

Project Id	89
Project Title	Genetically Engineering Probiotic Bacteria to Treat Intestinal Diseases
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Additional Faculty	Rafael Jimenez, DPTC
Faculty Department	Biological Sciences
Project Description	<p>Celiac disease (CD) is an autoimmune enteropathy resulting from sensitivity to antigens contained within gluten, a protein found in wheat, barley, and rye. The prevalence of CD is approximately 1:100 in the US, making it the most commonly diagnosed autoimmune disorder (Ciclitria et al., 2005). As a strict gluten-free diet is difficult to maintain due to its pervasiveness in the western diet, alternative treatments are actively being investigated, many focusing on bacterial prolyl endopeptidases that destroy the antigens responsible for this disease. The goal for this project is to develop a strain of probiotic bacteria that will effectively colonize the small intestine and express enzymes to enhance digestion and absorption of protease resistant dietary proteins that are common in the human diet (e.g., gluten and casein) and remove potentially harmful metabolites. To achieve this goal, this project will be divided into two lines of investigation. The first focuses on the genetic manipulation of probiotic bacteria to determine the feasibility of using them as a vehicle for efficient prolyl endopeptidase delivery into the small bowel. The second centers on the investigation of complex components in milk that are most effective at enhancing probiotic binding to milk products and intestinal epithelia. A proteomic approach will be used to assess the efficacy of genetically engineered probiotic strains to digest gluten and the influence of milk products on the expression of bacterial genes that are involved in colonization of the intestinal epithelium.</p>
Interdisciplinary Nature Description	<p>Regardless of the quality of the engineered probiotic strain, if it does not colonize the intestinal tract, it will not be useful for our needs. The conditions used for growth and storage of probiotic bacteria are key to the success of this colonization. In collaboration with Rafael Jimenez in the Dairy Products Technology Center, we are working on developing the optimal growth conditions for probiotics commonly used in milk-based foods (lactic acid bacteria). Specifically, probiotic strains will be grown in media supplemented with milk products obtained from the DPTC, including buttermilk powders and fractions that have undergone alternative methods of sterilization, to assess their effect on bacterial gene expression and colonization.</p>
Links	
Number of Honors Students Requested	1
Applicable Majors	BIO, MCRO, DSCI, ASCI, CHEM
desired_res	<p>Students working in my lab need to have a strong interest in Molecular Biology and Microbiology. Although courses at Cal Poly will be necessary to learn many of the skills required for this project (e.g., MCRO 224 and BIO 375), my lab has many students (MS and advanced undergraduates) who are accustomed to training new students in lab-specific techniques.</p>
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