Armand-Frappier Outstanding Student Award Recipient

Ms. Stephanie Jones, McMaster University, Hamilton, ON

Stephanie Jones completed her B.Sc. in Biology at Syracuse University in 2012, and is currently finishing her Ph.D. in the lab of Dr. Marie Elliot at McMaster University. Her research focuses on understanding the growth and development of Streptomyces bacteria, known for their antibiotic production capabilities and their complex life cycle. She discovered a novel form of Streptomyces development termed exploration, and has been working to characterize the genetic and biochemical factors underlying this form of development. Steph has found exploration involves the cooperation of two cellular growth mechanisms, and alters microbial community dynamics through various competition and communication strategies. Her work in the Elliot Lab has been supported by an NSERC Vanier scholarship. Steph will be starting a postdoc at the Massachusetts Institute for Technology in the lab of Dr. Mike Laub in September 2018, where she will be studying the evolution of chromosome dynamics and toxin-antitoxin systems in bacteria.

Exploring a new mode of bacterial development, communication and competition

Stephanie JONES, McMaster University, Hamilton, ON, MAE ELLIOT[1] [1]McMaster University

Streptomyces are filamentous soil bacteria best known for their antibiotic production capabilities, and their complex life cycle. It had always been thought *Streptomyces* grow solely as static colonies, until we discovered that *Streptomyces* can deviate from their classical life cycle via a novel mode of development termed ‘exploration’. Explorer cells are motile and can rapidly transverse a wide range of surfaces, including rocks, plastics, and agar. We investigated the cellular mechanisms underlying this rapid form of colony growth, and discovered that two distinct forms of cell growth, governed by independent cytoskeletal proteins, drive different phases of exploration. Exploring colonies raise the pH of their surroundings using the airborne volatile compound trimethylamine (TMA). Remarkably, exploring colonies can promote exploration by more distantly growing *Streptomyces* using TMA. In addition to its role in *Streptomyces* communication and behaviour modulation, TMA can also act as a competitive tool by reducing the survival of other soil microbes. TMA raises the pH of the surrounding environment, and this impacts nutrient availability. In particular, a rise in pH leads to significantly reduced iron solubility. TMA release by exploring cultures therefore effectively starves other microbes of iron. At the same time, *Streptomyces* explorer cells thrive in this alkaline, iron-depleted environment by secreting iron chelators termed siderophores, and by upregulating siderophore transport clusters. Our work has revealed a novel mode of bacterial development, and has begun to define the molecular and environmental factors underlying this unique developmental system. We have demonstrated for the first time in bacteria, a switch in cell growth mechanisms, from typical growth at the cell poles, to lateral wall-mediated growth. We have further identified a pH-raising volatile compound capable of acting both as *Streptomyces* communication tool and as a weapon against other microbes. Finally, we have shown that volatile compounds can be used to modulate microbial community dynamics, and in the case of TMA, leads to the creation of an iron-depleted environment suitable for *Streptomyces* colonization, but detrimental for the growth of other microbes.