SURE Project Description:
Mathematical Models of

Department of Mathematics
Dr. Eli Goldwyn

Project Description

Project Length: 10 weeks in Summer 2023 – dates are flexible
Hours: *approximately full-time (specific hours are flexible)*
Stipend: $4,500 plus free on-campus lodging

Mathematical models have provided important insights into a variety of biological, physical, chemical, and economic systems and have helped better understand and manage these systems. In this project, students will build and improve on existing mathematical models to better understand the nature of opioid addiction and recovery.

The United States Drug Enforcement Administration stated that "overdose deaths, particularly from prescription drugs and heroin, have reached epidemic levels" and the Department of Health and Human Services have declare the opioid crisis to be a "public health emergency". A better understanding of the addiction process and the efficacy of different treatment regimes would be an important step in finding public health policies to reduce the costs of this ongoing drug epidemic.

In this project, the students will build on existing compartment models (systems of differential equations) that describe the process of drug addiction and then fit their models to existing data. Historically, compartment models have been one of the most effective quantitative tools to understand infectious disease outbreaks. They have only recently been applied to the process of drug abuse. This leaves an opportunity for student researchers to build unique models to provide insight into the addiction process and to compare different treatment regimes. Because there are still many open questions involving the addiction and recovery process, students will have some flexibility in choosing the exact direction of their project. Potential project directions include modeling the counter-intuitive result that a recent decline in prescriptions has led to an increase in overdoses, modeling the effect of different risk factors on addiction, modeling the efficacy of different types of treatment programs, or modeling the role light and heavy users have on `recruiting' new users.

Students will also have the opportunity to work (remotely) with two faculty collaborators at Williams College and Bennington College and their students.

Please contact me at goldwyn@up.edu or with a message over Teams with any questions regarding the project or the summer work schedule.

Academic Requirements for Application

Having completed Calculus I and II (201 and 202 or equivalent) is required. A course on Differential Equations (321 or equivalent) is preferred. Programming or computational experience is also preferred but not required.