Pattern Formation and Rate of Growth in Escherichia Coli

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ABSTRACT

This research aims to observe and mathematically model the radial and spiral stream formation of Escherichia Coli colonies. The mathematical model is based on a recent study of the colony formation of Proteus mirabilis, a urinary catheters, leading to infection. Understanding the mathematical model for the radial and spiral stream formation of these bacteria will help us to further understand biofilm formation.

Figure 2. Proteus mirabilis experimental results (Xue, C., Budrene, E. O., & Othmer, H. G. , 2011)

RESULTS OF PROTEUS MIRABILIS

- After inoculation, on a hard nutrient rich agar surface, the colony front expands initially as a disc of uniform density.
- For the first 5-7 hours, swarmer cells (adherent) migrate out of the inoculation site, the slime layer gradually builds up and swarmer's de-differentiate into swimmer cells behind the leading edge.
- We observe that swimmer cells in the colony stream inward, forming complex patterns.
- A characteristic feature observed is that the spirals always wind CCW when viewed from above.

Figure 4. Mathematical model of Proteus mirabilis (Xue, C., Budrene, E. O., & Othmer, H. G. , 2011)

FUTURE WORK

Currently we are in the process of growing e-coli in vitro on a semi-solid agar. We are working on studying how an additive can affect the radial and spiral streams of growing bio-film. Assuming that cells secrete and respond to a chemoattract $6_3 2O_3$

Figure 3. Using a mathematical model to create simulated radial spirals. (Xue, C., Budrene, E. O., & Othmer, H. G. , 2011)

Acknowledgments

We would like to take the time to thank those that helped us with our research, and those that helped us to conduct our experiment in their lab. Thank you to Dr. Shawn Ryan, Dr. Kothopalli & Ryan D'Abnavi, M.S.