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Tuesday Lab

Independent Project-Exercise Physiology Article

In the article, “The Limits of Exercise Physiology: From Performance to Health”, by Brendan M. Gabriel and Juleen R. Zierath, we explore the current efforts of scientists to clarify the advantages of exercise for health and how developments in molecular biology could lead to more individualized approaches to therapeutic exercise physiology. Frequently exercising improves almost all organ systems in the body, which brings a wide range of health benefits, not only physically but mentally. Exercise is a fundamental intervention that has been clinically demonstrated to be effective, affordable, and able to postpone or even completely eliminate the health consequences associated with metabolic diseases. Exercise is also known to enhance a person's learning and memory function through the upregulation of neurotrophic molecules in the brain. The fact of the matter is that metabolic illnesses like type 2 diabetes and obesity are on the rise, and taken as a whole, they represent a serious threat to present day society. Even if there are now pharmacological treatments available to treat metabolic illnesses, many clinical success measures brought about by regular exercise are on the same level with or if not higher than those brought about by medications and insulin therapy. While it is safe to say that keeping a healthy diet keeps you thin and exercise keeps you healthy, there are still a lot of unanswered questions about the intricate biology underlying the variability in how individuals and groups respond adaptively to these regimes. Identifying the mechanisms through which regular exercise training modifies human physiology in both individuals and communities will eventually result in the discovery of molecules, pathways and novel treatments that impart the advantages of exercise, such as enhanced insulin sensitivity, and reduced aging related loss of strength and power.

It's interesting to note that the metabolic response to an extended exercise session has been compared to the results of several days of starvation, with reduced glycogen stores a

higher reliance on fatty acids. This suggests that both scenarios share a homeostatic mechanism to reduce disruptions in glucose homeostasis and preserve the brain's supply of glucose. This would also imply that the adaptive response to exercise training could be influenced by training with high or low nutrition availability. An emerging topic in exercise science is how different diets affect the molecular basis of the adaptive response to exercise. New paradigms around the idea of training in low glycogen states to force the muscle to rely on lipid oxidation which develops based on the energy requirements during exercise. The idea is to potentially enhance and extend the time course of activation of metabolic genes and their target proteins. The end goal would be to increase the transcriptional and enzymatic machinery in order to improve mitochondrial biogenesis and functional work capability. Today we now recognize that several pathways work in tandem with exercise to regulate the metabolic response and tissue remodeling, this is a large portion of biology that has been looked into.

Researchers are now able to examine physiological, cellular, and molecular adaptations to exercise with a wide range of instruments at their disposal thanks to the evolution of exercise physiology, but while exploring this, it is important for them to evaluate scientific problems from a wider perspective. The science of studying limits is typically exercise physiology, the limitations of peak performance, the limits of exercise health benefits, or the limits of obstacles/barriers to increasing exercise among the general public, the limitations of these groups can guide translational research. Endurance athletes have a high intramuscular lipid content and an even higher insulin sensitivity, with this research we have gained a better understanding of the affects endurance training has on our skeletal muscle, in addition to excess muscle lipid accrual and insulin resistance in type 2 diabetes.

The control of all three of the traditional physiological parameters that restrict endurance performance critically depends on mitochondrial function. Proteins linked to the formation of mitochondrial proton motive force are usually found in the outer regions of the mitochondrial reticulum, whereas proteins that use the proton motive force to produce ATP are found in the

inferior of the mitochondria. It is reasonable to wonder what else remains unclear about the metabolism of skeletal muscle in light of the recent progress made from the research of exercise physiologists. In particular, it is significant that the recognition of muscle as an interconnected network of energy synthesis and distribution, as opposed to a segmented system, has led to the development of several fundamental concepts of skeletal muscle metabolism. In the future, exercise physiologists might try and investigate muscle metabolic activity using an increasing number of non-invasive methods, which could provide more research for any unanswered questions.

In conclusion, not only does exercising strengthen our physical and mental health, it also plays a crucial role in preventing our bodies from getting any metabolic health issues like type 2 diabetes and obesity which are the main metabolic illnesses that people have in society today. In addition to exercising, not consuming enough food has major effects on our body weight and energy as well. When a person does not receive the correct amount of food to fuel the body, the lack of nutrients can lead to many different types of health issues. Psychologists' growing interests have inspired them to explore the boundaries of performance and the range of responses to exercise training in terms of boosts in oxygen consumption, insulin sensitivity, mitochondrial function, and muscle function and strength. Maintaining good dietary intake and regular exercise may improve the body's insulin sensitivity and energy homeostasis, resulting in prevention of metabolic diseases. Society however needs to be on board with achieving these health goals and physiologists need to stay on board with their research and get more answers that may be still questioned today.

Sources Page

Gabriel, Brendan M, and Juleen R Zierath. “The Limits of Exercise Physiology: From Performance to Health.”
***GoogleScholar*.https://www.cell.com/cell-metabolism/pdf/S1550-4131(17)30223-1.pdf**