Presented by Sean Collins, PT, ScD

Models of muscle physiology are fundamental to movement and physical therapy practice since they provide a guide to clinical decisions in the face of uncertainty. Well known and long standing examples include the sliding filament model giving rise to the length tension model and how this influences muscle testing; the force-velocity model helps us consider the muscle power spectrum; the three-system model of muscle energetics helps us divide our exercise prescriptions into power, strength, and endurance; and models of sensory motor reflexes guide our understanding of neuromuscular stretching approaches. These models have stood the test of time, however, a host of new models about muscle have been experimentally verified that provide explanations for what we see in practice; opportunities for innovation; and improvements to our understanding of movement as medicine. Developments in our understanding of previously considered passive proteins dystrophin and titin propose a new dynamic role for these proteins. Expanding our prior model of overload for exercise response to a more specific understanding of the molecular signal transduction events underlying muscle adaptation offers opportunity to consider signal amplification through the strategic use of combined therapies (examples include blood flow restriction, intermittent hypoxia, and instrument assisted mobilization). Muscle is now understood to not only receive hormonal signals, but to itself be an endocrine and paracrine organ that is involved with cross talk involved in system wide physiological regulation. The gut micro biome has also been connected to the molecular processes of muscular adaptation (both hypertrophy and atrophy). Finally, insights into the molecular mechanisms of myostasis provide a rationale for the commonly experienced phenomenon of muscle memory. This presentation will review and update attendees' mental model of muscle physiology through a discussion of insights and opportunities for current and future practice of physical therapy where movement is medicine.

Objectives:
Explain how models of muscle physiology inform physical therapy practice.

Describe the current models of muscle contraction, excitation, regulation and energetics and the associated practice implications of these models.

Describe the basic steps and molecular mediators in muscle adaptation through signal transduction (hypertrophy, atrophy and repair) and how signal amplification through adjunctive approaches can augment exercise prescriptions to improve muscle function.

Describe the muscle as an endocrine and paracrine organ and the therapeutic implications of these system wide signal pathways.

Describe the gut-muscle axis model that bi directionally connects muscle function and the gut microbiome as a confounding factor in a wide range of situations.

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Sean Collins is a Professor of Physical Therapy at Plymouth State University where he teaches clinical physiology. He is past Editor of the Cardiopulmonary Physical Therapy Journal and was awarded the Linda Crane Memorial Lecture in 2018 for making outstanding and enduring contributions to the profession of physical therapy by the Academy of Cardiovascular and Pulmonary Physical Therapy. He has taught physiology at the BS, MS and PhD level at three different universities and is currently working on a book titled: Clinical Physiology: A muscle centered approach.