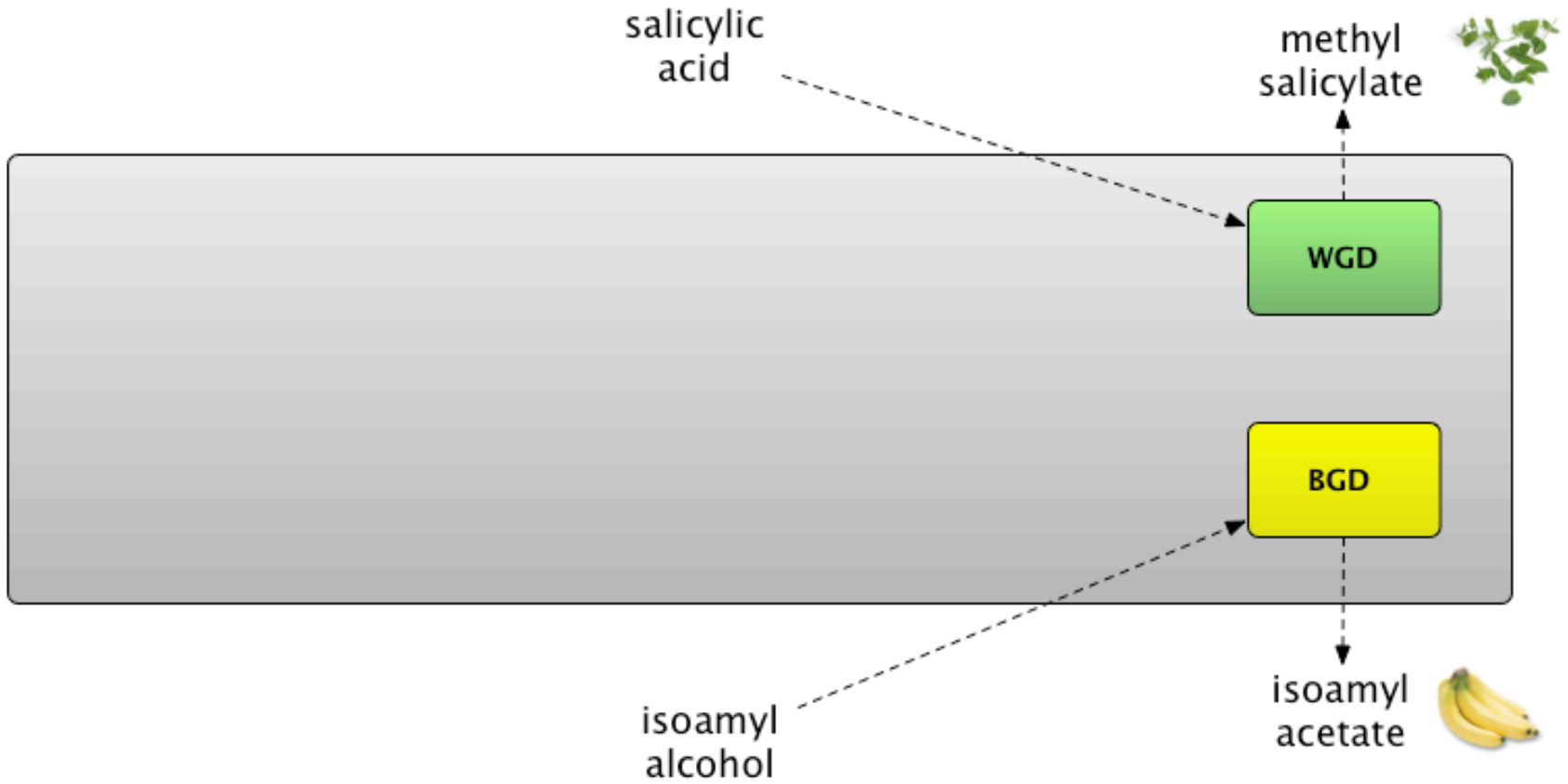
timeline:
initial planning

initial planning • scent production • self-generating scent • production regulation • eliminating indole



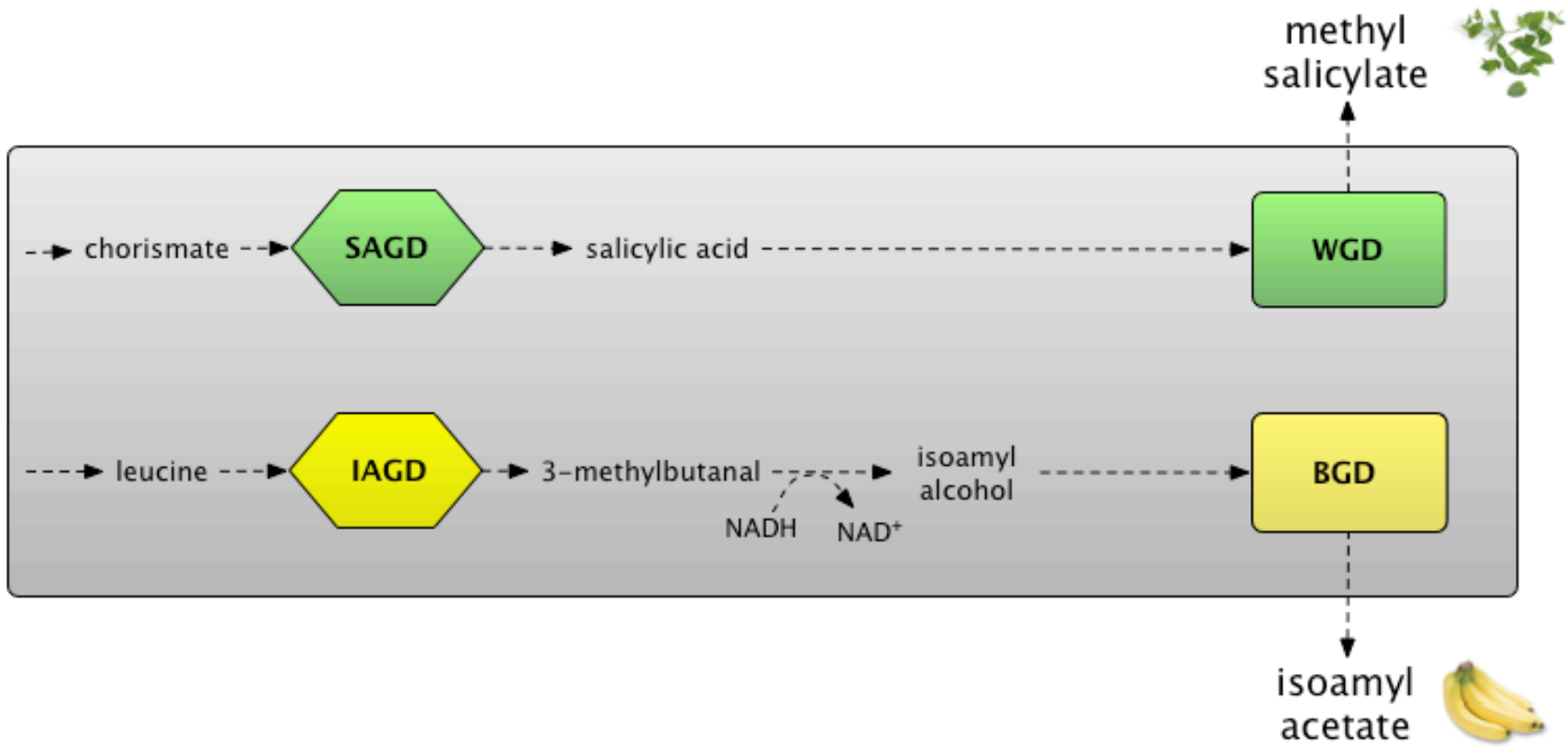
timeline:
scent production

initial planning • **scent production** • self-generating scent • production regulation • eliminating indole



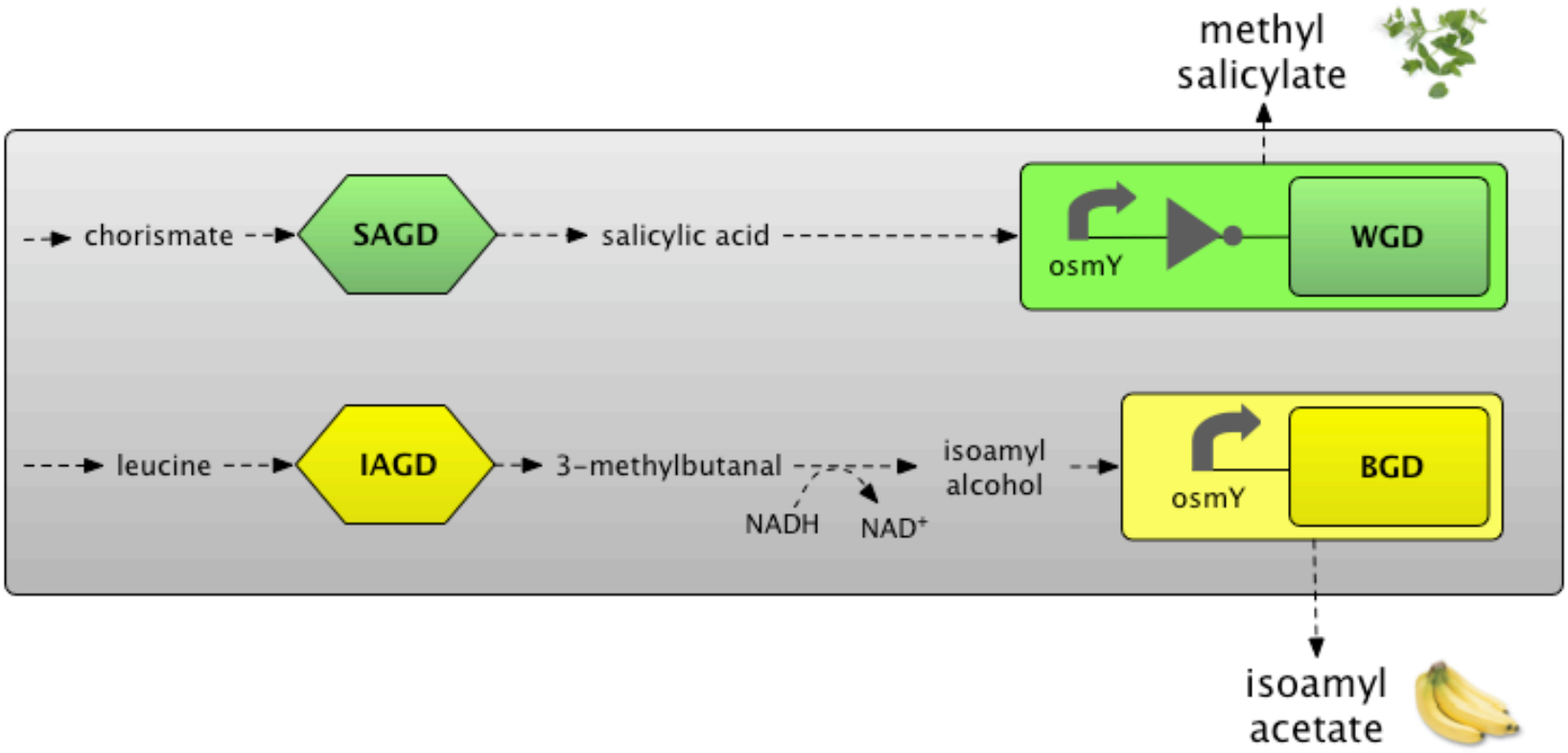
timeline:
self-generating scent

initial planning • scent production • **self-generating scent** • production regulation • eliminating indole



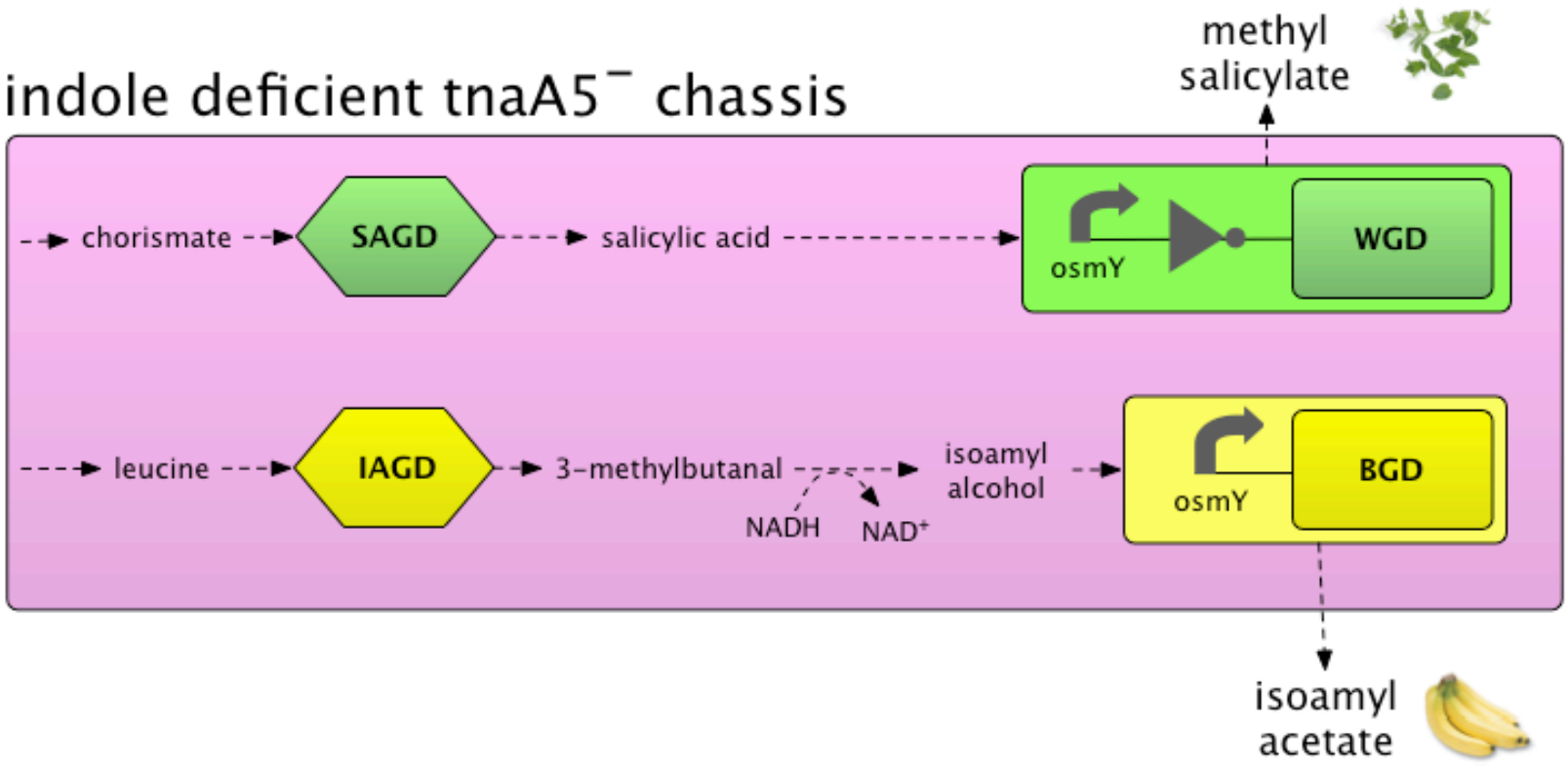
timeline:
production regulation

initial planning • scent production • self-generating scent • **production regulation** • eliminating indole

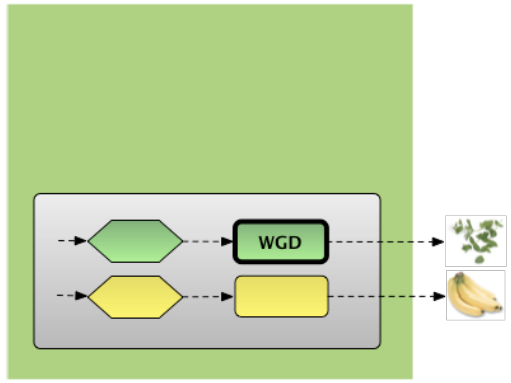


timeline:
indole elimination

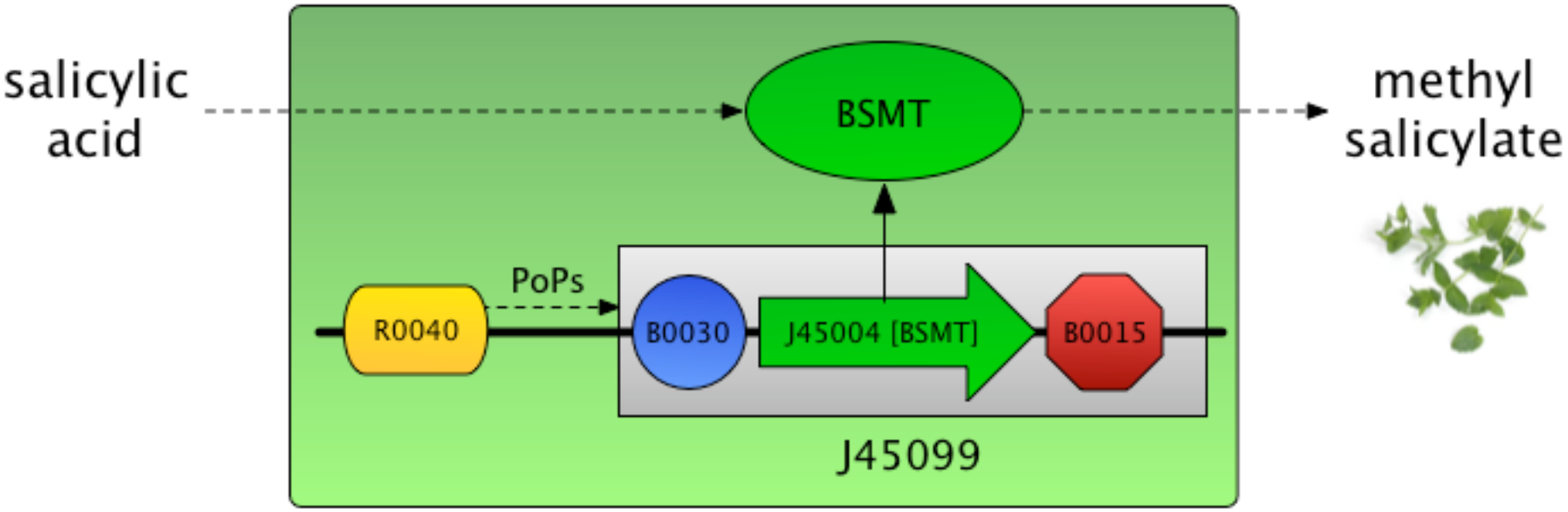
initial planning • scent production • self-generating scent • production regulation • **eliminating indole**



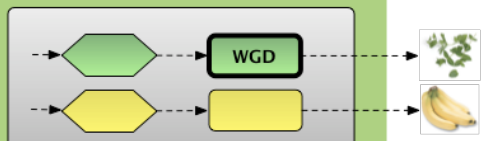
wintergreen generating device



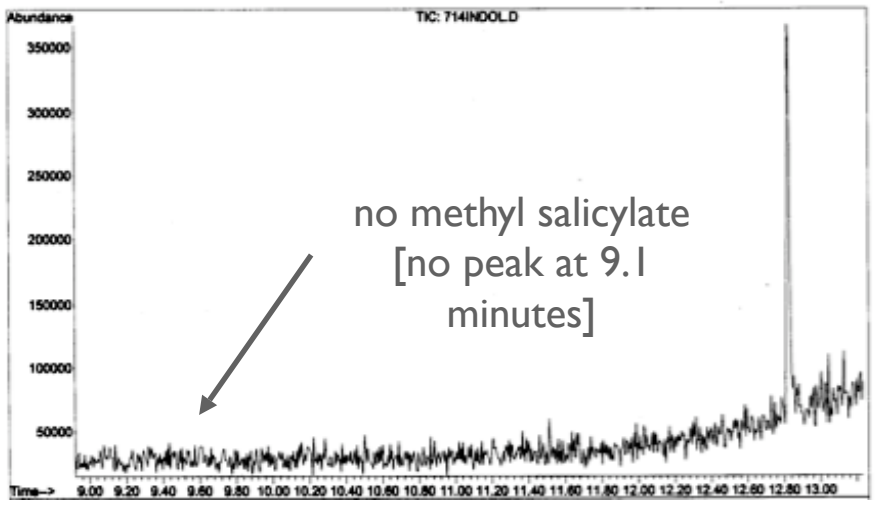
J45100 – Wintergreen Generating Device (WGD)



device generates wintergreen

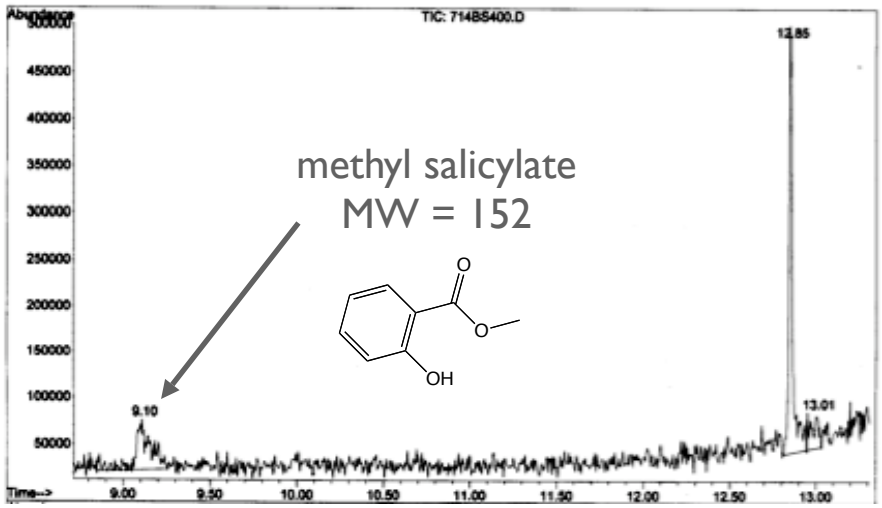


E. coli



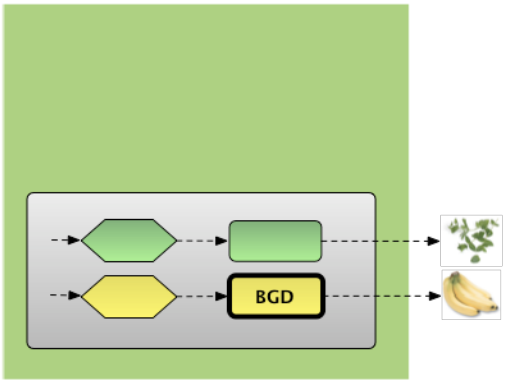
no methyl salicylate [no peak at 9.1 minutes]

E. coli + precursor (SA) + WGD

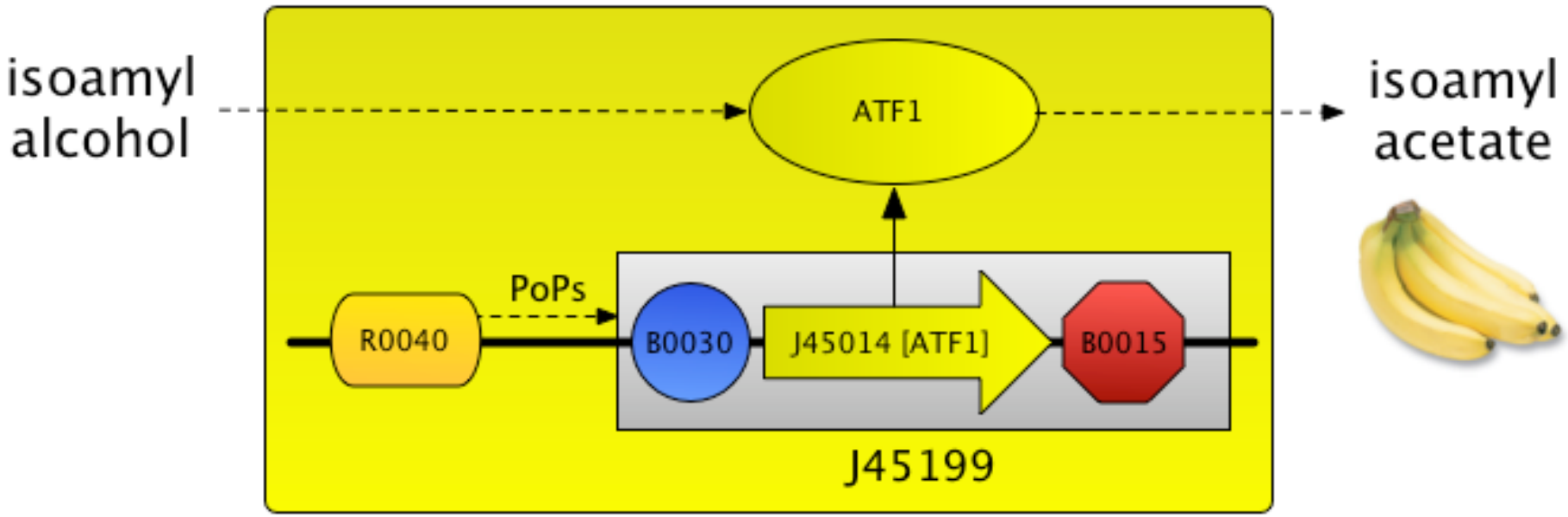


methyl salicylate
MW = 152

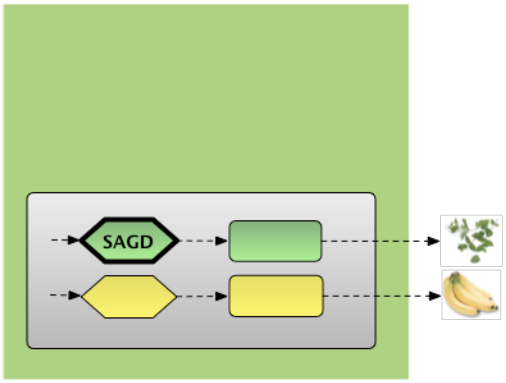
banana generating device



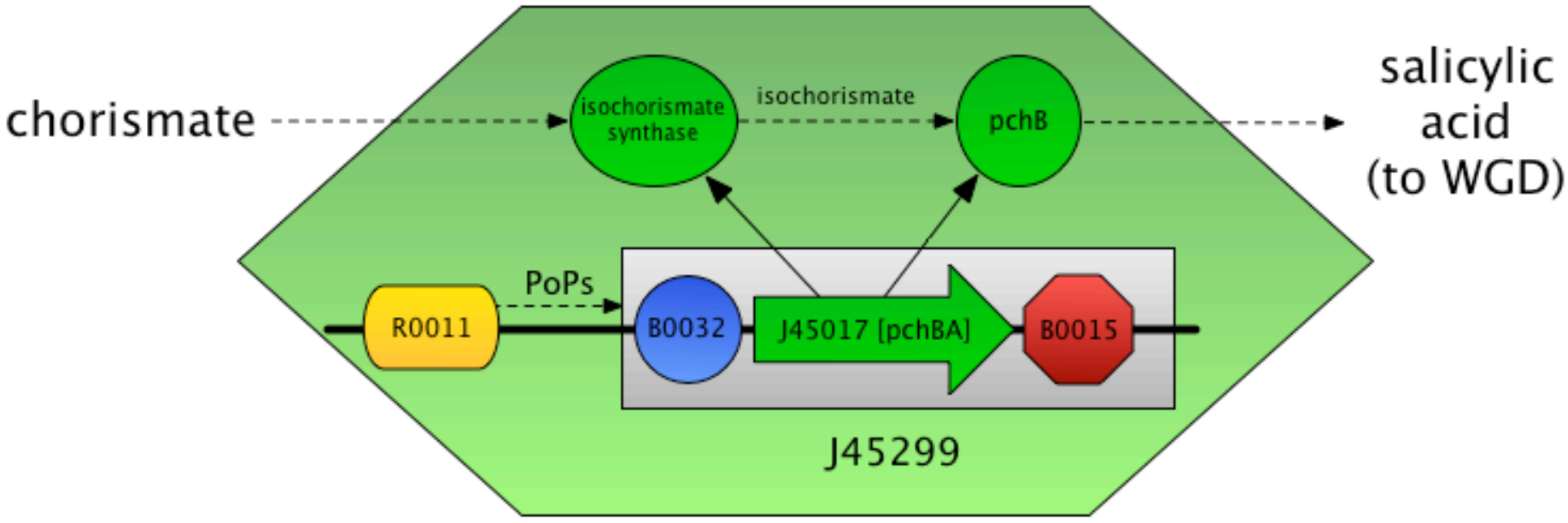
J45200 – Banana Generating Device (BGD)



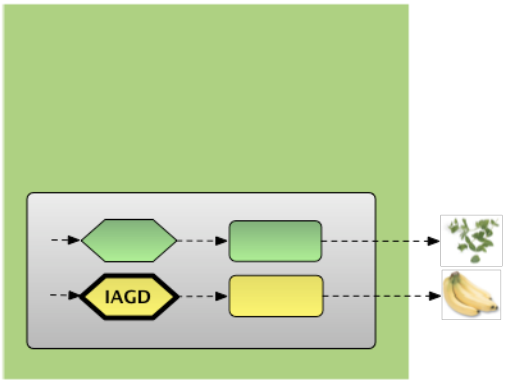
precursor biosynthesis



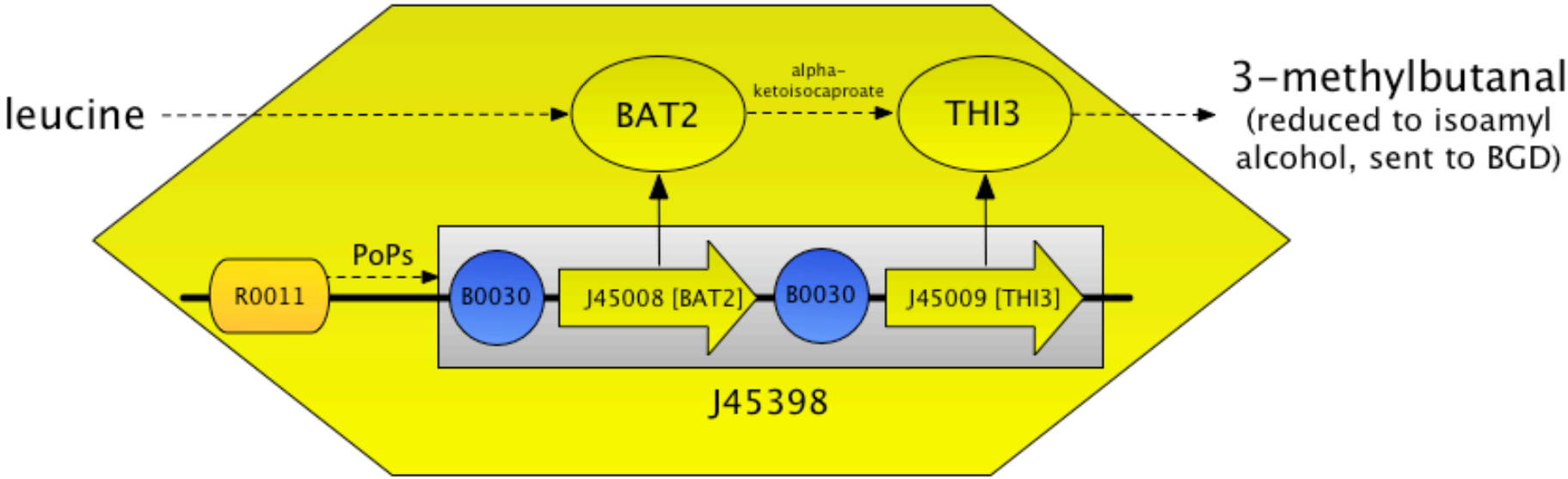
J45300 – Salicylic Acid Generating Device (SAGD):



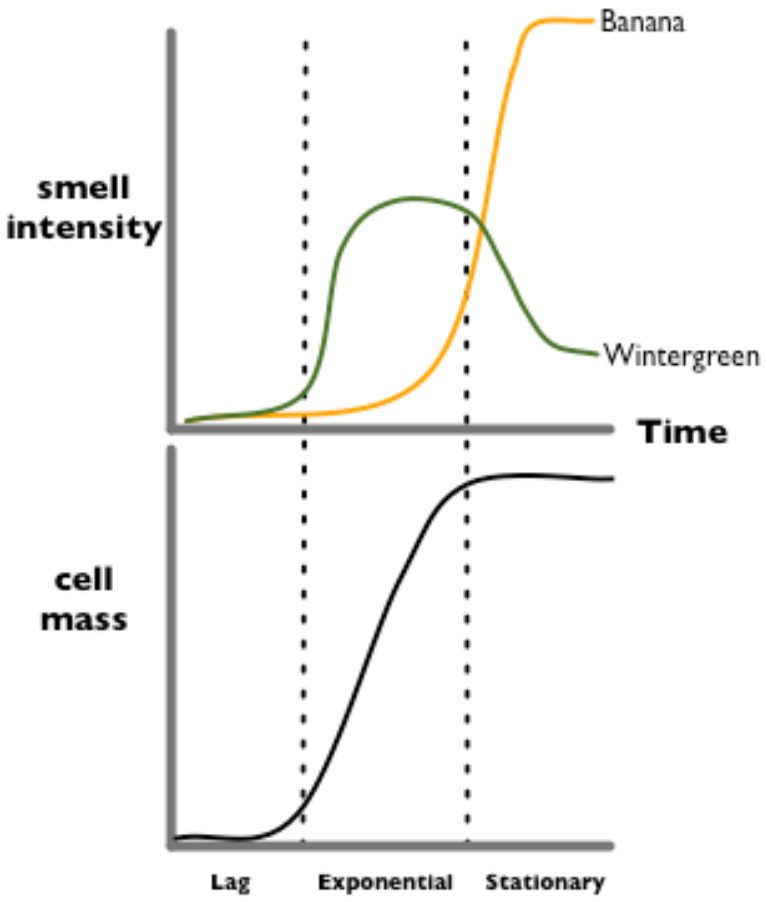
precursor biosynthesis



J45400 – Isoamyl Alcohol Generating Device (IAGD):

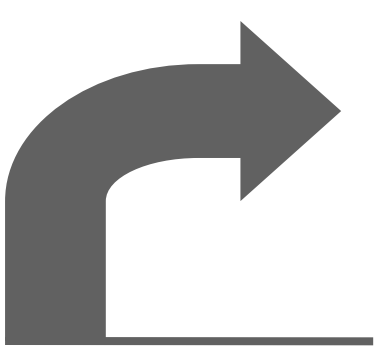


goal: the regulated system

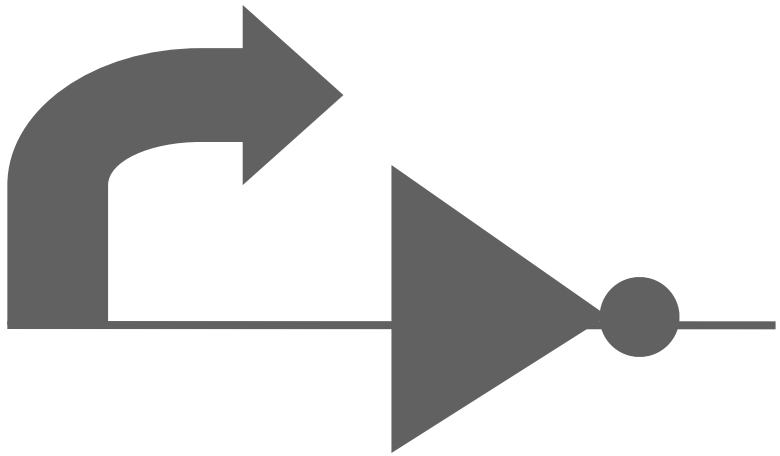


growth dependent regulation

- osmY: active in stationary phase & under high osmotic pressure conditions

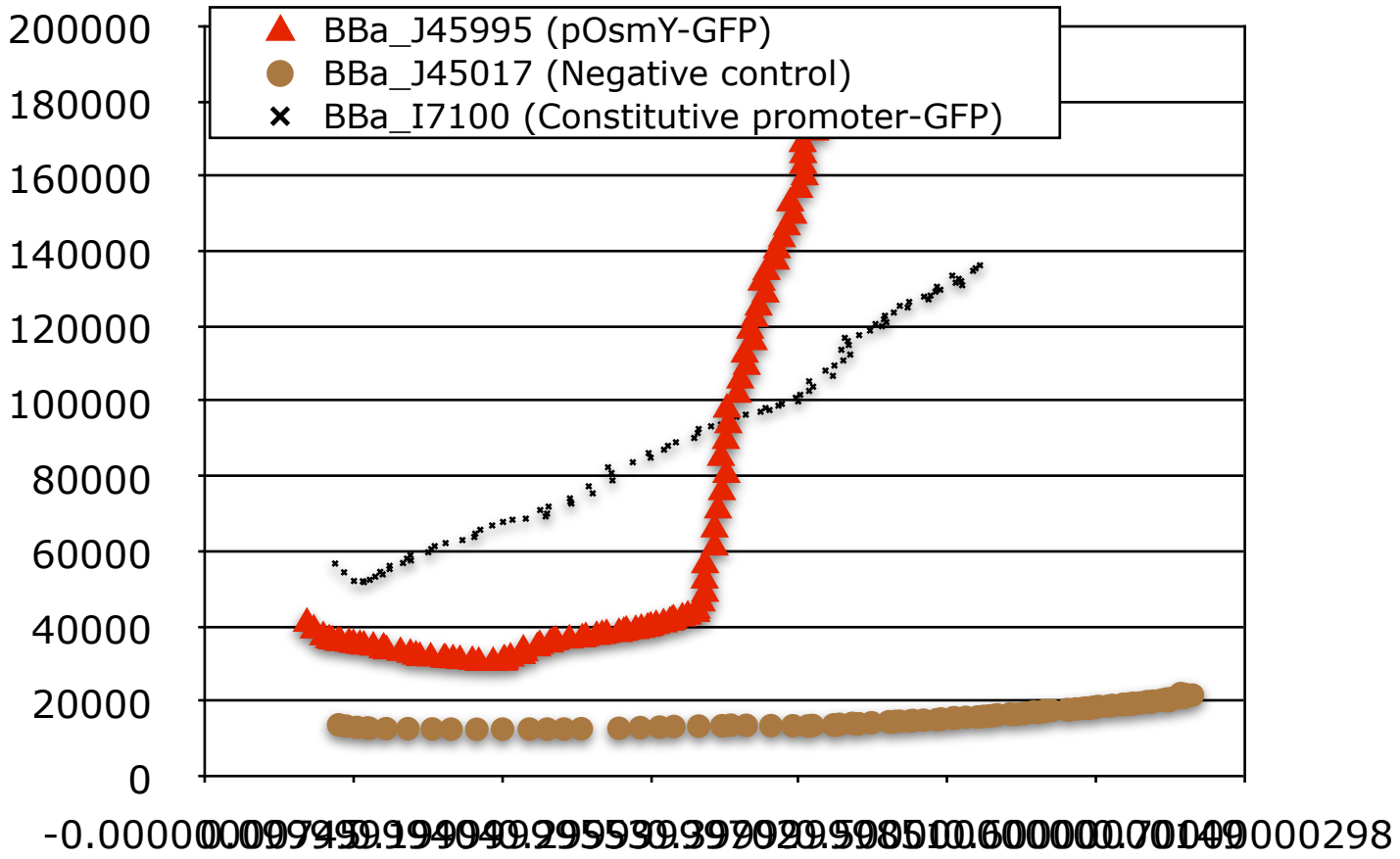


osmY

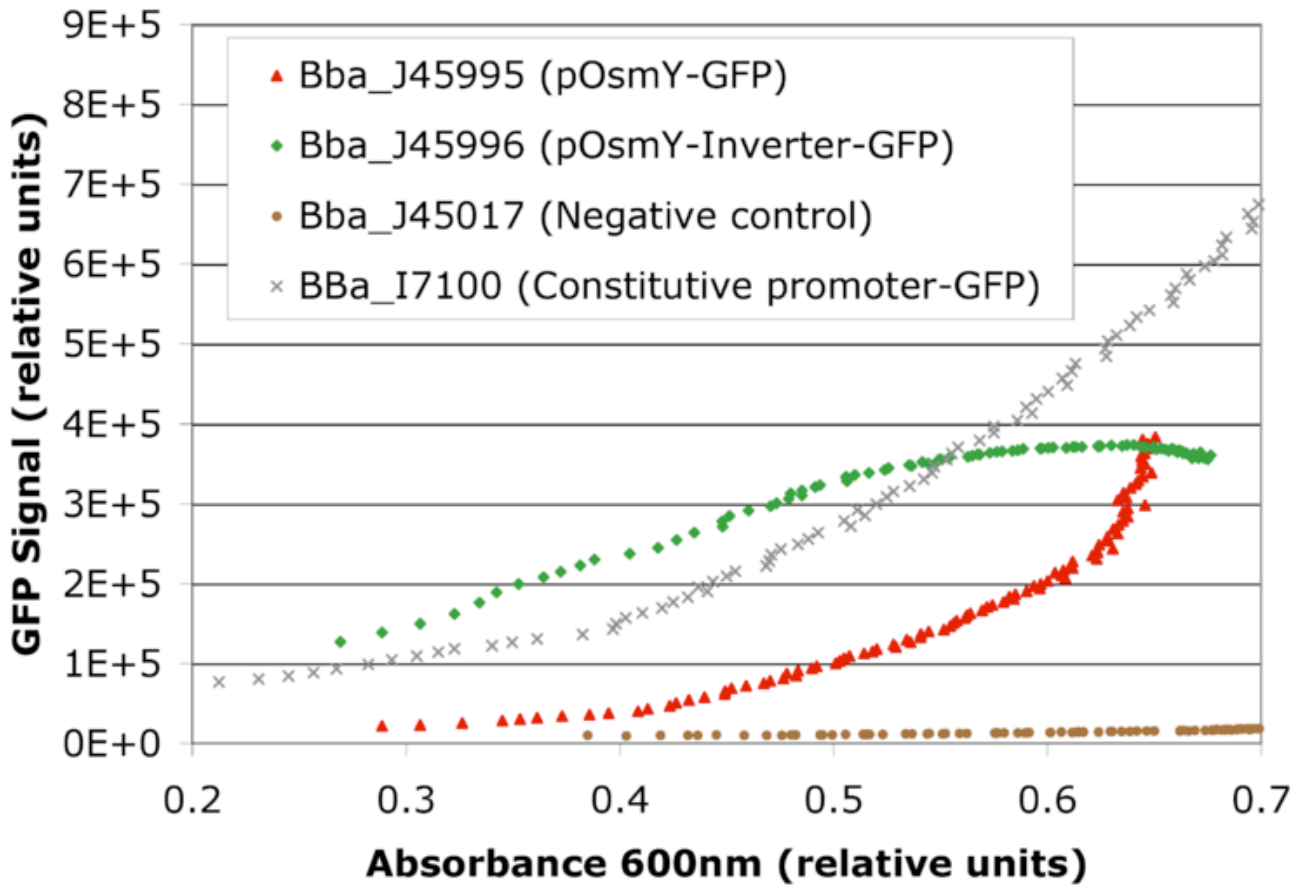


osmY + inverter

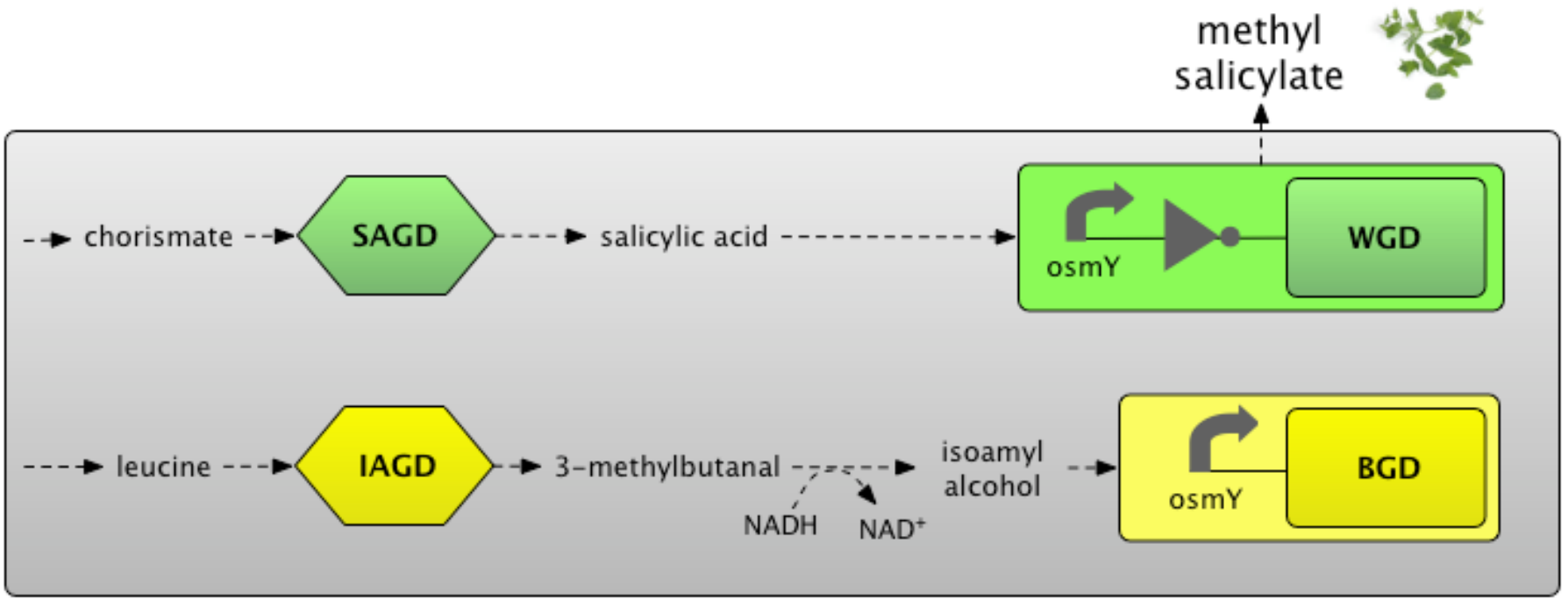
regulation is growth dependent



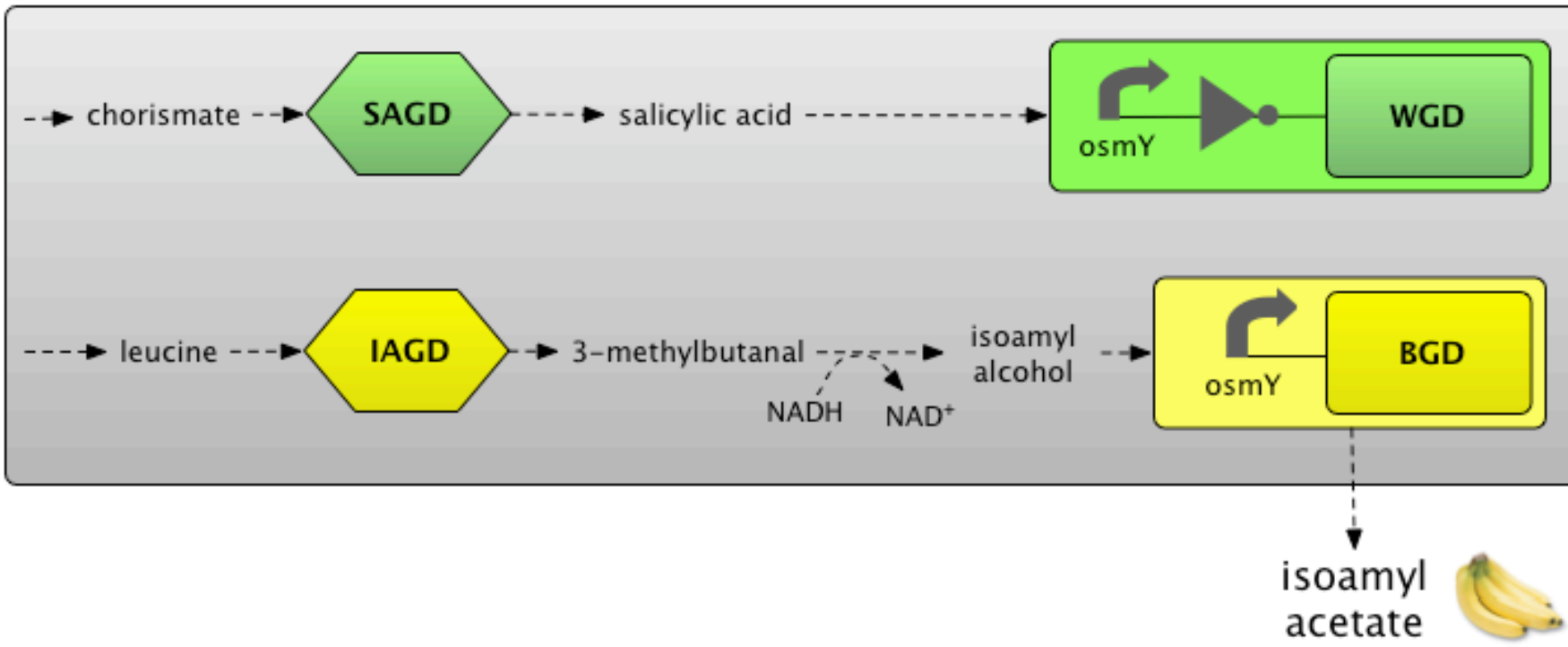
regulation is growth dependent



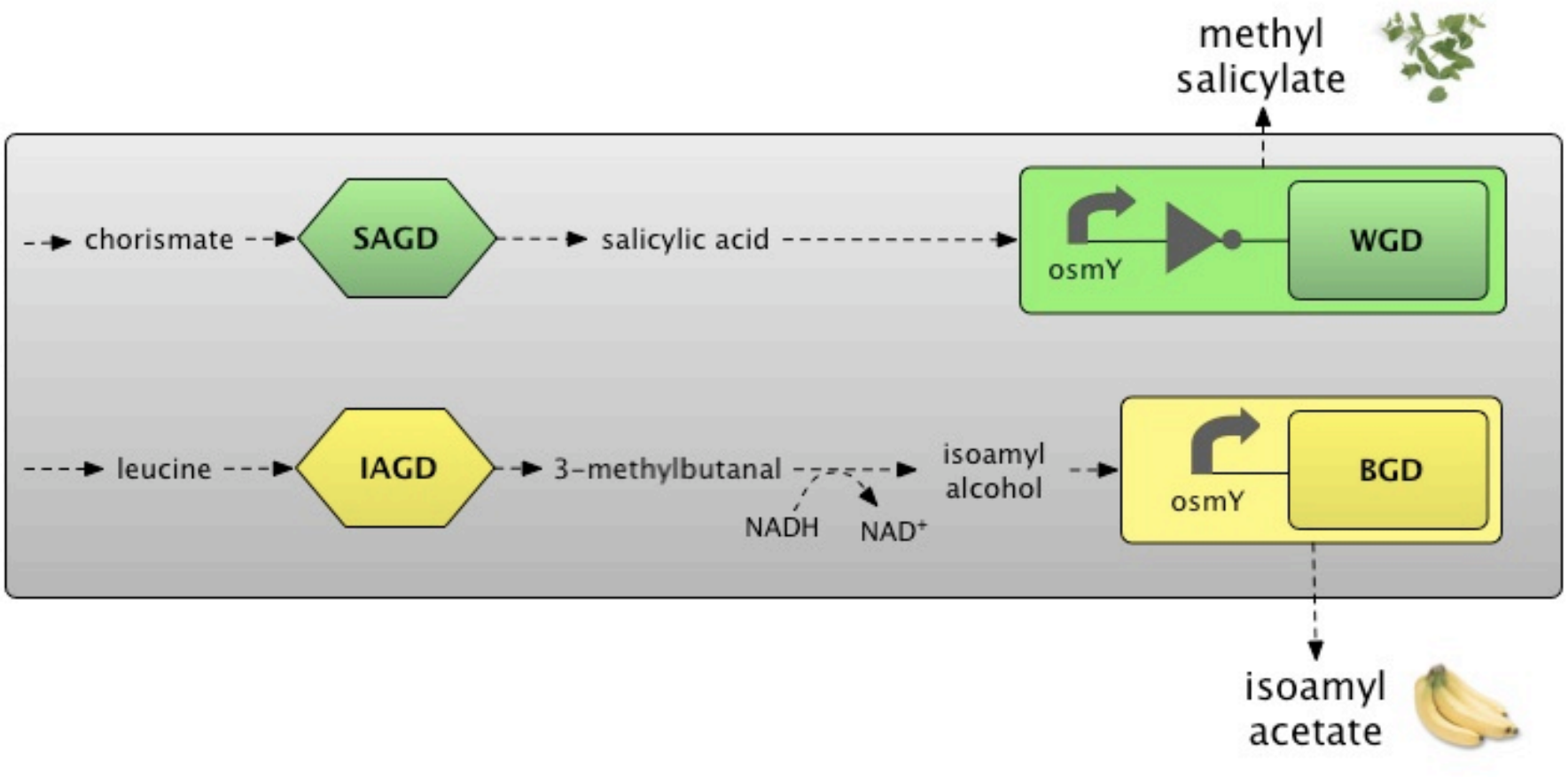
regulated system: exponential



regulated system: stationary

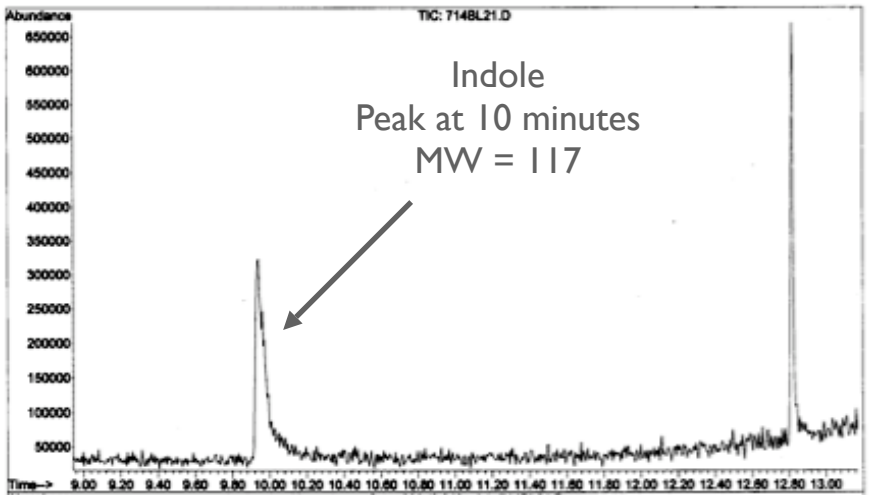


regulated system

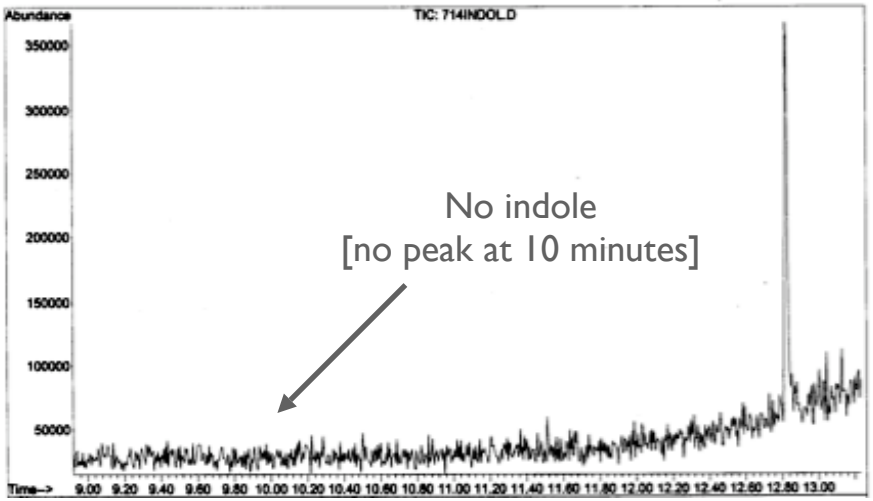


chassis (tnaA5^{-}) does not produce indole

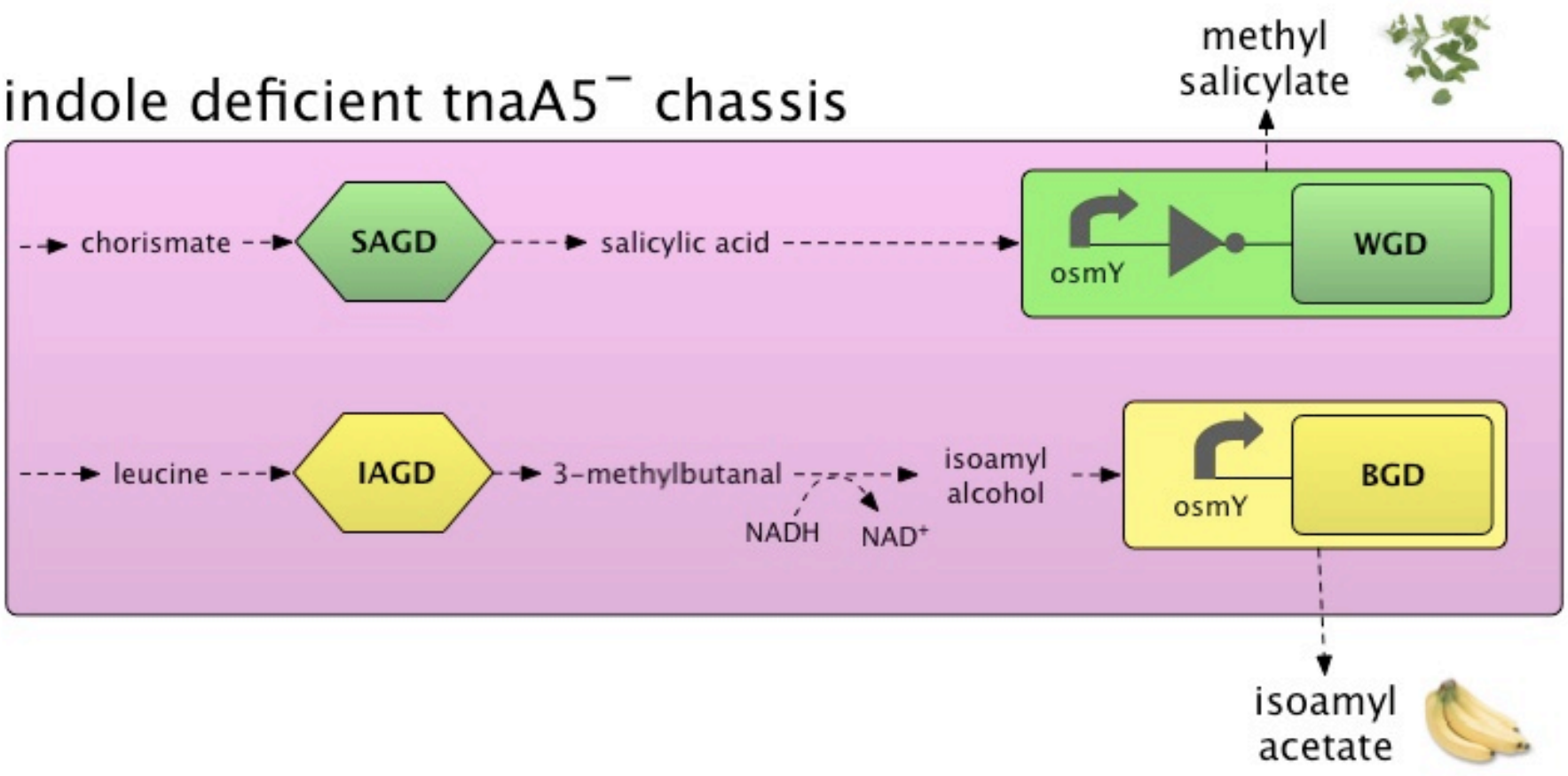
wild type *E. coli*



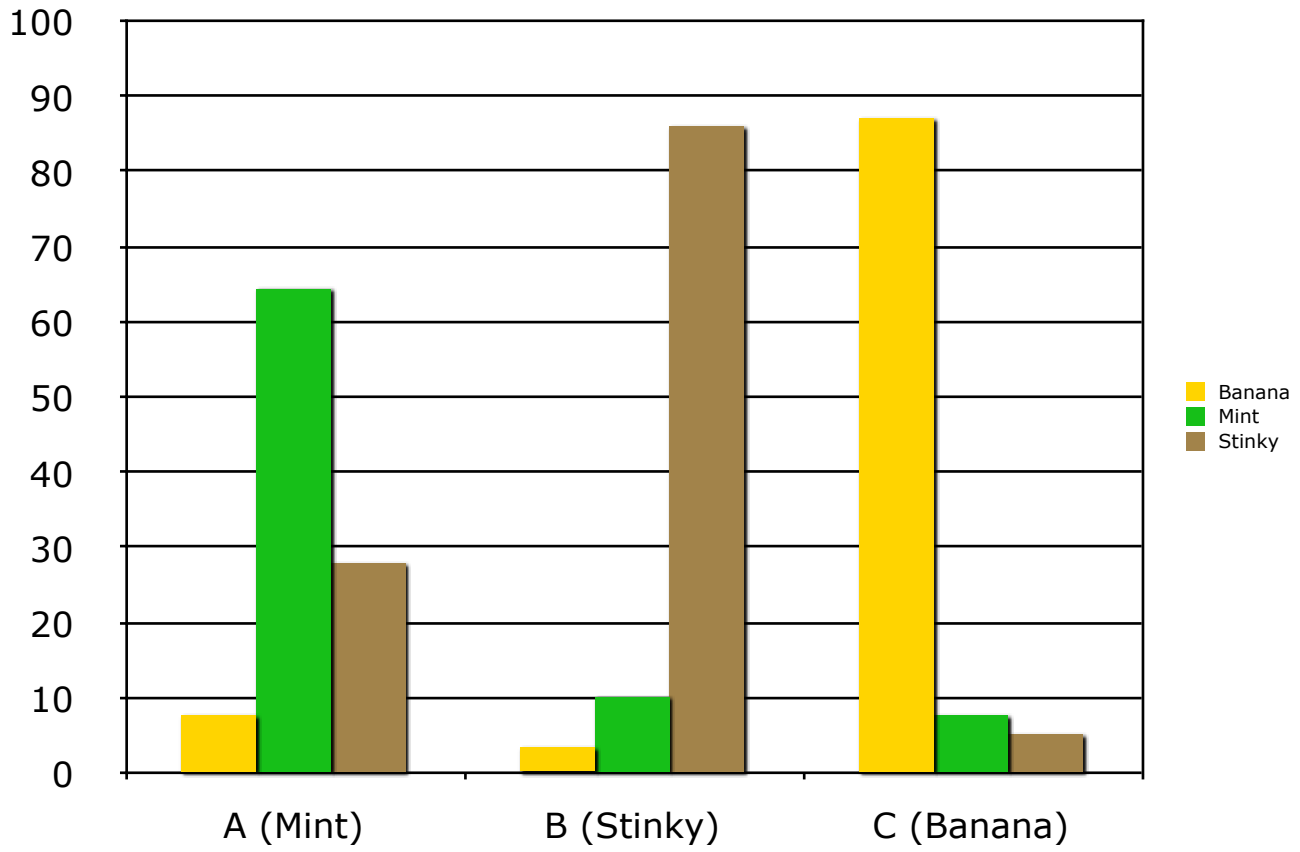
chassis: tnaA5^{-} *E. coli*



final system



smell test results



future applications

- Improve the workplace environment for microbiologists working with *E. coli*
- Port our system to bacterial species involved in bioremediation.
- Implement our system in bacteria responsible for bad human odor in the mouth, armpits and feet.
- Implement our system in yeast used in bread and beer production

conclusion

- Designed, built, and tested a synthetic biological system over the course of summer
- Engineered synthetic scent systems in E. coli
- Regulated via transcription control devices

acknowledgments

- **Natalia Dudareva**, Purdue University: gifts of expression vectors encoding BAMT, SAMT and BSMT enzymes.
- **Eran Pichersky**, University of Michigan: suggestion of eliminating indole from Escherichia coli to mitigate the natural "bad" smell.
- **Mary Berlyn**, CGSC, The Coli Genetic Stock Center: Esherichia coli strain YYC912.
- **Brian Cook**, MIT: valuable discussions.
- **Cornelia Reimmann**, University of Lausanne: gift of an expression vector carrying the pchBA coding region.
- **Dieter Haas**, University of Lausanne: gift of the Pseudomonas fluorescens strain CHA0.
- **Peter Bakker**, Utrecht University, The Netherlands: gift of an expression vector carrying the pmsCEAB coding region, as well as, gift of the Pseudomonas fluorescens strain WCS374.
- **Herbert P. Schweizer**, Colorado State University: gift of the pUCP22 Esherichia coli to Pseudomonas shuttle vector.
- **Pamela Silver**, Harvard Medical School: gift of yeast BioBricks vector.

questions and answers

growth curves