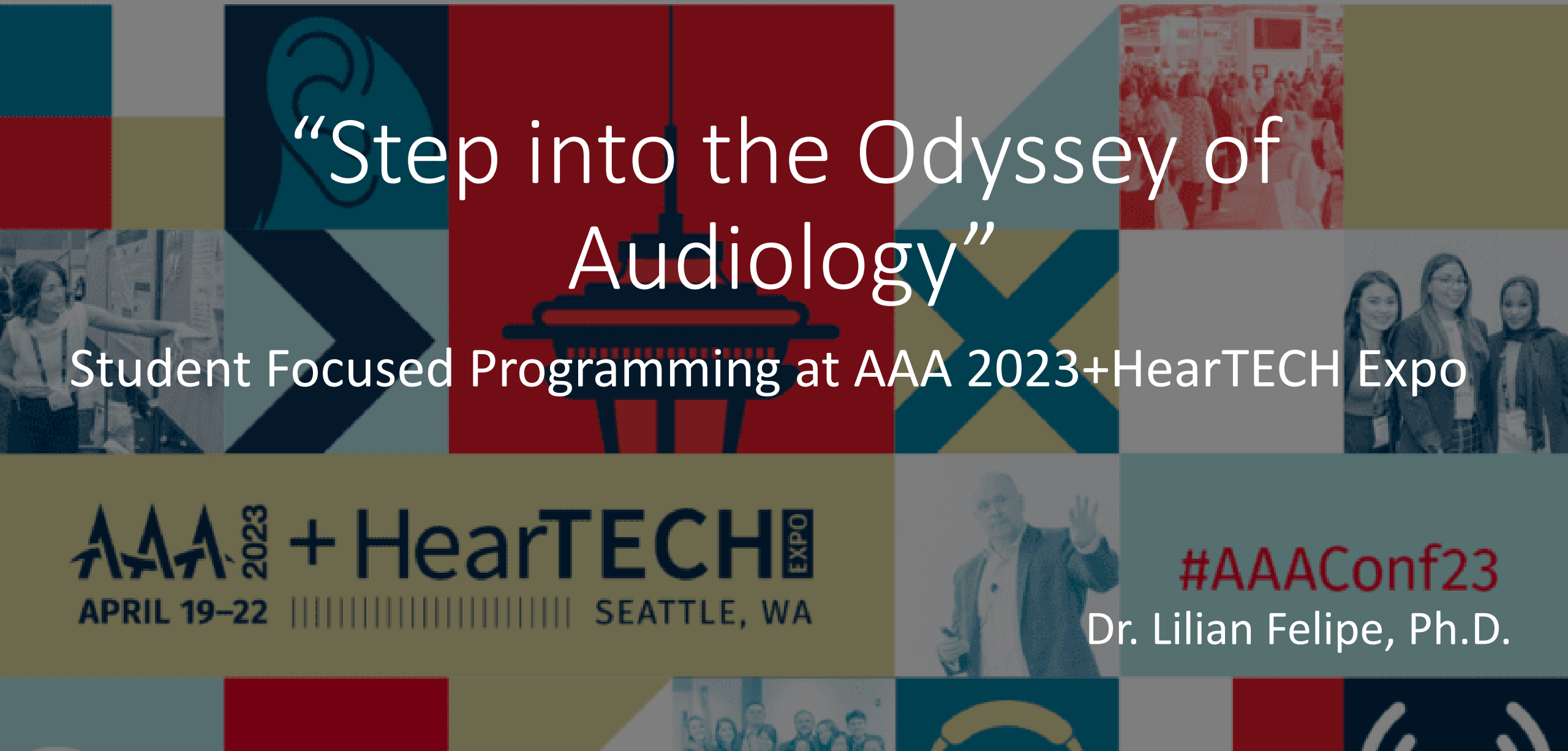
“Step into the Odyssey of Audiology”

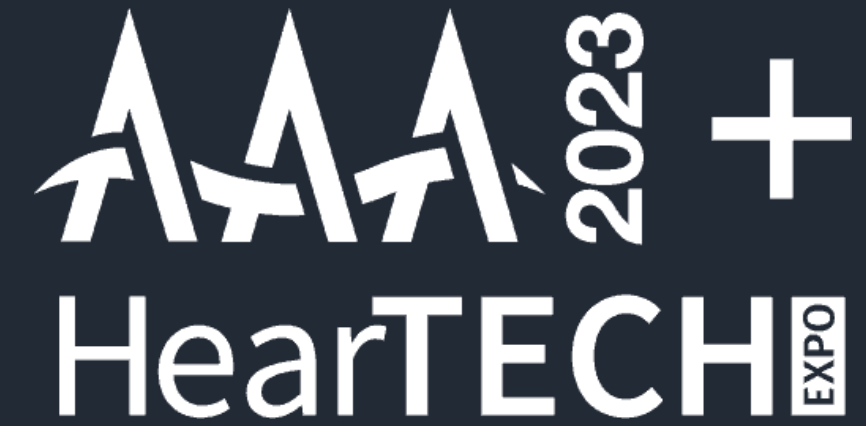
Student Focused Programming at AAA 2023+HearTECH Expo



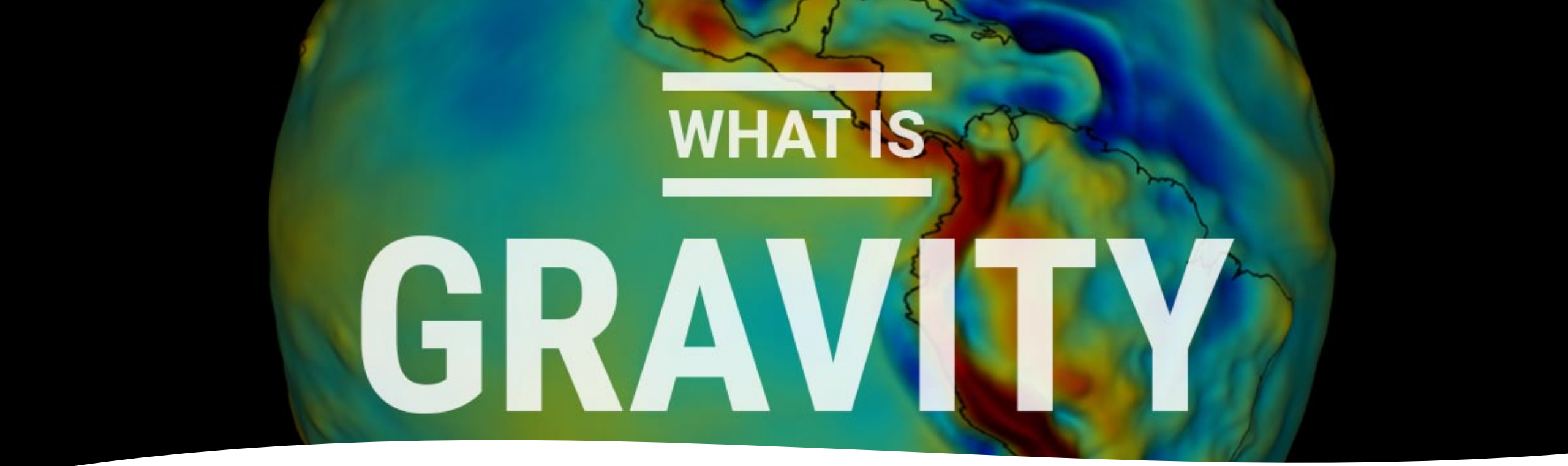
Dr. Lilian Felipe, Ph.D.

Who am I?

- Researcher
- International Experience

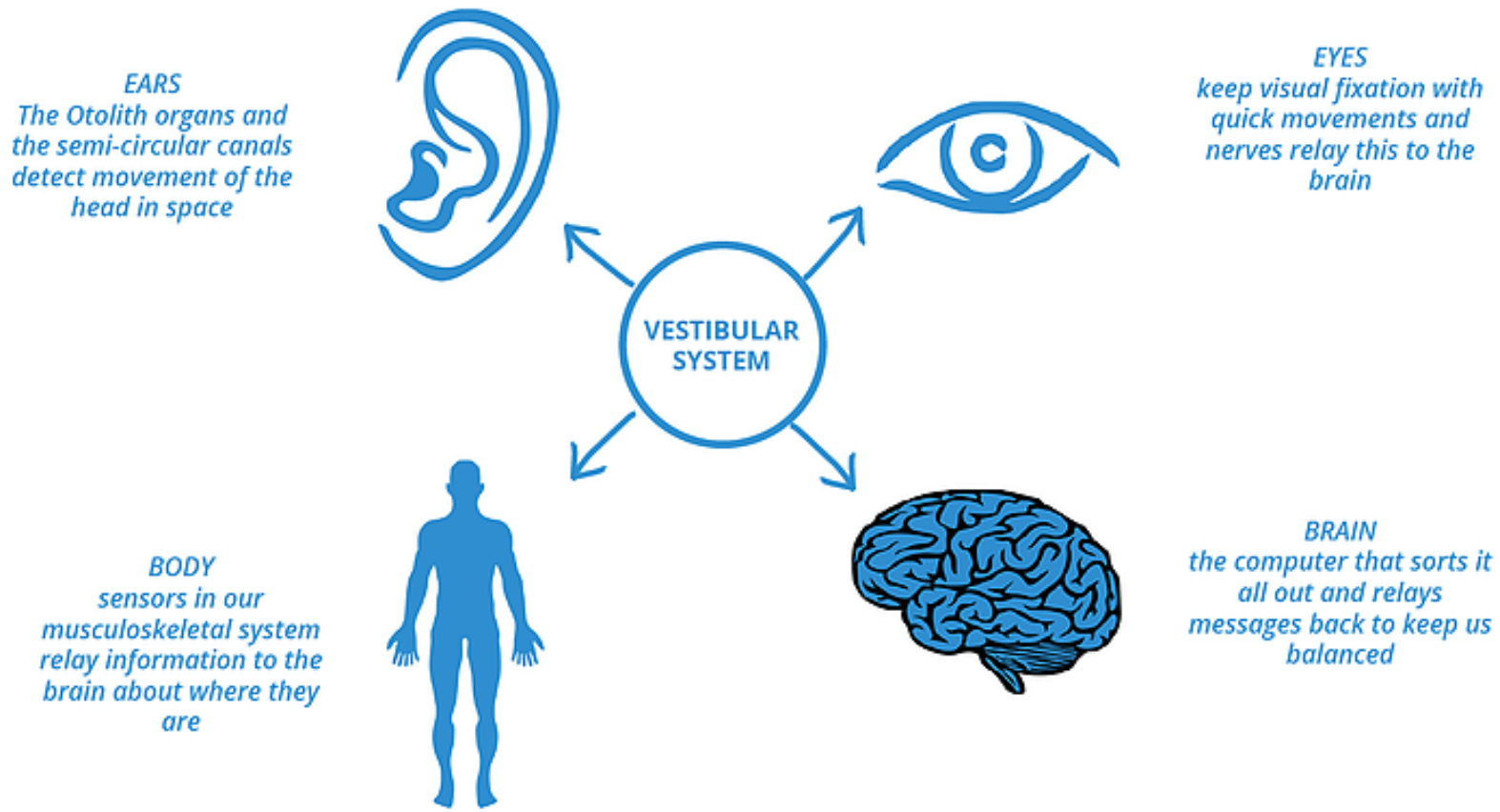


MICROGRAVITY AND VESTIBULAR SYSTEM



Gravity is essential for **spatial perception**, **postural balance**, and **generation of movements**.

VESTIBULAR SYSTEM AND MICROGRAVITY



OTOLITH ORGANS AND MICROGRAVITY

What happens during a spaceflight?

ASTRONAUTS AND MICROGRAVITY

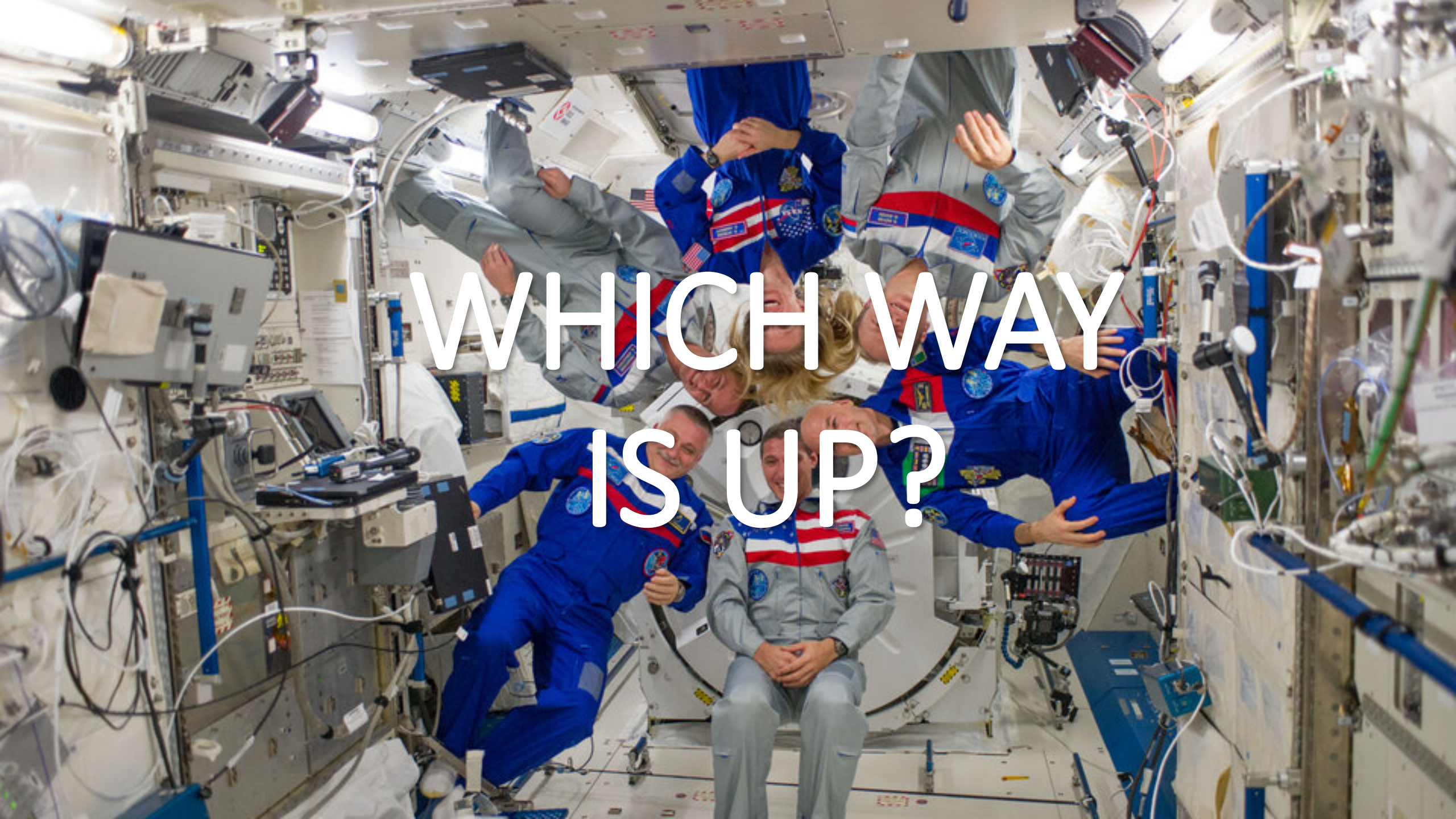
Once in space, the body will begin to adapt to an environment without gravity.

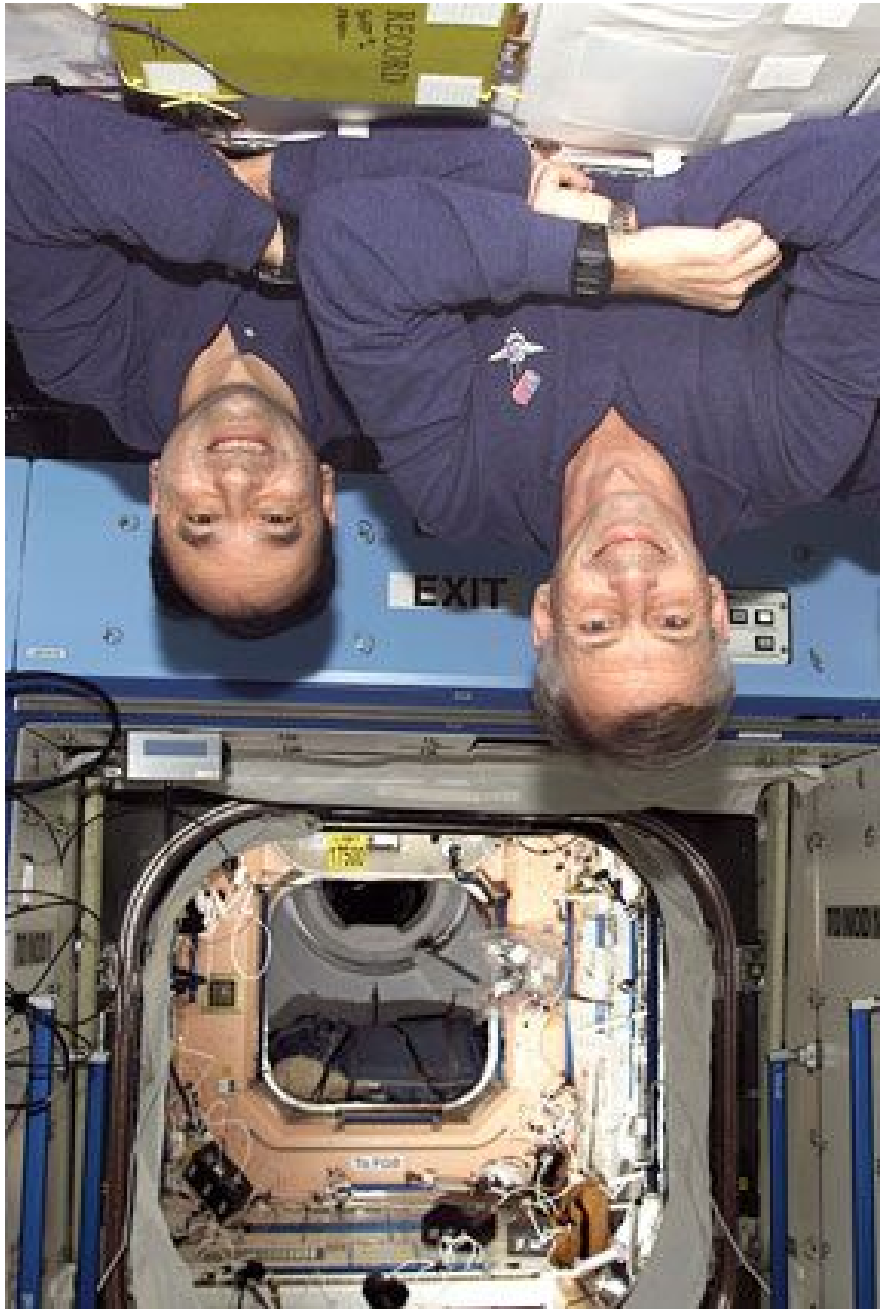
The most immediately noticeable effect is sensory disturbance involve the vestibular system.

BALANCE IN SPACE

Weightlessness experience: disorientation, motion sickness and a loss of sense of direction.

Operational activities: approach and landing, docking, remote manipulation, extravehicular activity and post-landing normal and emergency egress.


WHICH WAY
IS UP?



SPACE MOTION SICKNESS

State of diminished health characterized by symptoms that occur in response to the unaccustomed motion environment of microgravity.

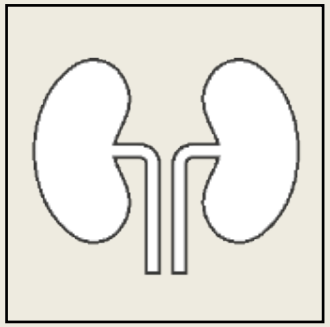
SPACE MOTION SICKNESS

Most common problem experienced in the initial hours of weightlessness: Space Adaptation Syndrome (SAS) or Syndrome of Motion Sickness, commonly referred to as space sickness.

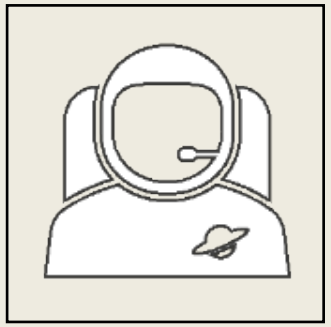
SPACE SICKNESS

60% to 80% of astronauts experience space adaptation syndrome within the first three days.

SPACE MOTION SICKNESS



No diagnostic laboratory tests exist for motion sickness.

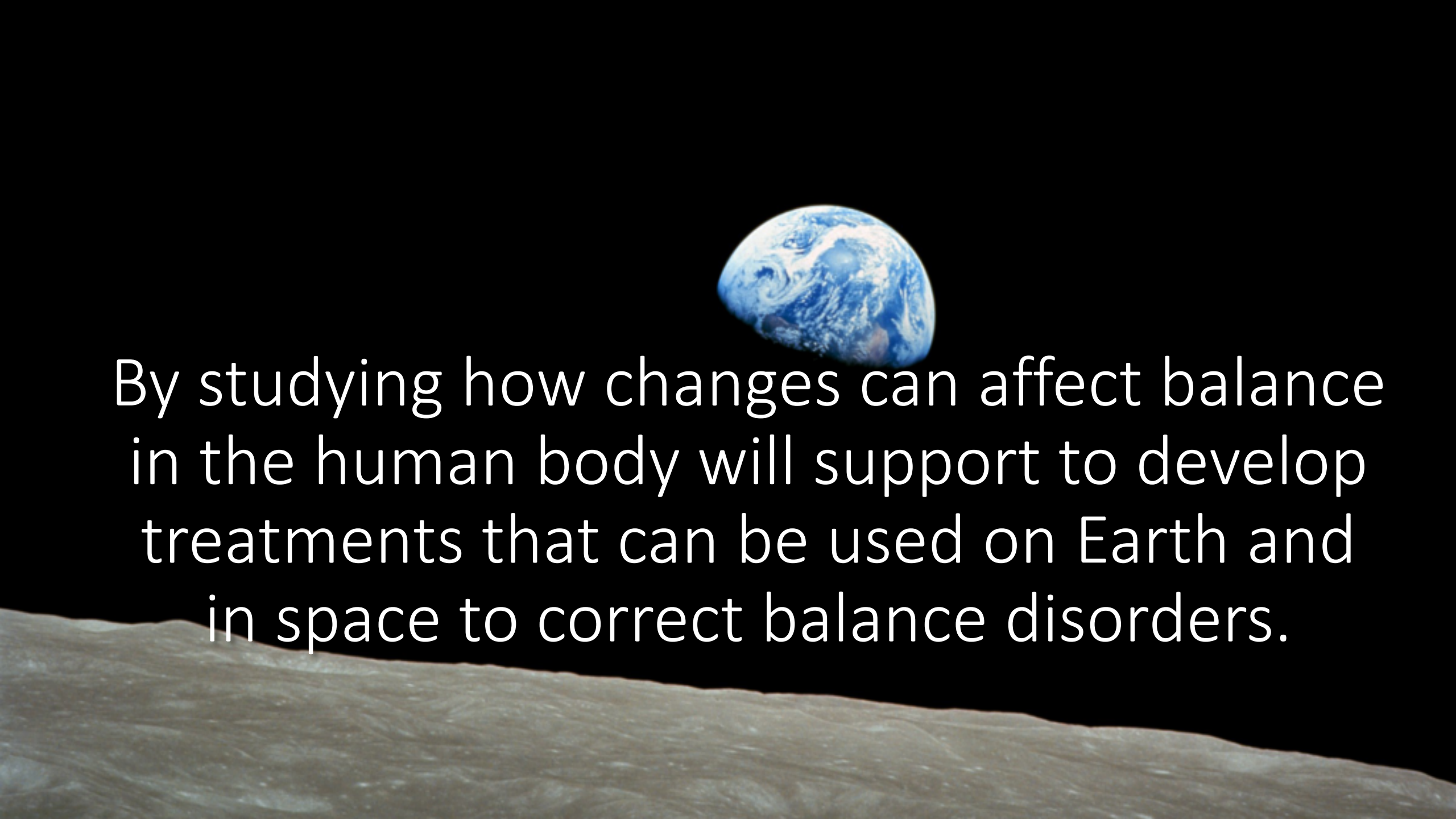


Space motion sickness are not fully understood.

Exposure to weightlessness changes the resting activity of the otolith organs.

BACK TO EARTH…

Readjust to gravity - problems standing up, stabilizing their gaze, walking and turning.



By studying how changes can affect balance in the human body will support to develop treatments that can be used on Earth and in space to correct balance disorders.


Future directions

Microgravity: an extreme environment for otolith organs

BY LILIAN FELIPE

Motion sickness in a car can be upsetting for all involved. Transferring this concept into a tiny cabin bound for space could have devastating consequences. Are the processes involved in 'space motion sickness' the same as motion sickness? How do astronauts overcome this? **Lilian Felipe** explains.

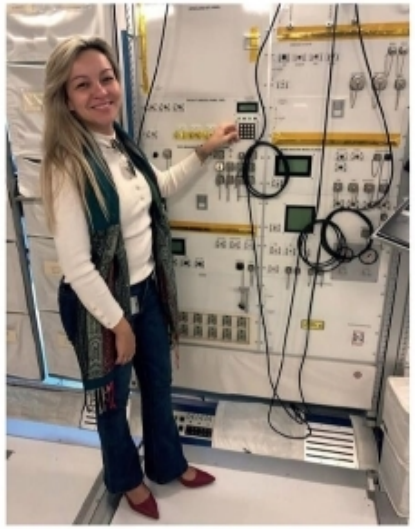
"Your mind is like a parachute: If it isn't open, it doesn't work." Buzz Aldrin.

We are involved in a 1G environment on earth, where our skeletal, balance, and engine (the cardiovascular system) have all adapted to work effectively with one another. Gravity plays a major role in our spatial orientation, aids in posture control, and has shaped our lives as a whole.

Gravity is also known to be a neural reference that influences how we perceive an object's movement and orientation. Just as a spacecraft maintains its position based on information from the radar, gyroscopes, and accelerometers, we also rely on several neural orientation sensors. These sensors obtain information from several areas of our body including the eyes, muscles, joints, and the body's accelerometers. Information from these areas aid the brain in determining which way is up, down, forward, backward, etc. Our vestibular system is responsible for collecting and interpreting sensory information about motion; this includes equilibrium and spatial orientation. The vestibular system consists of the semicircular canals and otolith organs. Our semicircular canals are largely responsible for sensing angular rotation, while our otolith organs are utilised to perceive inertial acceleration and gravity.

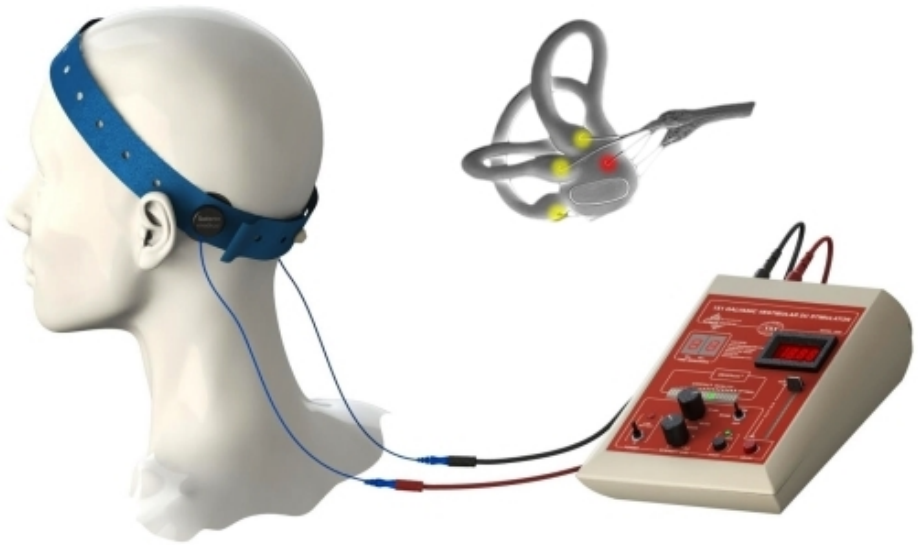
Humans are one of the most adaptable species on the planet, able to live in vastly different environments from desolate deserts and arctic areas to lush forests and busy cities. With that being said, space exploration represents the ultimate frontier in terms of challenging our adaptive capabilities. Astronauts stand at the forefront of this voyage, and have shed light on how modifications in gravitational forces affect our spatial orientation. Gravitational modifications in force, such as weightlessness during spaceflight, demand adjustment by several physiological processes influencing our balance and manner in which we perceive our spatial orientation.

As the human body enters microgravity, our otolith organs begin to lack gravitational information, leading our sensory input to expressively modify our spatial-orientation prompts. Astronauts experiencing weightlessness often suffer from disorientation, motion sickness and a loss of proprioception as their bodies try to adapt to the conditions of microgravity. Such changes can impact operational activities including approach and landing, docking,



Lilian during her training at the European Space Agency.

Space adaptation syndrome (SAS) or space motion sickness (SMS) can be described as a state of diminished health explained by signs that occur in response to the unfamiliar motion setting of microgravity. Motion sickness first appeared as an operational problem in the second manned Soviet mission in 1962, and became a significant concern in later missions, especially with increased flight duration. SMS is not a sickness, but it is generally thought to be a natural response to the adaptation of the neurosensory and perceptual systems to microgravity. Although the symptoms of space motion sickness are similar to that of earth motion sickness, scientists are unsure of whether or not the stimulus is the same. This is due to the fact that some crew members who experience earth motion sickness do not endure motion sickness when in space



Felipe L., Microgravity: an extreme environment for otolith organs. ENT & Audiology News. 2021

"One truth I have discovered for sure: When you believe that all things are possible and you are willing to work hard to accomplish your goals, you can achieve the next 'impossible' dream. No dream is too high!"

Buzz Aldrin