CLERMONT MATHEMATICS (MCGP)
UC CLERMONT COLLEGE

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: 03/01/2020

PROJECT TITLE: <u>Minimizing the Energy Exerted by Heart Muscles — A Multi-disciplinary Calculus Project</u>

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Project Description

The purpose of this research is to explore one of the many complex applications of Calculus in medical sciences, the blood vessel branching. The relationship among the angles and radii of bifurcating blood vessels can be explained using the mathematical process of optimization (Roux, 1878; Adams, 2011). We will examine several mathematical models, or cost functionals predicting the best branching angle of a smaller blood vessel that minimize friction along the branching path. We will also construct various models of vascular branching to describe fluid (blood) flow through cylindrical pipes that model blood vessels. The models will be based on the Navier-Stokes equations on the motion of viscous fluids. Then, we will investigate the relation between prediction and observation. The student will be introduced to the fundamentals of Law of Laminar Flows discovered by Jean-Louis-Marie Poiseuille (1840).

The student is expected to know calculus 1 material while no knowledge of human anatomy is required. Knowledge of CFD software will be helpful though not required. The Dean of Clermont College offered 50% funding for this project