TCS Awards At SICB Austin, Texas, Jan 3-7, 2014

The Crustacean Society (TCS) is pleased to announce the winners of the Best Student Paper and Poster Competition held during the annual meeting of the Society for Integrative and Comparative Biology, January 3-7, 2014, in Austin, TX. There were 17 high quality competitors. The Best Student Oral Presentation Award was presented to **Suzanne Cox** (University of Massachusetts, Amherst) for her talk entitled, "Does cavitation limit the speed of mantis shrimp?" (with co-author S. N. Patek). The Best Student Poster Award was presented to **Evelyn Dickinson** (Bowdoin College) for her poster entitled "Cardiac muscle in *Homarus americanus* responds differently to loading in transverse and longitudinal directions" (with co-authors A. S. Johnson, O. Ellers, and P. S. Dickinson). Each award consists of a certificate, US$100 cash, and a one-year membership in The Crustacean Society, including subscription to *The Journal of Crustacean Biology*. TCS thanks those members who served as judges and all student participants.

Christopher B. Boyko
Program Officer

Does cavitation limit the speed of mantis shrimp?

Cox, S. M., & S. N. Patek (University of Massachusetts, Amherst & Duke University, USA)
scox0@bio.umass.edu

With one of the fastest feeding strikes in the animal kingdom, mantis shrimp strike prey with a raptorial appendage that can reach velocities of 30 m/s with accelerations of 1x105 m/s2 in water. Fast movement can lower local pressure causing cavitation bubbles that collapse and emit shockwaves powerful enough to erode holes in metal. Some mantis shrimp generate cavitation while using hammer-shaped appendages to smash hard-shelled prey. Cavitation bubbles form upon impact with their prey and may enhance prey processing. However, cavitation is rarely produced during the extremely fast rotation preceding impact, a time when cavitation bubble collapse would damage the exoskeleton and not provide benefits. Thus, mantis shrimp may have features that reduce cavitation during forward rotation, yet little is known about the conditions for cavitation formation in biological systems. Here we test whether mantis shrimp operate at an upper boundary of speeds that do not produce cavitation. We measured the maximum speeds for 7 individual *Odontodactylus scyllarus* striking under naturalistic conditions and noted cavitation presence before impact. In addition, *O. scyllarus* appendages (10 individuals) were attached to a mechanical model of the mantis shrimp strike called 'Ninjabot' and rotated at and above animal strike speeds. When rotated at the same and higher speeds than in natural animal strikes, the appendages cavitated regularly. A stainless steel cylinder of same scale as *O. scyllarus* appendages rotated with Ninjabot also cavitated above, at and well below mantis shrimp maximum strike speeds. These results suggest that cavitation is difficult to avoid in these conditions and mantis shrimp may indeed be circumventing cavitation through shape and kinematics.

Cardiac muscle in *Homarus americanus* responds differently to loading in transverse and longitudinal directions

Dickinson, E., A. S. Johnson, O. Ellers & P. S. Dickinson (Bowdoin College, USA)
edickins@bowdoin.edu

Central pattern generators (CPGs) are neural networks that generate stereotyped outputs, which drive rhythmic behaviors. CPGs can be modulated by neurotransmitters and feedback systems; in *Homarus americanus*, the neurogenic heart is controlled by a CPG: the cardiac ganglion, which generates bursts of action potentials that drive cardiac contractions. There are over 80 different identified neurotransmitters in the lobster; however, the effects of the stretch feedback system on CPG are less well understood. Since the heart is naturally loaded in three dimensions by pressure, uniaxial and biaxial (longitudinal and transverse) stretches of 2.5 mm were imposed on the heart muscle to understand the effects of stretch in cardiac modulation. The active force (force of contraction) increased in response to both transverse and longitudinal uniaxial stretching; however, the increase in force of contraction was greatest under transverse loading. The passive forces increased in response to both transverse and longitudinal uniaxial stretching, but longitudinal loading resulted in the greatest increase. Transverse but not longitudinal uniaxial loading had a state-dependent effect on frequency. Biaxial loading increased both the force of contraction and the passive forces during stretch and additionally had a state-dependent effect on frequency. These initial results suggest that the different muscle characteristics in the longitudinal and transverse direction, in conjunction with the stretch that occurs during normal cardiac function, is important in determining overall contraction parameters in the heart. Supported by NSF Grant IOS−1121973, and NIH Grants 5P20RR016463−12 and 8P20GM103423−12.