Skeletal Muscle: From Molecular Motors to Animal Movement

Skeletal muscle converts chemical energy from food into movement. It is the biological motor that translates signals from the nervous system into interactions with the environment. In contrast to many built systems, muscles use molecular scale motors. These motors are each capable of movements of just 0.00001mm. Yet working together, they can generate limb movements 10 million times larger. This amplification is made possible by the structural elements that packages these molecular motors into what we recognize as muscle tissue. How muscles perform during movement is likely to be the result of the interaction between molecular motors and these structural elements. This interaction will depend on muscle activation level; structural elements are likely to have more effect when fewer motors are turned on. Animals vary activation level widely, enabling them to use muscle for everything from subtle facial expressions to powerful leaps. However, our current muscle models are based solely on the properties of the molecular motors. Understanding how the interaction between molecular motors and structural properties affects performance is a major challenge in muscle physiology, and essential to our ability to understand, predict and replicate animal movement.