New Year's science in space for a healthier life

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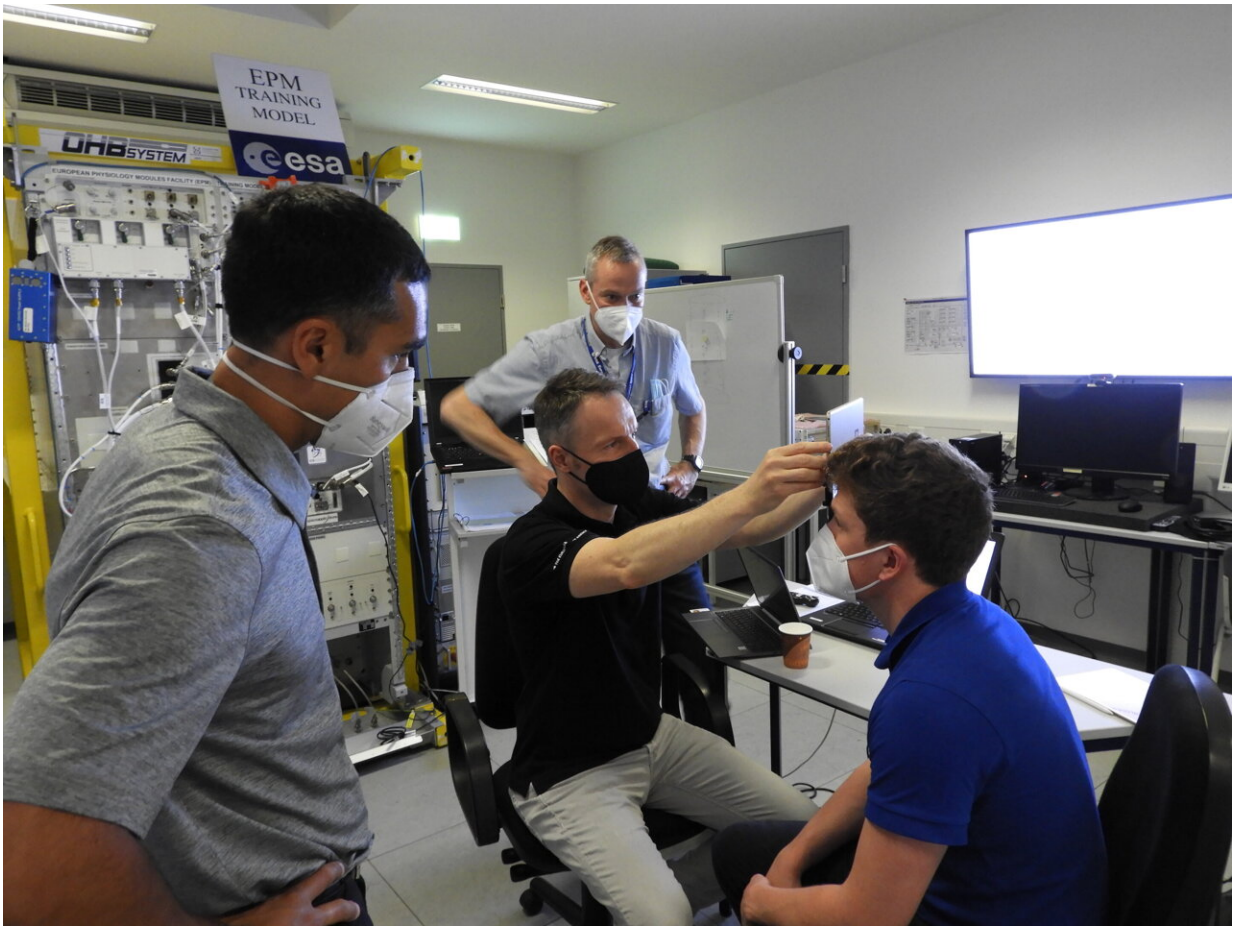

Irish national trainee Eóin Tuohy has his retina imaged by ESA astronaut Matthias Maurer during training for Retinal Diagnostics at ESA's European Astronaut Centre in Cologne, Germany. Eóin is part of the team behind the technology demonstration, and helped adapt an ocular lens used for routine clinical diagnostic operations, for use with a tablet in space. Matthias and his NASA colleague Raja Chari (left) are two of the first astronauts to try the

technology in orbit. Images of their retinas taken during spaceflight will be used to train an artificial intelligence (AI) model. All going well, this model will be used to automatically detect changes in the optic nerve of astronauts, known as Space-Associated Neuro-ocular Syndrome (SANS). Credit: ESA/NASA

Another year passes, and our muscles, bones, eyes and ears deteriorate as we age—even more so in space. Reactions in ESA astronaut Matthias Maurer's body after barely two months on the International Space Station are giving European scientists clues on how to fight the downsides of growing old on Earth.

Vision and hearing loss

Around 70% of astronauts experience changes in the optic nerve during a long stay in space, a phenomenon known as Space-Associated Neuro-ocular Syndrome (SANS). This vision pathology is also regarded as the number two risk to human health during a mission to Mars.

Matthias and his NASA crewmates Thomas Marshburn and Raja Chari lent their eyes to the Retinal Diagnostics experiment. A special ocular lens clipped to the back of a tablet allowed the astronauts to record images of their eyes and send them to Earth.

These images will be used to train an AI model that could detect ocular changes and automatically give a diagnosis. The device will not only help astronauts exploring deep space, but also facilitate sustainable health care on our planet.

The International Space Station is far from being a quiet place. Creaking noises, humming fans and constant conferences with ground control are part of the sounds that fill Matthias's life in space. The Acoustic

Diagnostics experiment studies the effects of the background noise in the Station on the hearing of the astronauts.

Feeble muscles

Matthias's muscles weaken in orbit, much like they do as people grow old. He is helping a team of medical scientists on Earth to identify how muscle mass is lost and how to prevent it.

After receiving a fresh delivery of science from the SpaceX Dragon vehicle in time for Christmas, Matthias sorted synthetic muscle cells the size of a grain of rice inside the Kubik minilab. Part of these cells will be electrically stimulated to trigger contractions in weightlessness, while others will experience artificial gravity via centrifugation.

Researchers of the MicroAge project will monitor how the tissue responds to microgravity and accelerated aging processes. This could one day help people to better maintain their strength and mobility into old age.

Another experiment looking into muscle health is Myotones. Matthias used a non-invasive, portable device on the Space Station to monitor the tone, stiffness and elasticity of certain muscles in the leg. He is one of the 12 astronauts taking part in this study to identify the best countermeasures for many people affected by strained muscles.

Matthias is also trying to optimize his fitness in space, an exercise routine that takes about two hours each day. During several workouts using the treadmill and doing squats, he put on a wearable electro muscle stimulation (EMS) suit that activated his muscles. The EasyMotion research aims to better understand physiological strain for astronauts and could lead to new rehabilitation treatments on Earth.


GALLEY
FRIDGE
FIRE PORT
BioServe
POTATO CREAM SOUP

ESA astronaut Matthias Maurer eats cream of potato soup developed by Saarland chef Christian Heinsdorf for Matthias's Cosmic Kiss mission. Matthias shared this special meal from his home region with his Expedition 66 crew mates in orbit using specially-design spoons as part of an investigation into into the antimicrobial properties of laser-structured surfaces. Credit: ESA/NASA

Maintaining body fat and muscle also comes down to diet. Matthias keeps logging his meals to track his energy intake and assess his nutrition. The NutrISS study introduces a new approach to calibrate diet and exercise for long stays in space. The science teams on Earth hope that a carefully-tailored high-protein diet could limit the typical microgravity-driven loss of bone and muscle.

Space fever and cosmic dreams

Body temperature is known to be higher in space. This 'space fever' poses a potential risk to astronaut health. The Thermo-Mini experiment has recorded Matthias's core body temperature and circadian rhythm using a tiny thermal sensor strapped to his forehead for nearly 40 hours over three sessions.

The data will help understand this phenomenon and prove that this small device could be used in hospitals and by people working in extreme environments on Earth such as miners or firefighters.

When it comes to recovery, sleep plays a major role in human health and well-being. Insufficient sleep or sleep disorders can increase the risk of diseases and has an impact on people's performance.

Matthias has been wearing a headband during his sleep for the Dreams experiment.

The device gives information about the different sleep phases and sleep efficiency. This user friendly technology could help astronauts and people on Earth to improve their sleep routines and identify potential disorders.

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