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News
Features

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Living In Space Triggers Changes In Our GENES

https://www.dailymail.co.uk/sciencetech/article-8986743/Living-space-low-gravity-triggers-changes-GENES-study-worms-ISS-shows.html

Living in space at low gravity triggers changes in our GENES, study of worms on International Space Station reveals - in setback to plans for interplanetary travel

Daily Mail 25th Nov 2020 >

- **British researchers put worms on the space station and others in a centrifuge**
- **They found in low gravity the neurones inside the worms subtly changed**
- **It is one of 30 research papers published into the effects of gravity on animals**
- **Experts hope understanding why astronauts suffer health issues after a stay on the ISS could help develop counter measures for future long-haul space flights**

The low gravity of space changes our genes, a study of worms on the International Space Station revealed, creating a potential set back for future crewed missions.

Researchers from the University of Exeter devised an experiment involving worms on the space station in orbit around the Earth to study the effect of gravity on DNA.

While most genes were only subtly affected, nervous system cells, known as neurones were especially impacted, the team discovered.

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This is one of 30 papers published across different Cell Press journals examining the impact of long-term space flight or lower gravity on humans and other animals.

It comes as NASA steps up preparation to send the first woman and next man to the Moon in 2024 and to Mars - a journey taking up to eight months - in the 2030s.

Lead author of the worm study, Dr Tim Etheridge, says understanding which genes are effected by space travel could help target treatments to make it less dangerous.

A series of investigations, including worms, fruit flies, mice and humans have been carried out on the ISS since the first crew arrived on the station in 2000.

One of the 30 new papers published across Cell journals, saw worms sent to the ISS, others put on a centrifuge on Earth and their genes studied for any changes.

While most genes were only subtly affected by changes in gravity, nervous system cells, known as neurones were especially impacted, the team discovered.

Gene changes could be why astronauts appear to suffer so many problems - including with eyesight and blood flow while in space, according to the British team.

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Reducing the effects of gravity on health could slow physical decline in space, a 'crucial step' for deep-space exploration and understanding the impact low gravity has on genes is an important first step in reducing those effects.

Dr Etheridge, said they looked at levels of every gene in the worms' genome and identified a clear pattern of change caused by lower levels of gravity on the ISS.

'These changes might help explain why the body reacts badly to space flight,' he said, adding it 'gives us some therapy targets for reducing the health effects'.

The worms, Caenorhabditis elegans, were exposed to the lower gravity of space and higher gravity than found on Earth through a centrifuge.

Researchers then examined the genes before and after each experiment to better understand how gravity impacts genetics and look for possible treatments.

Around 1,000 of the worms' genes were 'subtly changed' by being in low gravity.

Lead author, doctoral student Craig Willis, said overcoming any physiological conditions first requires understanding its underlying molecular mechanism.

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'We have identified genes with roles in neuronal function and cellular metabolism that are affected by gravitational changes,' he said.

Some genes experienced stronger effects, especially nervous system cells - known as neurones - which transmit information between different parts of the brain and nervous system through chemical signals and electrical impulse, researchers found.

'These worms display molecular signatures and physiological features that closely mirror those observed in humans,' said Willis.

'Our findings should provide foundations for a better understanding of spaceflight-induced health decline in mammals and, eventually, humans.'

Dr Etheridge said: 'This study highlights the ongoing role of scientists from Europe and the UK in space flight life sciences research.'

Another study, published as part of this latest cohort examining the impact of low gravity and space flight, looked at changes to mitochondria caused by spaceflight.

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They discovered that mitochondrial dysfunction was to blame for those problems.

We started by asking whether there is some kind of universal mechanism happening in the body in space that could explain what we've observed,' says senior author Afshin Beheshti.

'What we found over and over was that something is happening with the mitochondria regulation that throws everything out of whack.'

They found problems with the liver, eyes and more were related to pathways linked to the mitochondria - so looked further and found it was a common link.

'I was completely surprised to see that mitochondria are so important, because they weren't on our radar,' Beheshti says.

The team hope to now be able to develop countermeasures, including drugs to reduce the risks of mitochondrial disorders.

Another study, by Sanford Burnham Prebys Medical Discovery Institute, found that fruit flies who spent half their lives - several weeks - on the ISS experienced 'profound structural and biochemical changes to their hearts.

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The study, published in Cell Reports, suggests that astronauts who spend a lengthy amount of time in space - which would be required for formation of a moon colony or travel to distant Mars - could suffer similar effects.

The research also revealed new insights that could one day help people on Earth who are on long-term bed rest or living with heart disease.

'For the first time, we can see the cellular and molecular changes that may underlie the heart conditions seen in astronaut studies,' says Karen Ocorr, study author.

'We initiated this study to understand the effects of microgravity on the heart, and now we have a roadmap we can use to start to develop strategies to keep astronaut hearts strong and healthy.'

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Astronauts, such as Major Tim Peake (pictured), have been shown to suffer varying degrees of side-effects from spending time on the International Space Station due to the lower gravity