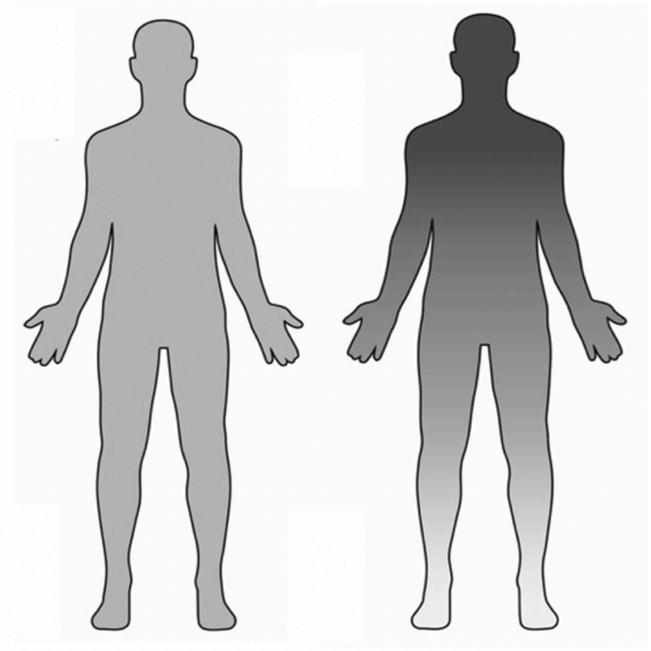
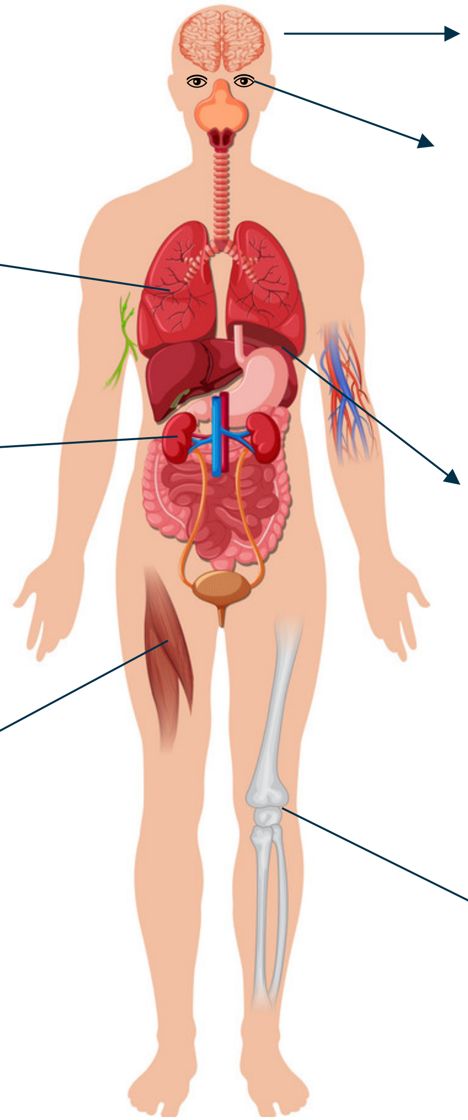

#SpaceCare

WHAT HAPPENS TO THE BODY IN SPACE?

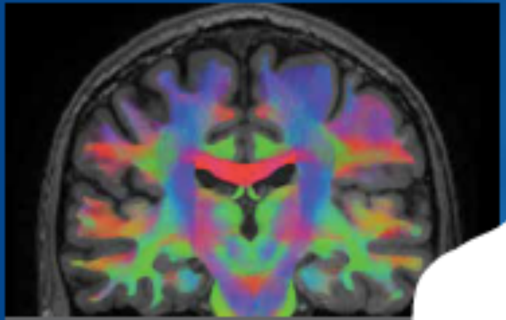


ON EARTH

IN SPACE



- IMMUNE SYSTEM AFFECTED
- SLEEP DISTURBANCES
- RADIATION EXPOSURE
- NUTRITION AND METABOLISM
- ...



↑ Brain scan (University of Antwerpen)

↑ Testing GRIP prototype on weightless parabolic flight

↑ Space food for the Energy experiment

↑ ESA astronaut Alexander Gerst with a thermometer on his forehead to measure his temperature continuously (ESA/NASA)

ESA's Human Research Programme On Board the ISS

Ageing

Cardiovascular

Immunology

Muscle and bone

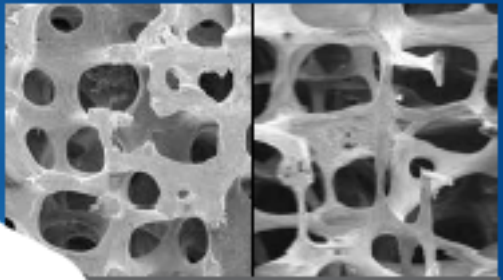
Neurophysiology

Nutrition

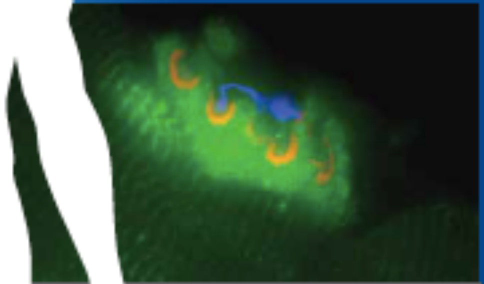
Respiratory system

Thermoregulation

...



↑ Comparison of normal (left) and osteoporotic (right) bone architecture (University College London — T. Arnett)



↑ Laser image of a calf muscle (Charité)

↑ ESA astronaut Samantha Cristoforetti running the Skin-B experiment (ESA/NASA)

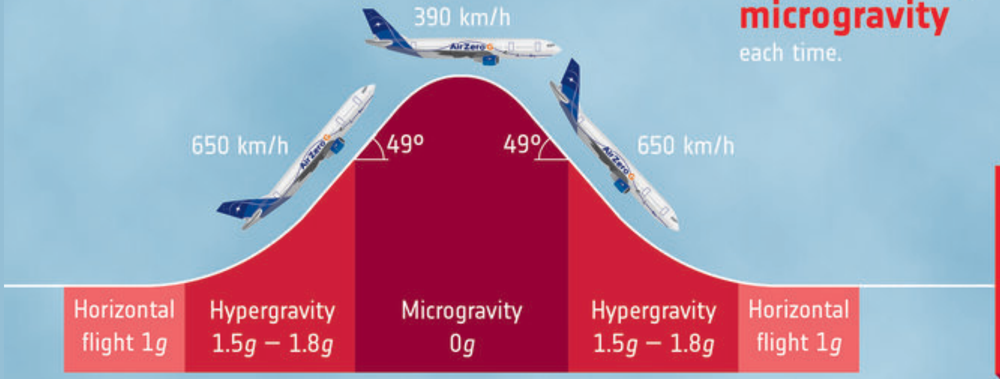
→ SCIENCE WITH(OUT) GRAVITY

Parabolic flights

A refitted aircraft flies for three hours in repeated **rollercoaster parabolas.**

The climb can be changed to **simulate lunar or martian gravity.**

30 parabolas a day offer **20 seconds of microgravity** each time.



Parabolic flights are often used to conduct research with humans and **validate experiments** before they fly to the International Space Station.

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SCIENCE WITH(OUT) GRAVITY
Bedrest
Bedrest volunteers spend five to 60 days in bed tilted towards the head end, usually at 6° below the horizontal.
By submitting themselves to this upside-down regime, the volunteers' bodies start to adapt as though in space with blood and fluids rushing to the head and muscles and bones wasting away.
At least one shoulder must be touching the bed at all times including during showers and toilet visits.
New bedrest studies run in Cologne, Germany, now include a human centrifuge to recreate gravity towards the feet.
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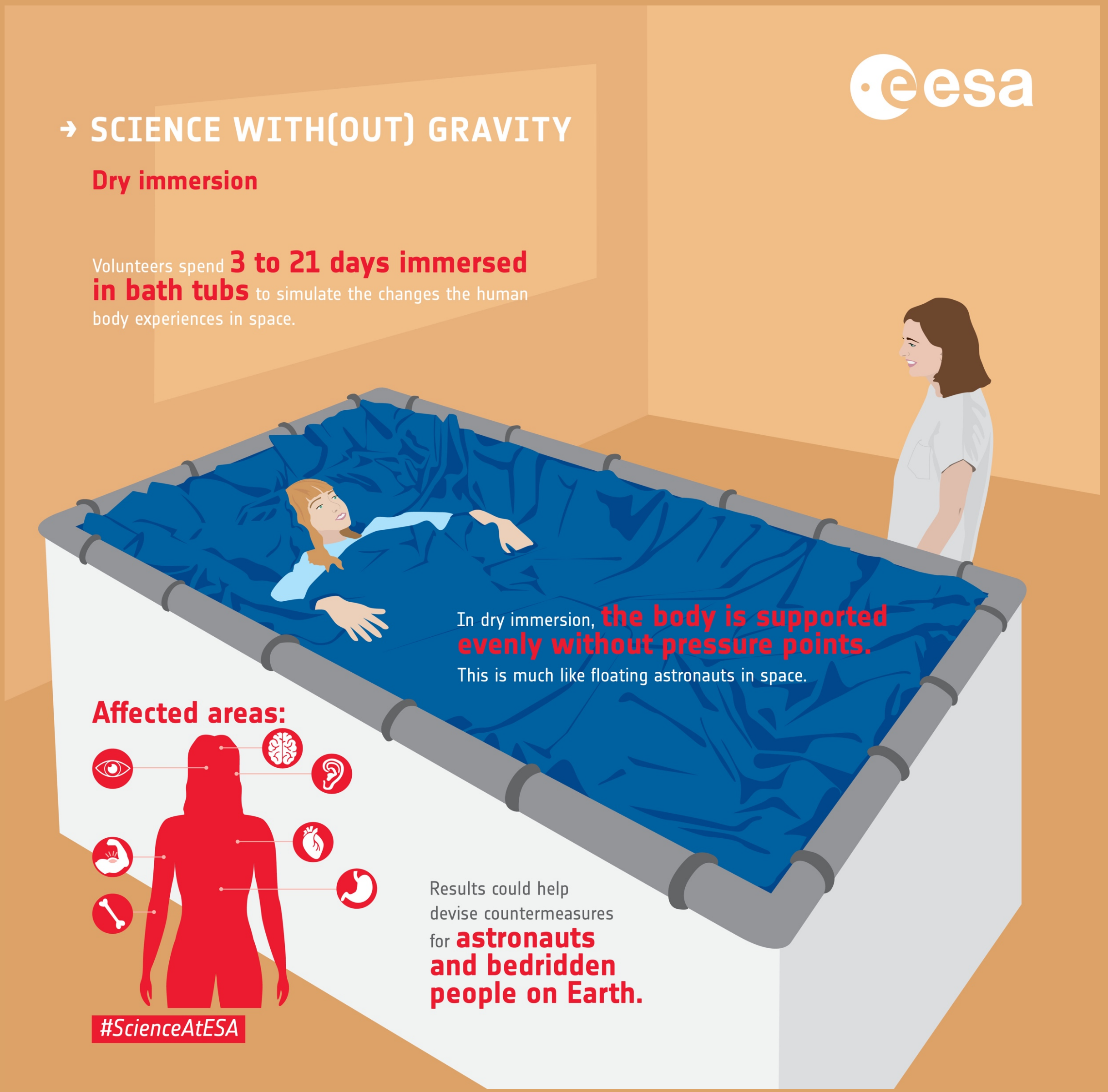
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SCIENCE WITH(OUT) GRAVITY
Dry immersion
Volunteers spend 3 to 21 days immersed in bath tubs to simulate the changes the human body experiences in space.
In dry immersion, the body is supported evenly without pressure points.
This is much like floating astronauts in space.
Affected areas:
Results could help devise countermeasures for astronauts and bedridden people on Earth.
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→ ISOLATION STUDIES

Sirius

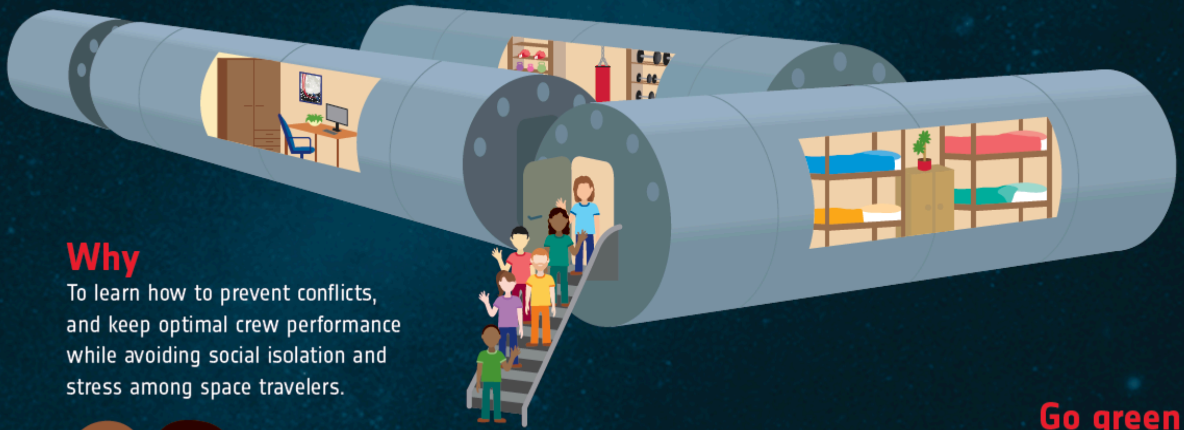
The Sirius programme simulates space missions on Earth to better understand human behaviour, health and performance in **isolation** and **confinement.**

Sensory and social deprivation

Six volunteers live and work without natural daylight, no fresh air and limited human interaction.

Challenges

The crew has to cope with limited communications, emergency scenarios and simulated spacecraft manoeuvres – all while being cut off from the world.



Why

To learn how to prevent conflicts, and keep optimal crew performance while avoiding social isolation and stress among space travelers.

Go green

The crew grows vegetables under artificial light in a greenhouse. This source of food will be crucial for future long-duration missions away from Earth.

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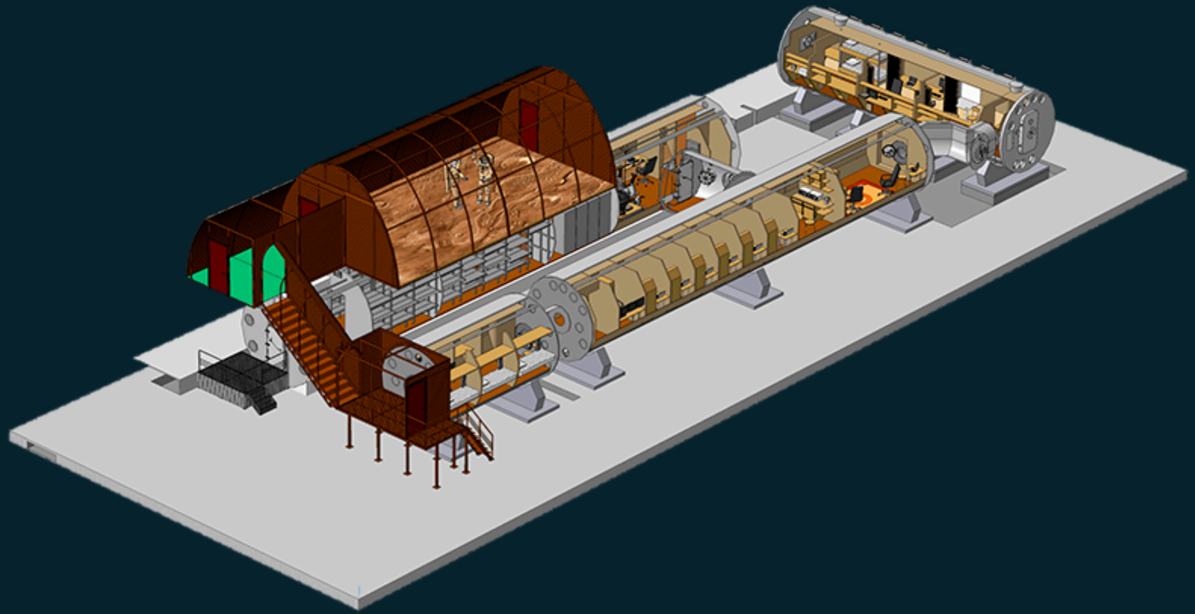
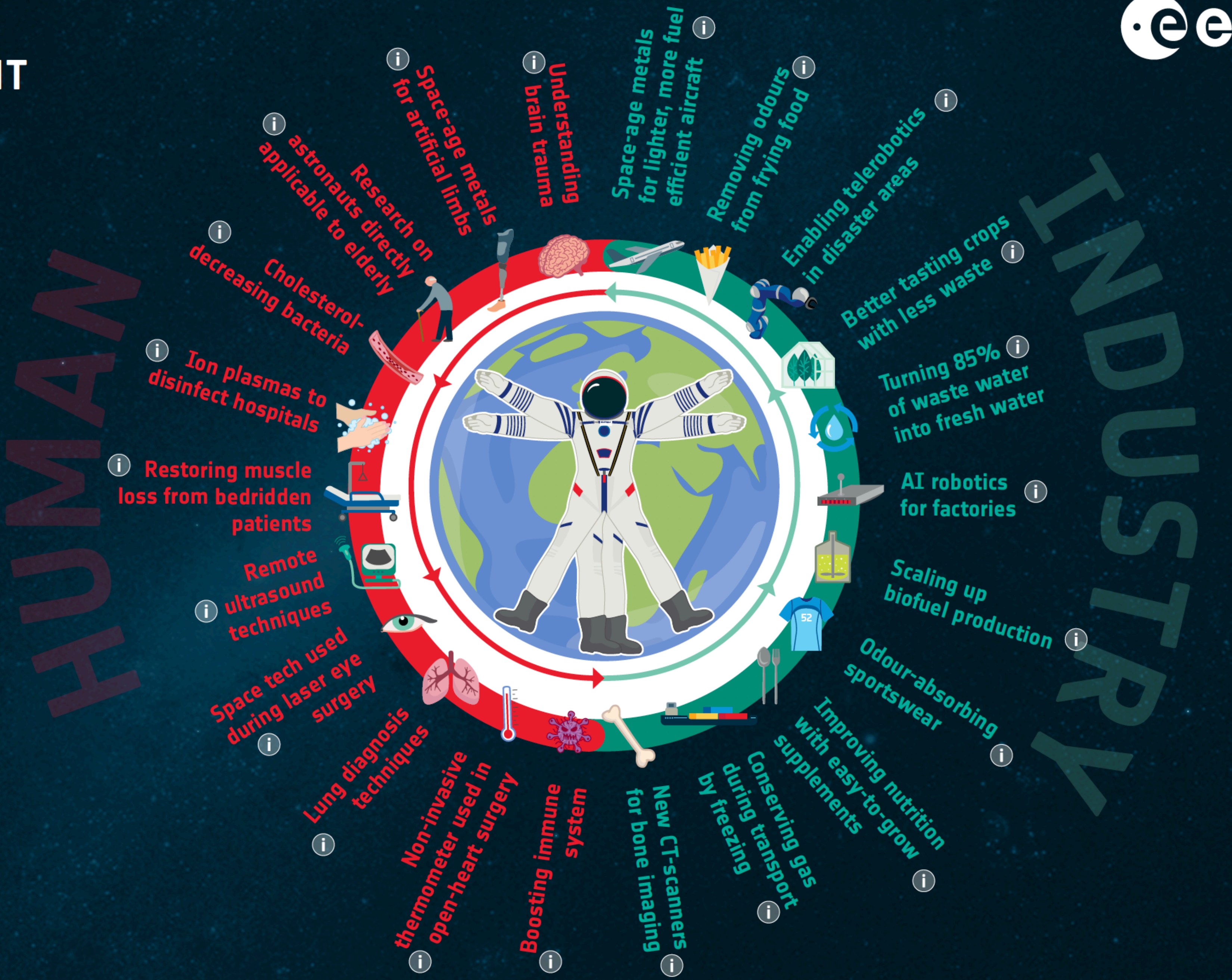


BENEFITS OF SPACEFLIGHT

Human and robotic spaceflight contributes to a **circular economy.** Our research and technology developments improve energy efficiency, automation, robotics and artificial intelligence, as well as habitation, recycling, waste management and additive manufacturing processes and technology.



European Astronaut Centre, Cologne