UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2013 Mary Gates Hall

Online Proceedings

SESSION 1T

MOLECULAR AND CELLULAR BIOLOGY

Session Moderator: Hannele Ruohola-Baker, Biochemistry
111 JHN
1:15 PM to 2:45 PM
* Note: Titles in order of presentation.

Patterns of Importin Evolution in *Drosophila*
Emily Hsieh, Senior, Biochemistry, Biology (Molecular, Cellular & Developmental)
Levinson Emerging Scholar, Mary Gates Scholar, Undergraduate Research Conference Travel Awardee
Mentor: Harmit Malik, Basic Sciences (UW Genome Sciences), Fred Hutchinson Cancer Research Center
Mentor: Nitin Phadnis, Division of Basic Sciences, Fred Hutchinson Cancer Research Center

The nuclear transport pathway performs the fundamental function of moving cargo between the cytoplasm and nucleus in all eukaryotes. Nuclear transport is carried out through a highly conserved mechanism across all eukaryotes. Yet, in *Drosophila*, several components of the nuclear transport apparatus, including importins, evolve rapidly under positive selection. Genetic conflict with selfish elements has been suggested as a possible cause for this pattern of rapid evolution. Here, we present a comprehensive phylogenomic analysis of importin gene evolution in *Drosophila*. Importins are adapter molecules that directly mediate the transport of cargo into the nucleus. Our analysis reveals a recurrent pattern of gain and loss of importin paralogs across independent lineages of *Drosophila*. Interestingly, we discovered that almost all new copies of importins have acquired a testes-specific expression pattern since their birth through gene duplication. This pattern of repeated gains of testes-specific copies of importins suggests a function in suppressing genetic conflicts such as segregation distortion in the male germline. Segregation distorters such as *SD* in *Drosophila melanogaster* act by impairing nuclear transport in the testes. We are currently performing functional tests for the hypothesis that an increased dosage of these testes-specific importins may serve a role in suppressing segregation distortion in the male germline by restoring nuclear transport during spermatogenesis.

POSTER SESSION 3

MGH 241, Easel 146
2:30 PM to 4:00 PM

Evolution of Meiotic Drive in Pure Species of Fission Yeast
Sapna Jennifer (Sapna) Saini, Senior, Biology (Physiology)
Joel William (Joel) Hummel, Senior, Biology (Physiology)
Mentor: Sarah Zanders, Basic Sciences
Mentor: Harmit Malik, Basic Sciences (UW Genome Sciences), Fred Hutchinson Cancer Research Center

In most eukaryotic organisms, sexual reproduction is a critical component of the life cycle. Through meiosis, diploid cells containing two copies of each chromosome divide to produce genetically diverse haploid gametes (*e.g.* sperm) that contain one copy of each chromosome. This process is fundamental in sexual reproduction. Generally, meiosis results in a 50:50 transmission of heterozygous alleles into gametes. For example, human males make approximately 50% sperm with an X chromosome and 50% with a Y chromosome. Because only one copy of each chromosome can contribute to a given offspring, there is an evolutionary pressure on alleles to compete for preferential inclusion in gametes. Sometimes alleles can "cheat" to gain a greater than 50% transmission through meiosis. This is known as meiotic drive. Meiotic drive could have significant implications: altering fertility, speciation, and the evolution of chromosomes in eukaryotic organisms. For example, competition between alleles may be driving the rapid evolution of chromosome segregation factors acting during meiosis and mitosis, potentially driving chromosome segregation away from a theoretical ideal. Though meiotic drive has not been well understood due to limited model systems, we have developed a novel system utilizing genetically tractable fission yeast *S. pombe* and *S. kambucha*, to investigate meiotic conflicts between competing alleles. In *S. pombe*, heterozygous alleles are widely thought to segregate fairly in meiosis, suggesting that active meiotic drive loci are not present in this organism. We have found that silenced meiotic drivers can be de-repressed in aged germ cells, leading to greater than 90% transmission of certain alleles through meiosis. This provides experimental evidence in support of the evolution of cheating in meiotic processes that could ultimately result in decreased fertility amongst eukaryotic organisms, including humans.