Program/Abstract # 15
Eco-Evo-Devo: Lessons from Semi-Aquatic Bugs
Abderrahman Khila [a,b], Ehab Abouheif [a], Locke Rowe [b]
[a] *Mcgill University, Montreal, PQ, Canada*
[b] *University of Toronto, Toronto, ON, Canada*

The integrative field of ecological evolutionary developmental biology or "Eco-Evo-Devo" attempts to understand how the environment interacts with genes during development to generate phenotypic diversity. Semi-aquatic bugs have long been used as models to study behavior, ecology, evolution, as well as biomechanics. Here, we demonstrate that we can perform single, double, and multiple gene knockdown using RNAi across multiple species of semi-aquatic bugs. We combine this feature together with previous knowledge of their ecology and evolution to study the developmental genetic and adaptive basis of appendage diversity between different segments, sexes, and species in this group. We will present the results from two studies: one study where we have identified genes that control leg length differences between segments and species, and another study where we identify genes involved in the sexual conflict between males and females. These two studies show the great promise that semi-aquatic bugs hold as powerful model systems for eco-evo-devo studies.

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Program/Abstract # 16
A Colon Homologue in Elasmobranchs? Evidence
Nicole Theodosiou [a], Alyssa Simeone [b]
[a] *Union College Dept of Biological Sciences, Schenectady, NY, USA*
[b] *Union College, Schenectady, NY, USA*

The transition from aquatic to terrestrial life approximately 370 mya presented inhabitants with the challenge of maintaining water homeostasis and preventing desiccation on land. In terrestrial vertebrates, the colon plays an important role in maintaining fluid balance. We have evidence of a structure homologous to the colon in an elasmobranch. The distal spiral intestine of the skate (L. erinacea) contains flattened villi, high concentrations of acid mucins and the water specific channel protein AQP4, all markers of the colon in land vertebrates. Water absorption occurs at an increased rate in the distal spiral intestine, compared to the proximal intestine. In addition, Hoxa13 and Hoxd13 are expressed in the developing skate gut, suggesting conserved roles for Hox genes in patterning the early colon. The evidence of a rudimentary colon in the skate is novel, since the formation of a colon was considered to be an adaptation to the evolution of terrestrial life and not a marine novelty. We propose that within the vertebrate lineage, the terrestrial vertebrate colon evolved as an expansion of the distal spiral intestine.

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Program/Abstract # 17
Wnt signaling in the cnidarian Nematostella vectensis: Insights into the evolution of gastrulation
Naveen M. Wijesena [a], Shalika Kumburegama [b], Ronghui Xu [c], Athula Wikramanayake [b]
[a] *University of Miami Biology, Coral Gables, FL, USA*
[b] *Department of Biology, University of Miami, Coral Gables, FL, USA*
[c] *University of Hawaii, Honolulu, HI, USA*

The evolution of gastrulation was arguably the key step that enabled metazoan diversification. The developmental mechanisms that induced archenteron formation during gastrulation are unknown, but one crucial step was likely the co-option of a localized molecular asymmetry that was present in ancient embryos. An increased understanding of development in early diverging metazoan taxa may provide insights into the origins of these mechanisms. Here, we show that initial archenteron invagination in Nematostella requires a maternally expressed core component of the Wnt/Planar Cell Polarity (PCP) pathway, NvStrabismus (NvStbm). NvStbm is localized to the animal pole throughout early development and becomes restricted to the apical side of invaginating bottle cells at the blastopore. Antisense morpholino-mediated NvStbm-knockdown blocked archenteron invagination, but had no effect on Wnt/ß-catenin signaling-mediated endoderm cell fate specification. Conversely, blocking ß-catenin nuclearization blocked endoderm specification but not primary archenteron invagination, showing that initial archenteron invagination can be uncoupled from endoderm specification in Nematostella, providing evidence for the independent evolution of these two processes. We will also present experimental evidence for the coordination of both Wnt/β-catenin and Wnt/PCP signaling by two other localized Wnt pathway components, NvFlamingo and NvFrizzled10. We propose a model for the evolution of gastrulation, where asymmetric accumulation and activation of Wnt pathway components at the animal pole of a blastula-like urmetazoan induced endoderm specification and the cell shape changes that led to initial archenteron formation. Supported by NSF funding to AHW.

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