

第 28 回身心統合科学 (BAMIS) セミナー

(BAMIS-BBSRC Joint International Forum)

The integrated control of skeletal muscle bioenergetics at exercise

「ヒトの活動筋における酸素摂取動態・エネルギー代謝の統合的調節」

日時：2013年5月10日（金）15:00~18:00

場所：筑波大学・5C606



Dr. Rossiter



Dr. Kemp

この度、Harry B Rossiter 先生（米国カリフォルニア大学ロスアンゼルス校・呼吸生理学）、並びに Graham J Kemp 先生（英国リバプール大学・磁気共鳴イメージ解析研究センター）をお迎えして、国際セミナーを開催します。

Rossiter先生は、運動耐容能が全身および末梢の酸素摂取動態に及ぼす効果について熱心に研究されています。運動時の呼吸・ガス交換応答の世界的研究者であったBrian J Whipp先生の愛弟子です。今回は、筋細胞ミトコンドリアから全身レベルに至るまでの運動時酸素摂取動態について発表して頂きます。

Kemp先生は、³¹P-磁気共鳴装置を用いて、ヒトの活動筋におけるエネルギー代謝を精力的に解析されています。今回は、運動時と回復時におけるクレアチンリン酸 (PCr) の応答動態を中心にお話して頂きます。

上記発表に先だち、本学医学部放射線診断科の岡本嘉一先生のMRIを用いた骨格筋評価の最前線に関するお話し、さらに、本学博士学生による研究発表を行います。

Harry Rossiter PhD, Visiting Associate Professor

Division of Respiratory & Critical Care Physiology & Medicine, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, USA.

Exercise induced activation of bioenergetic pathways in skeletal muscle

The control of skeletal muscle bioenergetics at exercise onset is a complex integrated process and an important determinant of exercise tolerance. Classically technical limitations have restricted the investigation of the integrated cellular processes determining bioenergetic kinetics, and their dynamic controls poorly understood. This presentation will draw on evidence from isolated mitochondrial complexes to measurements of oxygen uptake across whole muscles to explore the processes controlling and regulating skeletal muscle bioenergetic pathways at exercise onset.

Graham J Kemp PhD, Professor

Magnetic Resonance and Image Analysis Research Centre, University of Liverpool, UK.

Measuring human muscle ‘mitochondrial capacity’ in vivo: physiological implications of a comparison of ³¹P magnetic resonance spectroscopy measurements of post-exercise phosphocreatine recovery kinetics with invasive direct measurements of muscle O₂ consumption

Phosphocreatine recovery measured by phosphorus magnetic resonance spectroscopy (³¹P MRS) yields information about muscle mitochondrial function in vivo, although quantitative interpretation is complicated by interactions with cellular acid handling, creatine kinase and substrate/O₂ supply. Detailed modeling of oxidative phosphorylation has reinforced the classical picture of mitochondrial ATP production matched to ATP demand by ADP-feedback. However, a detailed comparison of ³¹P MRS measurements of phosphocreatine recovery after submaximal exercise with arteriovenous difference O₂ consumption measurements during maximal knee extension shows that mitochondria in the same cellular and vascular context behave very differently in different kinds of exercise - a cardinal feature of the systems perspective.

Yoshikazu Okamoto, MD, PhD. Lecture, School of Medicine, University of Tsukuba

Skeletal muscle MRI - Great potential for future clinical application-

Recently, skeletal muscle MRI has been applied for acquiring anatomical and metabolic information at the microscopic level by diffusion tensor imaging (DTI) and proton MR spectroscopy (H-MRS). Moreover, muscle perfusion has been tried to measure based on intravoxel incoherent motion (IVIM) concept and BOLD. Additionally, we are trying to assess hardness of muscle by using T1-rho. Integration of these parameters may produce new biological information for skeletal muscle. This presentation shows future clinical application of skeletal muscle MRI by getting information at the microscopic level.