1135-AA-2014 **Tim Lewis*** (tjlewis@ucdavis.edu), Department of Mathematics, University of California, One Shields Avenue, Davis, CA 95616. *Limb Coordination in Crustacean Swimming: Neural Mechanisms and Mechanical Implications.*

Despite the general belief that neural circuits have evolved to optimize behavior, few studies have clearly identified the neural mechanisms underlying optimal behavior. The distinct limb coordination in long-tailed crustacean swimming and the relative simplicity of the neural coordinating circuit have allowed us to show that the interlimb coordination in crustacean swimming is biomechanically optimal and how the structure of underlying neural circuit robustly gives rise to this coordination. Specifically, we use a *computational fluid dynamics* model to demonstrate that the crustacean stroke pattern is the most effective and mechanically efficient paddling rhythm across the full range of biologically relevant Reynolds numbers. We then use *coupled oscillator theory* to show that the organization of the neural circuit underlying swimmeret coordination provides a robust mechanism for generating this stroke pattern. Our result provide a concrete example of how an optimal behavior arises from the anatomical structure of a neural circuit. Furthermore, they suggest that the connectivity of the neural circuit underlying limb coordination during crustacean swimming may be a consequence of natural selection in favor of more effective and efficient swimming. (Received September 25, 2017)