# RESEARCH PROPOSAL FOR 2002

Submitted to:
SLV Research Center Committee
and the
Colorado Potato Administrative Committee (Area II)

**TITLE: Identification of Novel Fungicide Targets in the Early Blight Fungus, Alternaria solani Using Functional Genomics**

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## PROJECT JUSTIFICATION:

Early blight disease, caused by the fungus *Alternaria solani* (Ell. & Martin) Jones and Grout, is one of the most consistent and devastating diseases of potato virtually wherever the crop is grown. This disease is most prevalent when the environmental conditions are such that there are cooler nights coupled with hot, dry days promoting dew formation within the potato canopy. The San Luis Valley provides an almost ideal environment for this pathogen to cause disease. Fungicides are employed as the method of choice for controlling this disease. Weekly applications may be common allowing for a massive input of petrochemically-derived pesticides into the environment. The number of these applications may be reduced when using a disease forecasting system, however a large amount of potentially harmful chemicals are still being used.

My laboratory is focused on studying mechanisms in *Alternaria* species that allow for these organisms to be able to cause disease. If we can understand what makes a fungus a pathogen on a particular crop, we immediately can begin to think of novel new ways to control the disease-causing organism. In the past, fungicide development has been based on laboratory screening of chemicals searching for those that kill or harm the fungus in some manner. These chemicals that kill or cause harm to the fungus, may also cause potential harm to other living organisms.

With the advent of molecular biology and now genomics-oriented tools and technologies, we can begin to unravel what genes the fungus has that makes it a successful pathogen. In this proposed research, we would like to develop a library of early blight genes that are expressed or activated during potato infection. Once we have created such a library, we can then systematically test the role of each one of these genes and find out how important it is for the fungus to have that gene during disease development. Each individual gene can be turned off in the fungus using a variety of strategies (directed mutagenesis) that are routine in the fungal molecular biology laboratory such as ours. Each new "mutant" of the fungus can then be tested for its ability to cause a disease in the laboratory or greenhouse situation. If we find genes that are critical for pathogenicity, then each one immediately becomes a target for the development of new fungicides. It may be possible to find chemicals that do not have

direct antifungal activity *in vitro,* but prevent or stop plant infection by inhibiting or modulating the expression of a specific gene critical for disease. This type of approach is called Functional Genomics, and in our case we can further call this PathoGenomics. This type of strategy has been successfully used to identify critical pathogenicity genes in numerous plant pathogenic fungi in laboratories around the world.

Once our laboratory begins to identify novel chemical control targets, we will then approach large AgChemical companies for a partnership in a Novel Fungicide Discovery Program. These companies should be able to provide thousands of chemicals that we can test in the laboratory in a high throughput manner for their ability to affect expression of our genes that we have found critical for infection. Once potential control chemicals are identified, these then can be used in whole-plant assays in the greenhouse initially and eventually under field conditions.

**PROJECT STATUS:** (Indicate if new or ongoing. You may give a very brief history of the project if it is ongoing) - NEW

## *How this project can be of financial benefit to potato producers in the San Luis Valley.*

The development of environmentally friendlier fungicides is important for potato agriculture. Using our approach, we may find even more effective, less costly chemical control strategies than those currently available. Importantly, CSU ultimately owns all IP -intellectual property (inventions) developed by researchers. Each fungicide target we can identify is effectively an individual piece of IP. It is highly possible that an agreement can be reached between CSU, SLVRCC, and industrial partner(s) in regards to royalties, licensing fees etc. A best-case scenario is that an agreement can be reached between all parties so that a portion of all licensing fees, profits, and royalties made from this technology would be given back to SLVRCC because SLVRCC has made an investment in technology development.

**OBJECTIVES FOR 2002:**

1. **Create an *Alternaria solani* library of genes expressed during potato infection**
2. **Begin to study the role of individual genes in pathogenesis**
3. **Identify and establish relationship with Industrial Partner(s)**

**FUNDING REQUEST:**

2002 Request:

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| 1/2 time Postdoctoral Scientist | $15,000 |
| Materials and Supplies | $ 3,000 |
| Total | $18,000 |