



Highlighted Topics series: Plasticity in Skeletal, Cardiac, and Smooth Muscle

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Highlighted Topics series: Plasticity in Skeletal, Cardiac, and Smooth Muscle

This issue of the *Journal of Applied Physiology* introduces a new *Highlighted Topics* series on "Plasticity in Skeletal, Cardiac, and Smooth Muscle." Muscle plasticity forms a major basis for physiological adaptation to our external environment. Examples of muscle plasticity abound, from exercise adaptations, to the effects of a microgravity environment, to the aging process, and to an assortment of pathophysiological conditions. Muscle plasticity can be both beneficial and maladaptive. Through research on the underlying mechanisms of muscle plasticity, we will be able to develop better training processes to improve human performance as well as effective therapies to counter maladaptive changes.

In this issue, Drs. Baldwin and Haddad offer a mini-review focusing on "Effects of different activity and inactivity paradigms on myosin heavy chain gene expression in striated muscle." Their work on the plasticity of myosin heavy chain isoform expression in skeletal and cardiac muscles has led to a better understanding of the influence of hormones, unloading, and neuroactivation on the expression of key contractile proteins. This review emphasizes muscle plasticity as an integrative function relating the influence of internal and external factors. Also in the January issue, Drs. Halayko and Solway explore "Molecular mechanisms of phenotypic plasticity in smooth muscle cells." A novel integrated hypothesis is presented proposing a central role for the monomeric Rho GTPase family in regulating both gene transcription and structural remodeling of the contractile lattice. This model accounts for the unique mechanical adaptation and plasticity of smooth muscle.

In the February issue, Dr. Reid examines "Redox modulation of skeletal muscle contractions: what we know and what we don't." Skeletal muscle continually produces reactive oxygen and reactive nitrogen species. Both are essential for normal force production, but either, in excess, can compromise contractile function (e.g., during fatiguing exercise or inflammatory disease).

There are three mini-reviews in the March issue. Drs. Housmans and Potter examine the "Pathophysiology

of cardiac muscle contraction and relaxation as a result of alterations in thin filament regulation" in the first review. Cardiac muscle contraction depends on the interactions of thin and thick filament proteins. Familial hypotrophic cardiomyopathy (FHC) mutations affect these interactions and induce functional defects that impair normal contractility. Dysfunctional properties of the FHC mutation include altered Ca^{2+} sensitivity, changes in ATPase activity, changes in force and velocity of shortening, and destabilization of the contractile complex.

The other two mini-reviews in March explore plasticity in muscle energetics. In the first mini-review, "Contractile activity-induced mitochondrial biogenesis in skeletal muscle," Dr. Hood explores the physiological consequences of increased muscle mitochondrial content and the essential role of activity-dependent plasticity in exercise. He also emphasizes recent advances in our understanding of the molecular basis of mitochondrial biogenesis. In the second mini-review, "Plasticity and energetic demands of contraction in skeletal and cardiac muscle," Drs. Sieck and Regnier examine factors affecting ATP consumption during cross-bridge cycling, an energy demand that must be met by ATP production. An imbalance between energy supply and demand may be one of the causes of muscle fatigue and contractile failure.

Muscle cells display a tremendous ability to adapt to new levels of gene expression in response to a wide range of environmental perturbations and clinical conditions. There is growing appreciation for the crucial role of muscle plasticity in overall health and disease. The introduction of cellular and molecular techniques has accelerated our understanding of basic mechanisms underlying muscle plasticity, and future genomic studies may provide additional insight regarding the diversity of muscle plasticity. Clearly, this is an important area in applied physiology, and it is the hope of the Associate Editors and myself that this series will promote further research in this exciting field of study.

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