IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Biology in Space (8)

Author: Prof. Malcolm Jackson
University of Liverpool, United Kingdom, mjj@liverpool.ac.uk

Prof. Anne McArdle
University of Liverpool, United Kingdom, mdcr02@liverpool.ac.uk
Dr. James Henstock
University of Liverpool, United Kingdom, jamesrh@liverpool.ac.uk
Dr. Kai Hoettges
University of Liverpool, United Kingdom, hoettges@liverpool.ac.uk
Mr. Adam Janvier
University of Liverpool, United Kingdom, sgajanvi@student.liverpool.ac.uk
Dr. Samantha Jones
University of Liverpool, United Kingdom, sjones13@liverpool.ac.uk
Dr. Chris McArdle
University of Liverpool, United Kingdom, cm@innotec-uk.com
Dr. David Zolesi
Kayser Space Ltd., United Kingdom, d.zolesi@kayserspace.co.uk
Mr. Gianluca Neri
Kayser Space Ltd., United Kingdom, g.neri@kayserspace.co.uk
Ms. Libby Jackson
UK Space Agency, United Kingdom, libby.jackson@ukspaceagency.bis.gsi.gov.uk

MICROAGE: MICROGRAVITY AS A MODEL FOR ACCELERATED SKELETAL MUSCLE AGEING

Abstract

Major demographic changes are affecting modern societies, leading to rapidly increasing numbers of older people with relatively poor health and quality of life. Physical frailty is a major factor affecting the ability of individuals to maintain independence and is primarily due to age-related loss of skeletal muscle mass and function. The mechanisms underlying age-related loss of muscle have not been fully evaluated, but we have demonstrated that muscle from ageing animals and humans show attenuated adaptations to exercise that compromises their ability to maintain muscle mass and function. We have evaluated key mechanisms underlying adaptations of skeletal muscle to exercise and demonstrated that the exercising muscle of young or adult animals and humans generates reactive oxygen species (ROS) that stimulate activation of specific transcription factors leading to increased generation of a number of protective and cytoprotective proteins. Such responses do not occur in muscle from older animals and man in response to exercise. Astronauts and animals exposed to microgravity also lose skeletal muscle mass and their muscles are also relatively unresponsive to aerobic or resistance training in microgravity. Within a call from the UK Space Agency for an upcoming national mission on board the International Space Station (ISS), we have proposed to assess the potential analogous failure of muscle adaptations to contractile activity occurring in muscle fibres exposed to microgravity. The proposal was first selected in a shortlist of 14 proposals and then was successful as one of the three winning projects to be implemented on the ISS. The programme is sponsored by the UK Space Agency through the European Space Agency's European Exploration Envelop Programme, directed by the Institute of Ageing Chronic Disease of the University

of Liverpool and implemented in cooperation with the European Space Agency for the mission integration and operations. The payload developer is Kayser Space Ltd., an aerospace company located in the Harwell Campus (Didcot, Oxfordshire) holding extensive experience with life science payloads onboard the ISS. The paper will present the background, the research goals and perspective, as well as the implementation of the scientific protocol in a payload to be designed, manufactured and certified for a mission compatible with human spaceflight on board the International Space Station.