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Guest Editorial

Hot topics in muscle metabolism and adaptation

This special issue highlights comprehensive reviews and researches on topics in fundamentally important areas of skeletal muscle physiology.[1–6] The most important adaptive response of skeletal muscle to exercise, particularly resistant exercise, is increased protein synthesis, which is critical for promoting muscle hypertrophy and/or preventing atrophy. This process plays an essential role in promoting and maintaining skeletal muscle contractile and metabolic functions.

The review by Tinline-Goodfellow et al.[2] elegantly reviewed the literature on the regulation of muscle protein synthesis with a focus on the mechanistic target of the rapamycin (mTOR) complex 1 (mTORC1) pathway. The authors not only provided a comprehensive review of findings in support of the indispensable role of mTORC1 in promoting muscle protein synthesis in response to growth factors, nutrients and mechanical stimuli, but also brought our attention to the role of skeletal muscle periphery region, including recruitment of mTORC1 to this region, in promoting protein synthesis. They dived deep into the possible molecular mechanisms, linking the spatial specificity of skeletal muscle anabolism to substrate availability, signaling regulation as well as protein translation. This review provides a contemporary understanding of the beauty of the regulatory system for skeletal muscle mass control in our body.

Islam and Gillen's review[3] dealt with another equally important area of skeletal muscle physiology: exercise-enhanced insulin sensitivity and glycemic control. They focused on the exciting development of two similar exercise modes, high-intensity interval training (HIIT) and sprint interval training (SIT). These two exercise modes have recently gained much attention due to their short duration and high efficacy in achieving many of the health benefits of traditional moderate-intensity continuous training. The article presented unequivocal evidence that HIIT and SIT either in an acute or chronic setting are equally, if not more, effective in promoting insulin sensitivity in both healthy individuals and patients with metabolic syndrome. The authors provided a balanced review of the evidence in supporting the role of some molecular regulators, but correctly pointed to the lack of the scientific evidence of causal links. The review also raised a question about blunted glycemic benefits of HIIT and/or SIT in females and the need for more studies to improve the understanding of how intense interval training improves insulin sensitivity.

Finally, Koopmans et al.[1] brought us to another level of complexity of muscle adaptation with a focus on the role of myonuclei. The review provided a much-needed detailed description of the findings of how myonuclei, resident or satellite cell-derived, undergo transcriptomic, epigenetic, mobility and morphological regulations in response exercise stimuli in vivo. Intriguingly, the review presented evidence supporting that myonuclei may have the memory of past training adaptations. The authors postulated that this memory is likely due to epigenetic modification either by DNA methylation or myomiR modification.

These articles presented the most updated evidence in the research field regarding skeletal muscle adaptation to exercise training dealing with three fundamentally important questions related to the control of protein synthesis, glucose metabolism and gene regulation in myonuclei, hopefully provoking more questions and stimulating more research in exercise-induced adaptations in skeletal muscle.

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