Bactissiles
- The future of microbial combat
Problems with lacking specificity

● Antibiotic resistance
● Statistical probability
● Good bacteria gone rogue
Bactissiles
- The future of microbial combat
Diarrhoeal disease

- 5th leading cause of death in the world
- Kills 1.9 million people every year
- 3rd leading cause of death in low income countries
Pathogen requirements

- Clostridium
- Shigella
- Y. enterocolitica
- Campylobacter
- Vibrio cholerae
- Salmonella
Introduction Sensing Targeting Killing
Introduction

Sensing

Cell-cell model
Introduction

Sensing

Targeting

Induction

YenR (active)

yenbox fused with a promoter

YenR

No induction

YenR (inactive)
Introduction  Sensing  Targeting

yenbox  RBS  GFP

RBS  YenR

OHHL
1. yenbox
2. yenbox + J23101-YenR
3. yenbox + J23113-YenR
4. yenbox + J23102-YenR
Moving in low concentrations

Sensing

Targeting

Killing

CheZ

Twitching in high concentrations
Restoring movement

Sensing  Targeting  Killing
Ensuring specificity

- Only produce toxins while close
- Colicin Fy only targets *Y. enterocolitica*
Targeting

Killing

Modeling

yenbox → RBS → spot42_USP45

RBS → USP45 → CFY
Confirming inhibition
The Bactissile system

Y. enterocolitica

Tracking mode

Attack mode
Population model

- Test if the system works
- Many assumptions
- Test assumptions
  - Coexist
  - Rate-limiting module
Coexistence

Killing Modeling Applications in society

Fraction of living Y. enterocolitica

Time [s]
Modeling Killing Applications in society

Rate-limiting module

Graph showing the relationship between time (s) and the multiplier of parameter value. The graph includes three lines:
- Blue line labeled Killing with $R^2 = 0.9586$
- Orange line labeled Sensing with $R^2 = 0.9957$
- Gray line labeled Targeting with $R^2 = 1$

The x-axis represents the multiplier of parameter value, and the y-axis represents time in seconds.
Microbial Designs

- Infomercial
- Production price
- Medical trials
- Market
**Accomplishments**

- Sensing module
  - yenbox with WT promoter works
  - YenR induction
- Targeting module
  - Restoration of movement
- Killing module
  - Production of colicin in *E.coli*
  - Killing of *Y.enterocolitica*

**Modeling**
- Coexist is important for our model
- Production of colicin is a rate limiting parameter

**Policy & Practice**
- Learned about commercialisation
- Youtube channel
Acknowledgments