

# Department of Mathematics and Statistics Colloquia

## *Student Research Presentations*

(Monday, April 20 at 3:45 pm in Roop 103, refreshments at 3:30)

**Title:** Statistical Modeling of James Spiny mussel (*Pleurobema collina*): A Longitudinal Study

**Speaker:** Marisa Draper (Faculty advisor: Lihua Chen)

**Abstract:** The James Spiny mussel (*Pleurobema collina*) is endangered and is at the top of Virginia's conservation list. The James Spiny mussel plays an important role in the environment by filtering and cleaning water, and providing shelter and food for other macroinvertebrates. In addition to being rare and cryptic, mussels have a complicated life cycle that makes conservation efforts difficult. The goal of this research is to use mark-recapture data from field studies to fill knowledge gaps of James Spiny mussel that can help inform an action plan for conservation. In particular, this research focuses on identifying environmental and biological factors that may influence the detection probabilities of the James Spiny mussel.

**Title:** Outlier Detection in Regression Trees

**Speaker:** Nick Granered (Faculty advisor: Sam Prins)

**Abstract:** Classification and regression trees (CART) are an alternative to classical regression models. They do not have the same set of assumptions, they fit piecewise linear models, and are easily interpreted. We began with the usual goal of building models for predicting a biological metric such as turbidity in a stream using a variety of geographical predictors, with the ultimate objective of using these to detect streams that were outliers. The hypothesis is that these outliers are due to underlying Karst geology.

The talk will concentrate on a method we developed to detect outliers in regression trees using repeated cross-validations and the average deviance across the cross-validated trees. We compared this to the method for outlier detection in Cheze & Poggi (2006) and found that our new method performs very well in attempting to identify certain types of outliers.

Preliminary results using this approach on data from the Friends of the Shenandoah Valley identifies several sites as outliers using at least one metric, along with several other sites exhibiting some outlier behavior that we aren't completely sure how to interpret yet.

**Title:** Analyzing Error Associated with Modeling a Swimming Worm

**Speaker:** Cassie Hartley (Faculty advisor: Eva Strawbridge)

**Abstract:** This research examines a method of modeling the fluid movement associated with a swimming 1 mm long nematode (*C. elegans*). By modeling the worm as a sine curve,  $\sin(2\pi x - \omega t)$ , the induced fluid flow around the worm can be studied using the method of regularized Stokeslets. As with any numerical method, there is an error associated with this modeling process. This error is the focus of my research. I compute the arc length of the worm using multiple methods to examine whether this has any impact on error in this modeling process. I compare the output of each in order to study sources of error in our calculations of the movement of the artificial worm. I found that the two methods yielded different results.

**Title:** Oh Rats... Statistics: Relationship between Renin-Angiotensin System and Sex

**Speakers:** Katelyn Thomas and Christophe Langouet (Faculty advisor: Nusrat Jahan)

**Abstract:** Renin-angiotensin is a blood pressure regulator and plays an important role in the development of cardiovascular disease and kidney damage. Previous studies indicate a higher frequency of men developing renal damage potentially related to the renin-angiotensin system (RAS). The Bauer et al. (2011) microarray study seeks to find the impact of sex and gene expression on renal damage development. We analyzed their gene expression data, controlling false discovery rate at 0.01 level. Significant genes were further analyzed with a two-way ANOVA to investigate the effects of sex on the RAS system. Cluster analysis was performed on the significant genes to investigate genomic interrelationships.