The exact mechanisms of Xf pathogenicity remain unknown. Recently genomic sequencing revealed that Xf harbors known bacterial RTX-toxins, proteins known to disrupt host cell functioning, reviving old speculation that phytotoxins may be involved Xf pathogenicity. These proteins along with other virulence-associated proteins, including host-derived signals, have the potential to elicit a variety of plant defense responses leading to programmed cell death (PCD), lesion formation, and eventually premature leaf senescence and vine death. The objective of this study is to identify Xf and host-derived elicitors and characterize the plant's signaling responses during Pierce's Disease.

Any plant based disruption in PD symptom formation, via transgenic manipulation or an exogenous therapeutic, must preserve normal plant development and performance. Effective applications that meet this criterion can only be developed by understanding and isolating the developmental pathways that lead to PD symptom formation.

The mechanisms for Xf success through movement and pathogenicity are still being resolved, and even less is known concerning the plant's response to the bacteria. Recent findings indicate that leaves can exhibit severe leaf scorch symptoms in the absence of detectable levels of Xf (Krell et al. 2006; Gambetta et al. 2007). These results suggest that symptoms may develop some distance from the bacteria through either a phytotoxic substance and/or an elicited systemic plant response. Whether these responses are mediated through host or Xf-derived elicitors, they must result from mobile signals that are able to move throughout the plant. Elicitors may include cell wall fragments and membrane components, pathogen-derived compounds such as oligosaccharides, glycopeptides/glycoproteins, peptides/proteins, lipids, and phytotoxins (Ebel and Scheel 1992; Yamaguchi et al. 2000). Interestingly, some of the elicitors mentioned above, such as oligosaccharides and lipids, are produced via cell-wall digesting enzymes. The same enzymes that are thought to be released by Xf in order to degrade host pit membranes facilitating movement through the host vascular pathway.

Figure 1 shows a proposed pathway of signaling events that eventually leads to the formation of visible symptoms that we recognize as Pierce's Disease. Toxins, elicitors, abiotic and biotic stresses, induce a pathway beginning with reactive oxygen species (ROS) production, such as hydrogen peroxide (H2O2) and nitric oxide (NO), leading to phytohormone synthesis including jasmonates, salicylic acid (SA), and ethylene, activating programmed cell death (PCD), defense gene expression, and secondary metabolite accumulation (Norman et al. 1999; Orozco-Cardenas et al. 2001). Although there is almost no knowledge of the defense signaling pathways in Vitis, these pathways have been studied extensively in other organisms, including agriculturally important species such as tobacco and tomato.

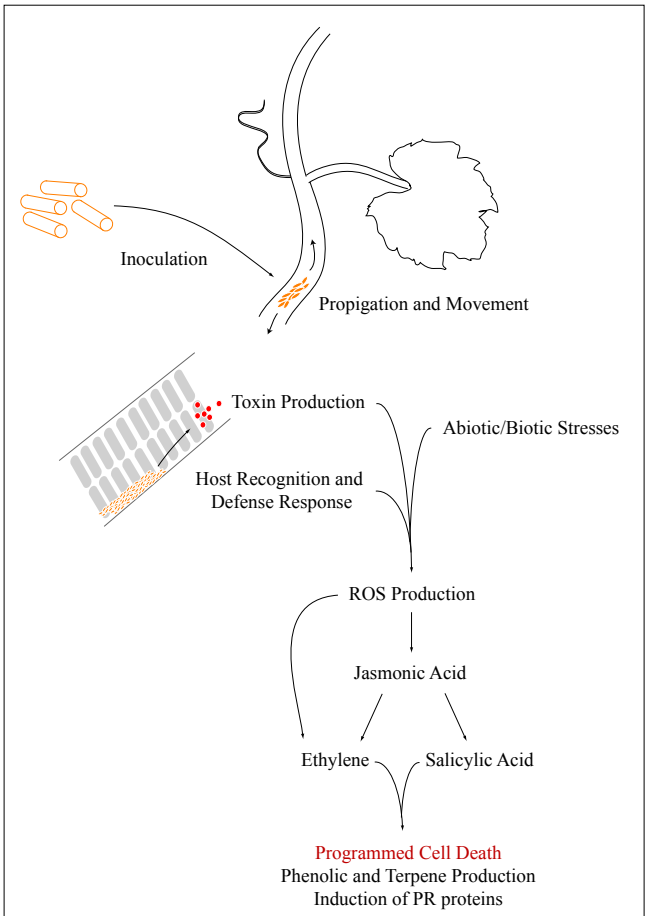

Figure 1. A proposed pathway of signaling events that occurs during infection, colonization, and the subsequent outcomes mediated by the endogenous signaling pathways. We will use multi-faceted approaches (e.g., protein analysis, anatomical data, hormone measurements) to confirm or identify other components in this pathway.