Research to boost astronaut health for future space missions

The research, which uses the low gravity (microgravity) environment of the International Space Station and other facilities that provide similar conditions to space, could also potentially benefit people who suffer from conditions such as muscle degeneration or back pain.

It is well known that the effects of space travel take a toll on the bodies of astronauts, whilst in microgravity their weight-bearing bones lose on average 1 per cent to 1.5 per cent of mineral density per month.

To counteract this, they currently need to exercise for two-and-a-half hours every day, take nutrient supplements, and consume high-protein diets to maintain muscle mass while tin space. Without these interventions, astronauts could experience up to a 20 per cent loss of muscle mass on spaceflights lasting between 5 and 11 days.

The five new projects, set to receive a share of £440,000 of UK Space Agency funding, will support much longer space missions needed to explore the Moon and further afield. They include an initiative from Manchester Metropolitan University to study the prolonged effects of isolation on physical and psychological health, and a research project from Northumbria University to investigate the relationship between microgravity and spinal health.

Science Minister George Freeman said:

> Our space science is about cutting-edge life science as well as rocketry and satellites: the UK is at the heart of state-of-the-art biomedical monitoring, providing huge potential insights into human health. For example, the way astronauts' eyesight deteriorates in space and then repairs back on earth could provide powerful insights to help researchers at labs like Moorfields to understand eye health and potential new treatments.
>
> This research could allow astronauts to safely embark on longer and more challenging missions, for the benefit of us all.

British ESA astronaut Tim Peake said:

> It's exciting to see this cutting-edge research taking place here in the UK.
>
> We can learn so much about the human body from spaceflight, especially the ageing process. This research could enable astronauts to carry out longer missions and explore further into space, whilst benefiting everyone on Earth.

Credit: Nick Caplan

The government recently launched its National Space Strategy which outlines its long-term plans to grow the UK space sector and make Britain a science and technology superpower, including building on manufacturing and technology capacity, attracting investment and working internationally.

This announcement comes during World Space Week, which runs from 4 to 10 October. The annual event, led by the United Nations, celebrates the contribution of science and technology to improving lives on Earth. This year's theme is Women in Space.

Through the UK's membership of the European Space Agency's (ESA) exploration programme, UK researchers have access to unique facilities including parabolic flights that reproduce gravity-free conditions in an aircraft and drop towers that produce a controlled period of weightlessness.

Elodie Viau, Head of ESA's ECSAT site at the Harwell Space Cluster in Oxfordshire, said:

> As we venture further into space, we are proud to see the UK's ESA membership help UK scientists conduct pioneering research to support these efforts.
>
> These projects are set to deliver a variety of benefits for people's health, which could be applied to both ESA astronauts and people on Earth.

In March this year ESA launched its first drive for new astronauts in 11 years, with more than 22,000 people applying, including nearly 2,000 from the UK. ESA is looking for up to six astronauts and up to 20 reservists, with the successful applicants to be announced next year.

The UK Space Agency has also provided £16,000 funding for Kew Gardens to explore how seeds might be stored and transported in space to support human exploration to Mars and beyond. The Agency is supporting the preparation and testing of 24 seed species before they fly to the International Space Station in a few years' time.

Northumbria University

Northumbria University, Newcastle, will explore how spinal health is affected by spending six months in microgravity on the International Space Station, whilst researching effective ways to improve post-flight spinal reconditioning for astronauts.

The research team will also investigate the effectiveness of artificial gravity, supplemented by resistive vibration exercise, in preventing loss of spinal health using long duration bedrest to simulate the effects of microgravity. The findings of this study will be beneficial to the health and

recovery of astronauts travelling to the Moon and Mars.

University of Liverpool

Astronauts rapidly lose skeletal muscle when they are exposed to microgravity. There is some evidence that this muscle loss is an accelerated form of the slow loss that occurs as we all age and contributes to frailty, weakness, and lack of independence in the elderly. The University of Liverpool will conduct a preliminary ground-based study to see if the chemical hydrogen peroxide, which is produced within the muscle by organelles called mitochondria, is a mediator of muscle ageing and loss of muscle following exposure to microgravity.

Manchester Metropolitan University

Manchester Metropolitan University will research the effects of prolonged isolation. Focusing on the SIRIUS confinement studies, a unique, Earth-based multi-compartment facility providing isolation, confinement, and remote conditions in exploration scenarios. The team will investigate the psychological stress, team function, performance, and health caused by extended isolation.

University of Birmingham

Space flight-Associated Neuro-ocular Syndrome (SANS) is a condition that can have severe consequences for astronaut health. The syndrome can cause various side effects from visual loss due to changes in the optic nerve, headaches as well as acute and chronic changes to the brain. This project will investigate methods for early diagnosis and monitoring through to establishing a drug treatment using GLP-1 receptor agonists to alleviate SANS and the associated long-term consequences.

University of Birmingham

When astronauts return to Earth, they are at increased risk of cervical intervertebral disc (IVD) herniation which can cause significant pain, weakness and numbness. The University of Birmingham will study the causes that contribute to this increased risk of cervical IVD herniation using state-of-the-art methodologies to measure muscle behaviour. Such knowledge will provide the basis for future interventions aiming to reduce such risk.