ENTER THE BIOFILM

THE UNIVERSITY OF BRITISH COLUMBIA
Biofilm
catheters
buccal infection
extreme industrial

S. aureus strain RN4220 biofilm
Biofilm growth curve

Figure 1: Growth curve of two strains (RN4220, green; 8325-4, red) of the biofilm culture.
AIP Phage genome P2
Size (<60 kbp)
Specificity
Characterization
Multiplicity
Lysogenic
Poly-β-(1,6)-linked N-acetylglucosamine
4-Nitrophenyl N-acetyl-\(\beta\)-D-glucosaminide

4-nitrophenol

300nm

405nm
DspB cleaves the bonds in the substrate
DspB addition results in lower biofilm density.
Insert sites using SDM
\[
\frac{d[AIP]}{dt} = \sigma(1-\frac{B_T}{K})(1-\frac{[AIP]}{[AIP]_{\text{max}}})[AIP]-\gamma[AIP]
\]

\[
\frac{dP}{dt} = -\frac{\ln 2}{\eta} P - \delta P + RZ - X
\]

\[
\frac{dB_T}{dt} = (\rho_B B_T + \rho_i B_i)(1-\frac{B_T}{K}) - AB
\]

\[
\frac{d[DspB]}{dt} = -\delta[DspB] + SZ \theta B_T
\]

\[
\frac{dr_{in}}{dt} = \begin{cases} 
Y \frac{d[DspB]}{dt} & \text{if } r_{in} < r_{in}\max
\frac{dB_z}{dt} = (1-p)\rho_i B_i(1-\frac{B_T}{K}) - \pi B_L + (1-p)\delta X \\
0 & \text{if } r_{in} = r_{in}\max
\end{cases}
\]

\[
\frac{dz}{dt} = \frac{(\alpha + d)^3}{A} \frac{dB_z}{dt}
\]
Modeling

- Use properties of biofilm, phage and phage genetic elements

- Used experimental results to determine model parameters
Accomplishments

• Created P2 - RBS - GFP - Term assemblies
• Made DspB BioBrick Part
• Characterized DspB
• Developed the Phage Standard - 3A Compatible
• Modelled our phage construct in the biofilm
• Wrote downloadable Java version of model
• Human Practices: Promoter Map, Gallery, NaNoWriMo
It’s biology,
But not as we know it.
Creation with human technology
Manipulating life...
Exploiting natural pathways
Fabrication of new living things!
Gene splicing and engineering

Playing God...
Mixing different organisms!
Art, like morality consists in drawing the line somewhere
- Gilbert K. Chesterton
Future

- Characterize P2 in *E. coli* and *S. aureus*
- Characterize DspB in *S. aureus*
- Make the entire proposed phage construct
- Test completed phage on biofilm
- Continue to refine model
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Delivery Method

- P2
- Phage
- DspB

Transformation

Existing Biofilm
Are people better - synthetically speaking?
Mediocre selves we leave behind
Parts, interchangeable, nothing lacking
Ever evolving, surpassing perfection?
Rewriting, repairing, repeating the past

Have we put the past behind us?
Did our ideals and our dreams ever catch
Up to the truth of stark reality? But when
Has man left the world unchanged?
Fate. What was once malignant, now more resistant?

Resistance to change, in our ways and lives
Haver perpetuated the old sinful balance
Humanity’s belligerence and greed, Incurability
Showed spill to spill, bomb by bomb
One hole with more holes, an eye for an eye

What is within our control? If you consider
And what, which we value, is within our reach?