Instructor Profile

Dr. Carlos C. Goller

Research Areas:

- Microbiology
- Molecular genetics
- High-throughput screening
- Molecular epidemiology

Techniques:
Bacterial culture, DNA isolation, qPCR, Gel electrophoresis, DNA sequencing and "Deep Sequencing", Bioinformatics, Molecular cloning, High-throughput screening.

Some of the most obscure environments are bustling with microbial life and genetic diversity. The genetic potential of these complex microbial populations remains to be elucidated and tamed. New technologies allow us to dig deeper into the genes these organisms harbor and begin to understand the functions of enzymes that could be useful for human health and industrial processes. Students in the BIT 495/595 Metagenomics module analyzed samples from kitchen sinks using deep sequencing and bioinformatics. The microbial diversity uncovered suggested that distinct microbial species may colonize kitchen sinks. Last summer, we developed more specific qPCR-based methods to search for microbes such as *Delftia acidovorans,* a microorganism that turns water-soluble gold into microscopic gold nuggets and can cause human infections, in these samples.

This **molecular diagnostic** tool will now be applied to survey household drains. During the course of the summer, you will use molecular biology techniques to purify genomic DNA from the microbial communities associated with drains and conduct PCR screens to identify samples positive for *Delftia acidovorans*. You will also use modern cloning techniques to clone and express uncharacterized genes that make *Delftia* so unique. The objective of this project, which will be conducted in collaboration with other labs at NCSU, the University of Wisconsin, and the Centers for Disease Control and Prevention, is to clone and functionally analyze

genes that could have implications in public health or produce biotechnologically useful gene products ("**biomining**").

A second direction is to search for phage, bacterial viruses, and compounds that specifically target *Delftia acidovorans* in order to discover novel **anti-infectives** for this opportunistic pathogen. We will screen overexpression libraries for susceptibility to compounds. This will make use of a new liquid handling robot in order to automate the process and conduct **high-throughput screens** of environmental samples and small molecules.

Your work will be important in establishing a pipeline for future explorations of *Delftia* by other NCSU undergrads, and you will contribute to the online open-access resource we have created. Moreover, you will learn first-hand how relatively simple microbial communities can provide tremendous genetic potential and shed some light on the dark genetic matter of niche environments.