

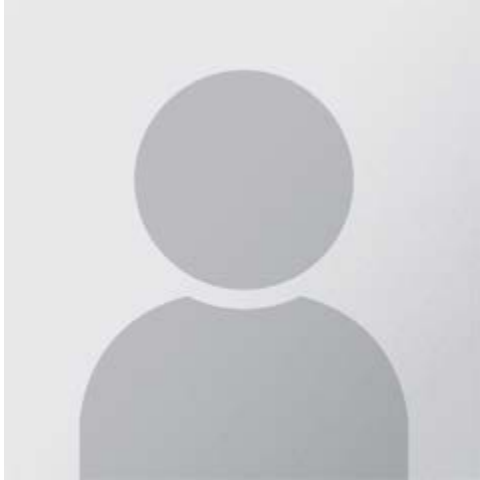
## 2004 State NMJAS Paper Competition Winner

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*Utilizing Bacterial Carpets for Bionanotechnology Applications*

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**Abstract:** The purpose of this experiment is to see if *Serratia marcescens* could be utilized to move 10 micrometer ( $\mu\text{m}$ ) beads and PDMS coated chips (Polydimethylsiloxane, PDMS) through a liquid medium. *S. marcescens* is a pathogenic, opportunistic flagellated gram-negative bacterium best known for producing a red pigment called prodigiosin. *S. marcescens* is readily available and easily swarms. If this swarming characteristic could be coordinated and directed it might be utilized as a bio-robot. It was hypothesized that the bacterial carpets would move the beads and chips faster than diffusion due to coordination of the *S. marcescens* flagella. A carpet of swarming *S. marcescens* were blotted onto 22 mm PDMS covered glass cover slips pre treated with Rain-X<sup>®</sup>. The cover slips were inverted and placed on a tunnel slide. 10  $\mu\text{m}$  polystyrene beads (Duke Scientific) were then pipetted into the tunnel slide to quantify movement. The bacterial carpet produced rapid linear movement of the 10  $\mu\text{m}$  beads. The hypothesis was supported as the 10  $\mu\text{m}$  beads next to the bacterial carpets moved at a significantly ( $p < 0.001$ ) higher velocities than the control beads and the calculated diffusion rate. The bacteria were successful in moving a PDMS chip in a clockwise rotation at an average speed of 4  $\mu\text{m}/\text{s}$ . This procedure indicates possible use of *S. marcescens* as a means to propel automobile chips which could contain biosensors.