

Undergraduate Research Seminar
Wednesday, September 3rd, 2014 5:30 p.m.
Leigh 309

Matias Kaplan

“Programmable RNA recognition and cleavage by CRISPR/Cas9”

The CRISPR-associated protein Cas9 is an RNA-guided DNA endonuclease used by bacteria to defend against phage infection. Cas9 first recognizes a short DNA sequence, the protospacer adjacent motif (PAM), next to the 20-nucleotide target sequence on the non-target DNA strand. Importantly, Cas9 has been reengineered to serve as a powerful new genome editing platform. Retargeting Cas9 to target RNA was thought to be a useful but unlikely goal. Wild type Cas9 finds its targets by first interrogating double stranded DNA (dsDNA) for short DNA sequences, protospacer adjacent motif (PAM) which are found next to and on the opposite strand as the 20-nucleotide target. Cas9 is shown to target site-specific single-stranded RNA (ssRNA) by presenting the PAM in trans as a separate DNA oligonucleotide, a PAMmer. PAMmers can be designed to bind or cleave RNA targets while avoiding DNA targets. In the study we show the ability to isolate specific mRNA from cells. These results demonstrate the ability to create programmable tagless RNA targeting systems.

Alyssa Egnew

“Analysis of Damage Patterns in Residential Structures after the 2011 Joplin, MO Tornado”

On May 22, 2011, an EF-5 tornado struck Joplin, Missouri, resulting in 161 fatalities and over 1,000 injuries¹. The UF Wind Hazard Damage Assessment (WHDA) Group conducted a damage survey after the event, documenting damage to over 1,300 structures using geo-tagged photographs. The survey found that over 80% of the damage was due to EF0-EF2 wind speeds, demonstrating that if weaker buildings had been identified and retrofitted, the losses would have been significantly reduced. The objective of this research is to create a statistical model that can predict tornado damage in residential structures based on a given set of predictor variables (year built, square footage, appraised value, distance from tornado centerline, EF rating, and wind speed). This model would be used to identify at-risk homes that could be structurally reinforced to improve their performance during a tornado outbreak. Using the guidelines of the Enhanced Fujita Scale (EF-Scale), each geo-tagged image collected during the survey was assigned an EF rating and degree of damage rating, in addition to specific failure mechanism labels based on observed damage (single or partial wall removal, total roof uplift, etc.). Additionally, addresses and parcel IDs were assigned to the images using Google Streetview®, Jasper County GIS and Pictometry Online®. This set of parcel IDs was then used to collect the house characteristics from the Jasper County Tax Assessor’s Office. Once all of the data was collated, and the distance from tornado centerline determined using the GPS coordinates of each home, the data was modeled and analyzed using Matlab R2013b and Minitab 15. Preliminary analysis revealed that the damage on the outskirts of the tornado path tends to be concentrated on smaller, less expensive homes, and that

the mean age of damaged homes increases with distance from the tornado. Future analysis will involve multiple linear regression models with degree of damage as the response variable, and a larger sample size (300) of aforementioned predictor variables.