Using Proteomics to Study Signaling and Secretion in Plant Defense Responses

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Plants perceive potential pathogens by recognizing pathogen-associated molecular patterns (PAMPs) through plasma membrane (PM) receptors. Recognition of flg22, a 22 amino acid PAMP derived from the bacterial flagellum, by the receptor-like kinase FLS2 induces defense signaling responses and contributes to innate immunity by restricting bacterial invasion. A quantitative phosphoproteomic analysis of Arabidopsis PM proteins revealed specific phosphorylation sites changing in response to treatment with flg22 using a [Nühse et al., (2007) Plant J 51:931]. By pursuing reverse genetic investigations of differentially phosphorylated protein candidates, we have discovered that a specific syntaxin, SYP132, appears to be the cognate t-SNARE required for secretion of antimicrobial proteins and/or compounds, implicating protein secretion as a major determinant of resistance. [Kalde M, et al., (2007) PNAS 104:11850]. Subsequent proteomic analyses of proteins secreted during infection by different genotypes of bacterial pathogens revealed a complex interplay between Type III secretion from the bacteria, host resistance responses, and alteration of the host secretome [Kaffarnik et al., (2009) Mol Cell Proteomics 8:145]. Because of our interest in the dynamics of PM proteins during bacterial infections, we have been developing improved strategies for simplified analyses of PM proteomes without the need for two-phase partitioning. Our progress in method development and initial application to the study of plant defense responses will be discussed.

Biosketch:

Dr. Scott Peck received his Ph.D. in Botany and Plant Pathology in 1995 from the Michigan State University. He is currently an Associate Professor in Department of Biochemistry, University of Missouri-Columbia.

Research Interests:

We study how potential hosts recognize and respond to invading microbes, particularly bacteria. Using proteomic and phosphoproteomic approaches, we have identified numerous proteins involved in cellular signaling and protein secretion. We are currently using a diverse platform of biochemical and genetic approaches to investigate the functions of these proteins.