Trondheim ESMAC Conference abstract

Basic Muscle Mechanics: from single Sarcomeres to Whole Muscle Function in Health and Disease.

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The molecular mechanisms underlying muscle contraction, as well as the function of individual muscles during human movement are ill understood. In fact, even the most basic properties, such as the force-length and force-velocity relationships are not known for most human muscles, and if they are known, it is for the most controlled, maximal, steady state conditions. We have attempted to gain further insights into how muscles work during human movement by elucidating the details of muscle contraction on the sarcomere, myofibril, single fibre, isolated muscle and intact muscle level. We demonstrated that the structural protein titin appears to play a major role in force regulation of muscles, especially in actively lengthening (eccentric) muscles. We also studied muscles in human disease, specifically in children with cerebral palsy (CP), in clinical and pre-clinical models of knee osteoarthritis (OA), and in models of diet-induced (high fat, high sucrose) diets. We identified severe side effects of botulinum toxin type A (Botox) injections into target (as is done routinely in patients with CP) and non-target skeletal muscles. We found that muscle weakness is an independent risk factor for the onset and progression of knee OA, and found increased fat deposition and fibrosis in fast (but not slow) skeletal muscles with obesity. These results indicate the high adaptability of skeletal muscles, the potential damage of muscles in disease, and the important mechanical and metabolic role of muscles in health and disease.

Lecture: My lecture will focus on presenting aspects of basic muscle mechanics, muscle function and muscle properties. These aspects will then be evaluated in a variety of disease models likely including CP, knee OA and diet-induced obesity.