Instructor Profile

Dr. Christina B. Garcia

Research Areas:

- Epigenetics
- Plant mineral nutrition
- Cellular differentiation
- Molecular cloning

Techniques:

Quantitative PCR, DNA methylation profiling, chromatin immunoprecipitation, PCR, Western blot, fluorescence microscopy, flow cytometry, recombinant protein expression in bacterial and animal cell culture, molecular cloning

In the last decade, the field of epigenetics has flourished as novel technologies have allowed investigators to characterize entire epigenomes – the genome-wide set of mitotically heritable features modulating gene expression independently of the DNA sequence. These advances have significantly enhanced our understanding of gene regulation in many different processes including development, disease progression, and stress responses from plants to animals.

My research focuses on assessing and elucidating epigenetic control of differentiation in plant and mammalian model systems with the ultimate goal of developing methods by which to control these processes at the epigenetic level. Nutrient mobilization from leaves is developmentally regulated, changing as the leaf metabolism transitions from being photosynthetic to senescent. Understanding how this transition is regulated has important implications for improving crop nutrient density and plant responses to nutrient deficiency. One of my research projects focuses on understanding how minerals, particularly Fe, are mobilized from source leaves to developing seeds in legumes. Previous research has indicated that earlier onset of leaf senescence was associated with

higher seed Fe content, and future work will focus on understanding how leaf senescence is controlled at the genetic and epigenetic levels. A student working on this project will gain experience with hydroponic plant culture, bisulfite sequencing to determine DNA methylation sites, high-throughput sequencing data analysis, quantitative PCR, and potentially gel zymography.

Myotube formation is a well-characterized process that is simple to perform *in vitro* by inducing differentiation of myoblasts. Significant changes in histone modifications and DNA methylation were associated with specific changes in gene expression during myoblast differentiation. A second research project involves validating changes in histone modification during myoblast differentiation at different genomic loci identified by ChIP-Seq (chromatin immunoprecipitation coupled to massively parallel next-generation sequencing). These experiments will provide the basis for future experiments in which transcription factors will be designed for the purpose of manipulating differentiation. A student working on this project will gain experience with mammalian tissue culture, *in vitro* differentiation methods, chromatin immunoprecipitation, high-throughput sequencing data analysis and visualization.

A third project involves molecular cloning which a student can perform concurrently with one of the projects described above. We are attempting to clone a novel fluorescent calcium indicator called CaMPARI. A student working on this project will gain additional experience with ligation, bacterial transformation, and affinity chromatography and may be able to perform experiments utilizing fluorescence microscopy and flow cytometry to assess calcium signaling in mammalian cells.