群馬大学重粒子線医理工学グローバルリーダー養成プログラム

第9回重粒子線医理工セミナー

日程　令和2年3月12日(木)14:00～15：30
場所　群馬大学重粒子線医学センターカンファ室

講演①Matteo Cerri M.D., Ph.D.

Department of Biomedical and NeuroMotor Sciences

The neural control of energy expenditure: exploiting torpor for biomedical application and space exploration

In mammals, torpor/hibernation is a state that is characterized by an active reduction in metabolic rate with a progressive decrease in body temperature. At the moment, the neural pathways responsible for the metabolic suppression that characterizes torpor are not known. Mice are facultative heterotherms, and torpor in these rodents can be reliably triggered by changing environmental conditions. This characteristic consents therefore to trigger torpor almost on command and the marker of neuronal activation cfos can be used to identify groups of neurons activated at torpor onset.
The metabolic suppression that characterizes torpor requires a reduction in the activity of metabolically active organs. Most of these organs, such as the brown adipose tissue, are controlled by the putative sympathetic premotor neurons located within the Raphe Pallidus. To enter torpor, these neurons have to be necessary inhibited. The inhibition of these neurons in rats induces indeed a state the resembles torpor, called Synthetic Torpor and that can be exploited for many medical applications and for space exploration. Synthetic torpor may in fact provide a enhanced radioprotection towards cosmic rays.
In this seminar, we'll present a quick overview on the state of the art in hibernation research, explore what the future steps will be and discuss possible applications.

講演②Dr Walter Tinganell Ph.D.

Clinical Radiobiology Group Leader at the GSI, Germany

Cosmic radiation limits interplanetary travel. Can synthetic hibernation allow this limit to be exceeded?

Space radiation is different from the radiation to which we are subjected to Earth every day. The Sun emits the majority of his radiation in the form of visible, infrared and ultraviolet radiation. During the Solar Particle Events (SPE) the Sun, with a giant explosion on his surface releases a massive amount of energy out into space in the form of x-rays, gamma rays and streams of particles, essentially protons and electrons. In space, a large component of the radiation comes from the galactic cosmic rays (GCR). GCRs are essentially formed of very energetic ions, most of them are protons (80%) but there is also a component of heavier ions like Helium and Iron. Thanks to their energy, GCR can penetrate habitats, spacecraft, and spacesuit creating a very dangerous interaction with the astronauts that can lead to harmful health consequences. The major risks associated with space radiation are the increase in cancer incidence, cognitive decline, and cardiovascular disease. In space indeed, there is still no effective shield to protect efficiently the astronauts, especially for the very long and far from Earth missions. The average annual dose of radiation absorbed by a man on earth is around 3.5 mSv. Astronauts in space are exposed to a dose of ionizing radiation of about 1mSV per day in a LEO (Low Earth Orbit) and will be exposed to around 2 mSv per day in a future trip to Mars. There are different shielding type, passive shielding, and active shielding. Passive shieldings are heavy and despite they are a good solution for shielding in a hypothetical Moon or Mars base, they are still not a good option for protecting astronauts during their trip. Other types of shielding are always under consideration.It has recently been discovered, by the group of Matteo Cerri of the University of Bologna, a method for inducing hibernation (torpor/synthetic hibernation) in normally non-hibernating animals. Hibernated animals undergo various phenotypic changes. Among these, hibernated animals become more radio-resistant. Studies about the effects of radiation on synthetically hibernated animals, we believe, will pave the way for new studies that envisage hibernation as a possible method to help the man in future space missions.

参加費無料

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