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

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Résumé

Space radiation is different from the radiation to which we are subjected on Earth every day. On Earth, radiation is produced by artificial sources like radios, bulbs, diagnostic medical applications, is produced by radioisotopes, radioactive elements in the Earth's crust, by the radon gas and by the Sun. 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. 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. Furthermore, 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. Hibernation is a natural process in which the vital conditions of an organism are reduced to a minimum. Hibernation was first studied in the 1960s when the first space missions would have brought man to the Moon, and then it was abandoned. In those years, it was discovered that animals during hibernation underwent a series of interesting physiological transformations, among them, animals became more radio-resistant. Only recently has hibernation returned to be an interesting scientific topic. It has recently been discovered that there is a method for inducing hibernation (torpor/synthetic hibernation) in normally non-hybernating animals. In an experiment carried out by the group of Matteo Cerri of the University of Bologna, it was indeed possible to hibernate a rat. Subsequent experiments have shown that even synthetic hibernation is also capable of inducing an increase in radioresistance. This discovery has paved the way for new studies that envisage hibernation as a possible method to help the man in future space missions.

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