45. Josiah Valk, Calvin College **Biology**

(Co-Authors: Ryan M. Bebej, PhD)

"Interpretation of Tail Function in Fossil Cetaceans through Multivariate Analyses of Caudal Vertebrae in Modern Mammals"

One of the keys to understanding the evolution of cetaceans involves elucidating the details of how their derived swimming mode evolved from that of a four-legged, terrestrial ancestor. The development of a specialized tail fluke allows for efficient generation of thrust and is the hallmark of modern cetaceans, but little is known about exactly when and how the fluke evolved. All 21 caudal vertebrae are known for the fossil archaeocete Maiacetus inuus, making it a representative model for the earliest whales. Principle components analysis was used to analyze nine measurements for the first four caudal vertebrae, as well as relative length and width-height ratio of the last nine, in comparison with a wide range of semi- and fully aquatic modern mammals. The first four caudal vertebrae of Maiacetus are consistent with a highly flexible tail. However, the proportions of the terminal caudal vertebrae do not indicate a well-defined tail fluke as they do in basilosaurids and modern cetaceans. Thus, the tail of Maiacetus seems truly intermediate in form and function between terrestrial and aquatic mammals. It appears to have had significant epaxial musculature for controlling its movement, and though a well-defined fluke may not have been present, a tail with a poorly defined nascent fluke cannot be ruled out. Maiacetus represents an early cetacean that likely used its muscular tail to supplement paddling of the hind limbs for generating propulsion during swimming.

46. Erika Steensma, Calvin College **Biology**

(Co-Authors: Dr. Daniel Michele)

"Mechanically-Activated Nitric Oxide Signaling in Duchenne Muscular Dystrophy"

Duchenne Muscular Dystrophy (DMD) is a fatal genetic disorder which causes severe muscle weakness, as well as dilated cardiomyopathy. On a cellular level, DMD is characterized by a lack of dystrophin, a protein of the dystroglycan protein complex which is hypothesized to regulate neuronal nitric oxide synthase (nNOS) activity. Mouse cardiomyocyte models have displayed a disruption in mechanically-activated nNOS activity upon the loss of dystrophin, which could be a source of DMD-related cardiomyopathy as nitric oxide regulates cardiac contractile functioning. However, as cardiac systems between mice and humans vary greatly, there is a need for nitric oxide signaling to be tested in human cardiac tissue. Therefore, nitric oxide synthase activity in response to mechanical stimulation was examined in human induced pluripotent stem (IPS) cell-derived cardiomyocytes. It was determined that mechanical stimulation is useful in regulating nitric oxide production in these cells, although the pathways by which this occurs are not certain. Further understanding of these signaling pathways could be useful in determining therapeutic approaches to restoring nitric oxide production, and thus cardiac function, in DMD patients.

47. Sophie Bennett & Heather Taylor, Grand Valley State University **Biology**

(Co-Authors: Dr. Alexandra Locher and Dr. Todd Aschenbach)

"Modeling the presence of exotic invasive shrubs in West Michigan Forests based on habitat characteristics"

The eradication of invasive species costs the U.S. government over 1 billion dollars annually. In order to more efficiently fight their spread, predictive models can be constructed to guide land managers to invasive hot spots. Forest type, canopy cover, soil properties, past treatment, and the presence of other invasive species were investigated as possible predictors for the presence of autumn olive (Elangus umbellatus), honeysuckle (Lonicera maakii, L. morrowii, or L. tatarica), and multiflora rose (Rosa multiflora) in West Michigan forests. A predictive map was produced that reflected current distributions of these species as well as the possibility of future spread. The viability of predictive models was further supported.

WM RUGS

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Saturday, November 15, 2014

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