Martin Fluck, J Mol Genet Med 2015, 9:3
http://dx.doi.org/10.4172/1747-0862.S1.005

OMICS International
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International Conference and Exhibition on

Molecular Medicine and Diagnostics

August 24-26, 2015 London, UK

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Genetical genomics of exercise and its application in personalized health care

The inability to carry out physical work is a serious health risk for modern Western societies. Aerobic fitness and high muscle power are associated with a reduced risk to develop chronic diseases such as type 2 diabetes, frailty and various forms of cancer. Both traits essentially rely on functional reserves in skeletal muscle. On the one hand, this relevance is illustrated by the close match of the surface area of capillary supply lines in skeletal muscle with whole body glucose transport capacity. On the other hand, the capacity to circumvent fall-related injuries is closely related to muscle's capacity for rapid and coordinated force production.

This relationship has its basis in the fact that skeletal muscle's functional capacity is to a pronounced degree conditioned by physical activity. This is mediated through structural adjustment in muscle fibers and associated connective tissue and capillaries in response to the impact of metabolic and mechanical stress. Genome-dependent regulation of adaptive processes in striated muscle can be investigated at the molecular and cellular level and used to map their functional impact on muscle and bodily health. Evidence is emerging that the response pattern of gene expression to exercise and medication reflects inter-individual variability in muscle plasticity and is importantly modified by genetic variations, as exemplified through small nuclear polymorphisms.

With these developments, a personalized counselling of the best exercise intervention and exercise-drug interaction based on the genome-based predictions of the effect on established clinical endpoints might soon become a realistic alternative to reformed medicine. Clinical trials are en route to exploit these personal landmarks to tailor exercise and medical interventions in order to maximize the individual responsiveness and benefit of cardio-rehabilitation. Once the proof-of-concept has been provided, and the dose – effect relationship is established for prominent gene-exercise interactions of the patient, genetical genomics of exercise may become an example for a realistic and sustainable systems approach to health care.

Biography

Martin Fluck is the Professor for Muscle Plasticity located at the Balgrist Hospital of the University of Zurich. His research centers on the adaptive pathways governing skeletal muscle function with specific focus on an integrative omics approach. He has published over 70 articles in peer reviews journal (H-index>24) and has served as an Editorial Board Member of repute.

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