Biology Seminar

"Proteome dynamics and cellular asymmetries during maize leaf development"

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ABSTRACT

To form new organs, multicellular organisms transition through several phases of growth. Stem cell populations undergo proliferative, symmetric divisions; differentiating cells undergo asymmetric division; and differentiated cells undergo directed cell expansion to acquire their ultimate size and shape. Maize leaves exhibit a developmental gradient encompassing each of these three stages, and therefore are an ideal model system. We carried out quantitative proteomic and phosphoproteomic analyses to characterize mature leaves and leaves undergoing these different growth phases. We identified ~12 000 proteins in the proteomic analysis and ~14 000 phosphorylation sites in ~3 500 proteins in the phosphoproteomic analysis. Surprisingly, there are relatively few differences between the proteomes of the three growing zones, but many differences between the phosphoproteomes, suggesting phosphorylation plays a key role in developmental transitions. Moreover, the prevalence of different phosphorylation motifs changes during growth. As an example of how the dataset can be used as a resource, we show how the expression of cell wall biosynthesis changes over growth, and identify unique phosphorylation sites and patterns. A second, more directed study was performed to characterize aspects of the second growth phase, asymmetric division and asymmetric cell division. Specifically, we examined the acquisition of cell polarity prior to asymmetric cell division. Again using the maize leaf as a model, we examined cellular polarization events that lead to generation of the maize 4-cell stomatal complex. Two *pangloss* mutants, each defective in a receptor protein, and three *brick* mutants, each defective in components of a complex that promotes actin nucleation, fail to polarize resulting in aberrant stomata. Identification and characterization of these mutants led us to propose a signaling pathway where the actin cytoskeleton is required for the polarized localization leucine-rich repeat receptor-like kinases, which in turn signal back to the actin cytoskeleton to promote cell polarity and asymmetric cell division.

December 11, 2014
12:00 noon
130 School of Medicine

Dr. Facette is a candidate for an Assistant Professor position in the Department of Biology.