



НАУЧНЫЙ ЦЕНТР МИРОВОГО УРОВНЯ  
ПАВЛОВСКИЙ ЦЕНТР  
ИНТЕГРАТИВНАЯ  
ФИЗИОЛОГИЯ  
МЕДИЦИНЕ, ВЫСОКТЕХНОЛОГИЧНОМУ ЗДРАВООХРАНЕНИЮ  
И ТЕХНОЛОГИИ СТРЕССОУСТОЙЧИВОСТИ

Department of sensory-motor physiology and countermeasures,  
Institute of Biomedical Problems, Russian Academy of Sciences



# DEVELOPMENT AND IMPLEMENTATION OF SPACE COUNTERMEASURE TECHNOLOGIES IN TERRESTRIAL MEDICINE: PRESENT AND FUTURE

## Elena Tomilovskaya

Head of the department of Sensorimotor Physiology and Countermeasures

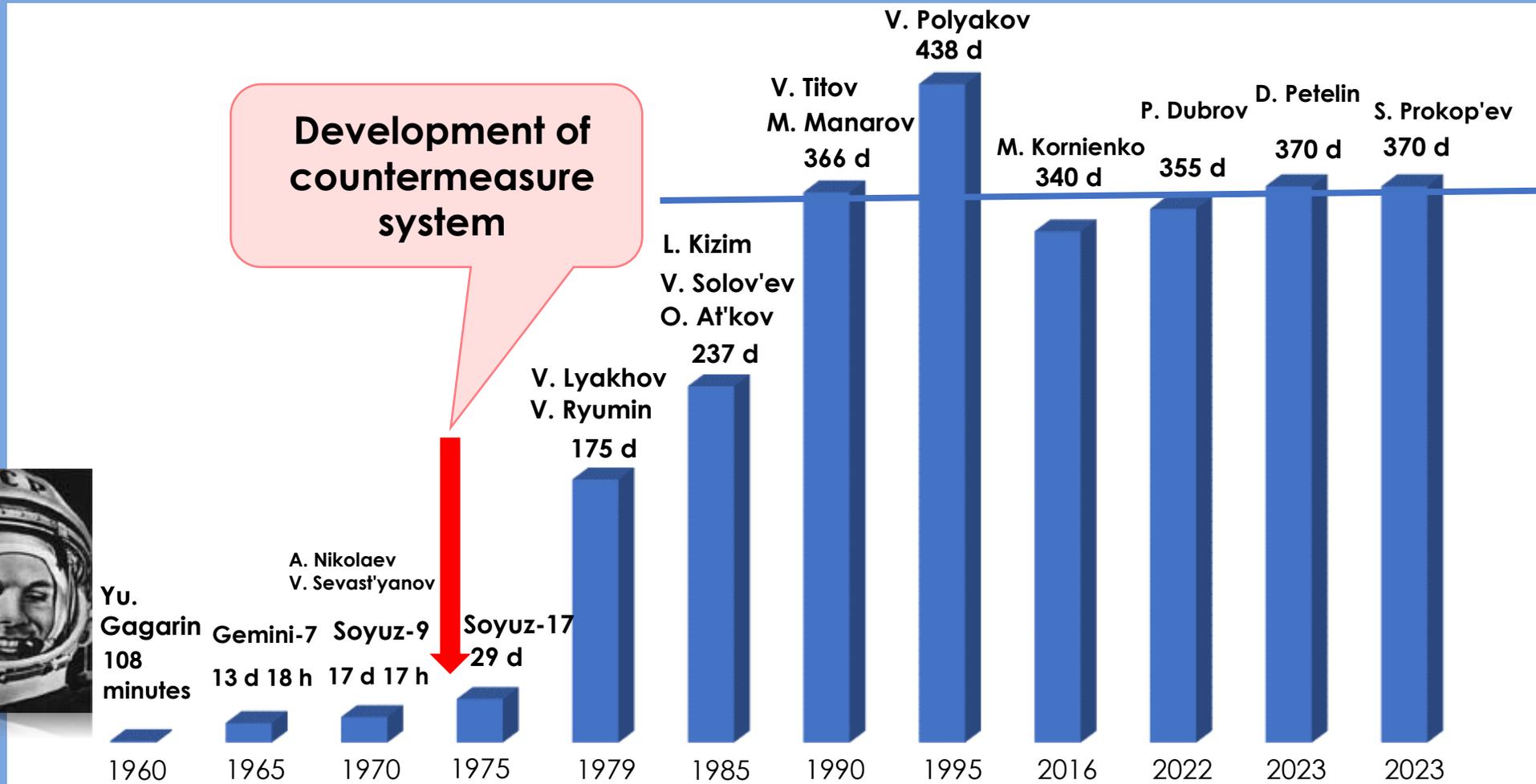
PhD in Biological sciences

Corresponding Member of the Russian Academy of Cosmonautics named after K.E.

Tsiolkovsky

Academician of the International Academy of Astronautics

# Duration of space flights



365 d

# Aims of countermeasure system in space flights



## Compensation for unloading of the motor system

### ACTIVE MEANS:

- Treadmill (T-2)
- Veloergometer (VB-3)
- Resistive exercise device ARED

### PASSIVE MEANS :

- Electromyostimulators
- Axial loading suit "Penguin"
- Occlusive cuffs
- Expanders
- Suit "Chibis" (LBNP)
- Anti-G suit "Centaur "
- Water-salt additives





**Axial loading  
suit "Penguin"**

correction of spinal disorders of posture  
and locomotions



improving the quality of life

increase the resistance to physical loads

increase of social activity

**Rehabilitation suit "Regent"**



To date, the Institute's technologies have been implemented in 350 institutions providing specialized preventive, therapeutic, and rehabilitation assistance to the population

## REHABILITATION SUIT "REGENT"

SPACE PROTOTYPE

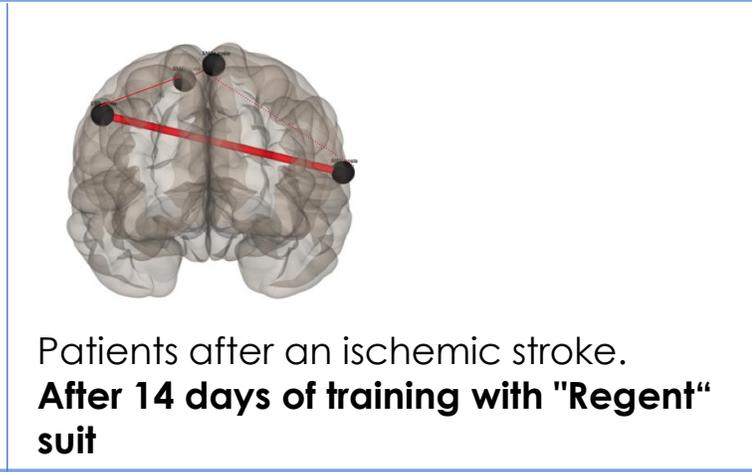
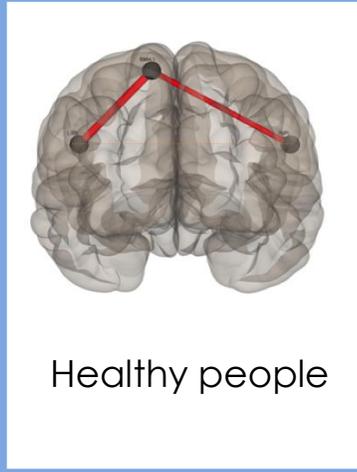
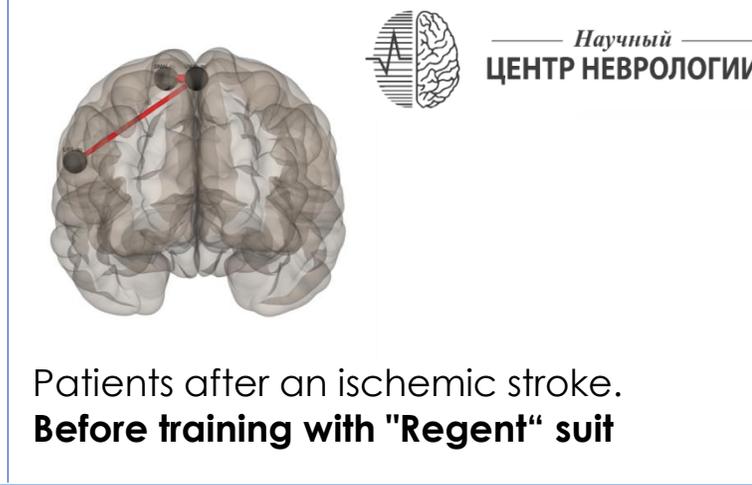
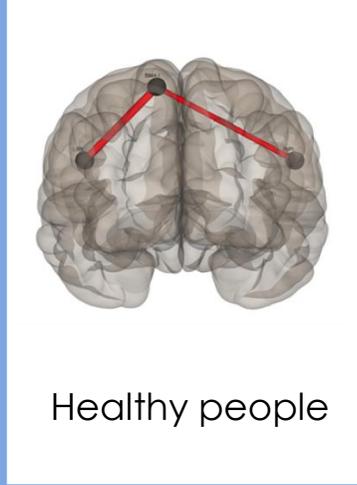
REHABILITATION SUIT



Employees of the Institute of Biomedical Problems of the Russian Academy of Sciences and the Center for Aerospace Medicine and Technology - the authors and developers of the technologies being implemented - were awarded in 2009 the "National Prize for the Best Doctors of Russia "Challenge" for the creation of a new direction in medicine.

## Recovery after Stroke

Научный  
ЦЕНТР НЕВРОЛОГИИ



# REHABILITATION SUIT "REGENT"



- A highly effective device for the rehabilitation of patients with: cerebral palsy, ischemic stroke, traumatic brain injury;
- Easily compatible with other neurorehabilitation technologies



- Correction of functional disorders of posture and locomotion,
- Increased the tolerance to physical loads,
- Improving the quality of life,
- Increased of social activity.



Balance therapy



Locomotor training with hanging

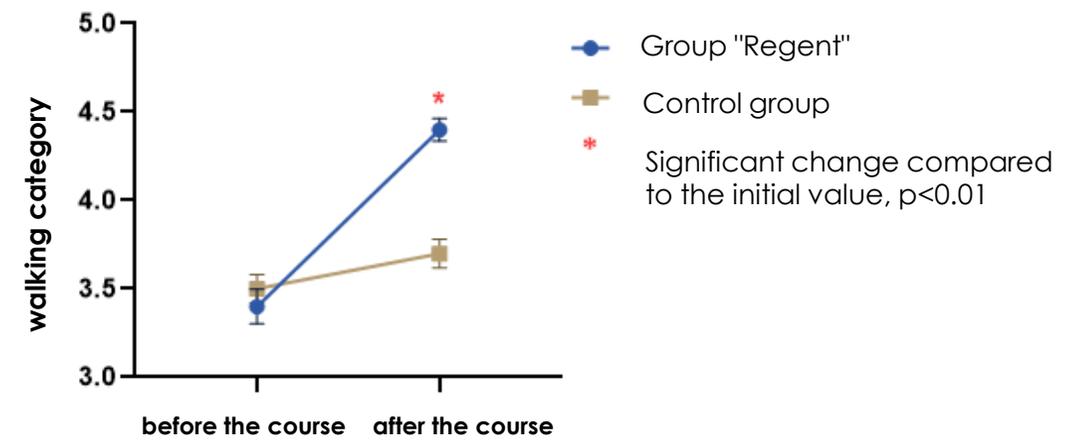


A virtual reality

## Clinical trial results (324 patients)



ЦЕНТР ПАТОЛОГИИ РЕЧИ И НЕЙРОРЕАБИЛИТАЦИИ



Increased motor activity of the speech apparatus in all patients from the Regent group



compensator of support unloading

KOR

noninvasive activation of  
cerebral cortex response

all the stages of  
normalization of muscle

indirect prevention of

various neurological

activation of bone consolidation  
mechanisms





## Ground-based microgravity model – Dry Immersion

relief of spasticity

unloading of the musculoskeletal system

reduction of chronic pain syndrome

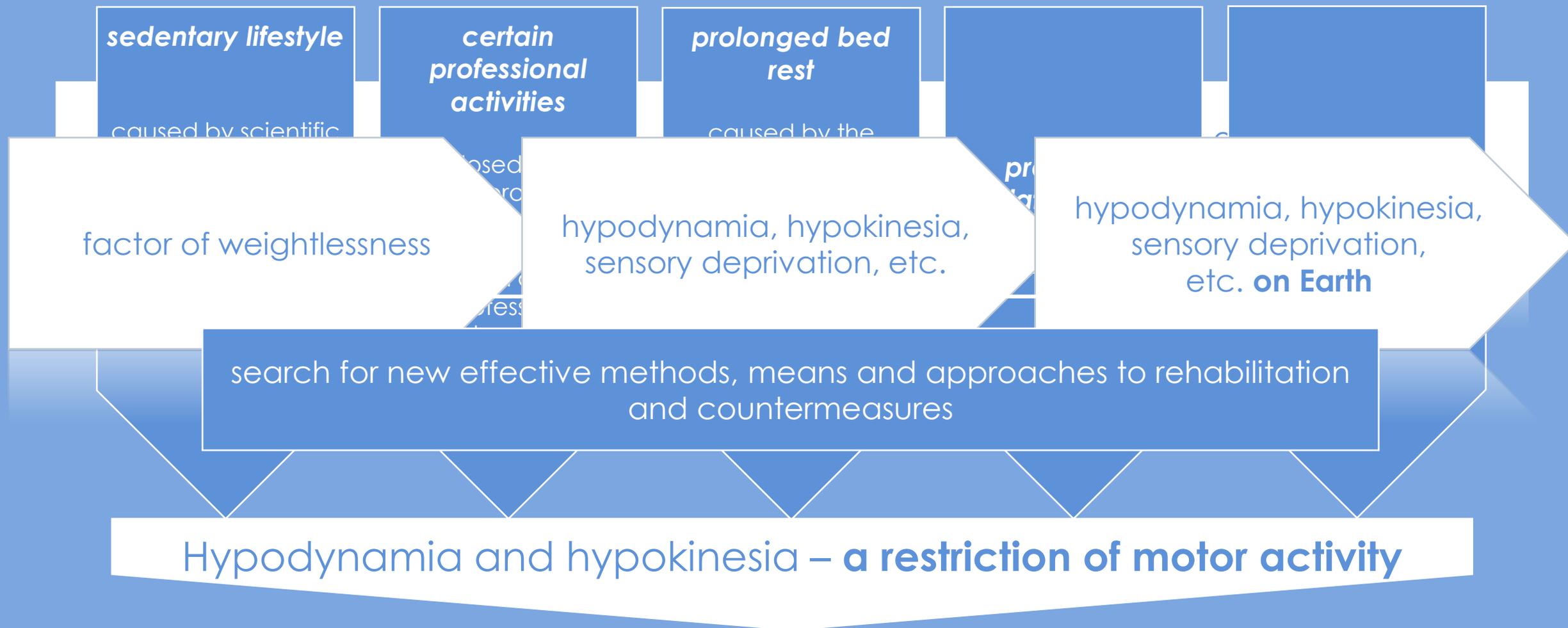
reduction of the depression level

increase of immunity

reduction of edematous syndrome

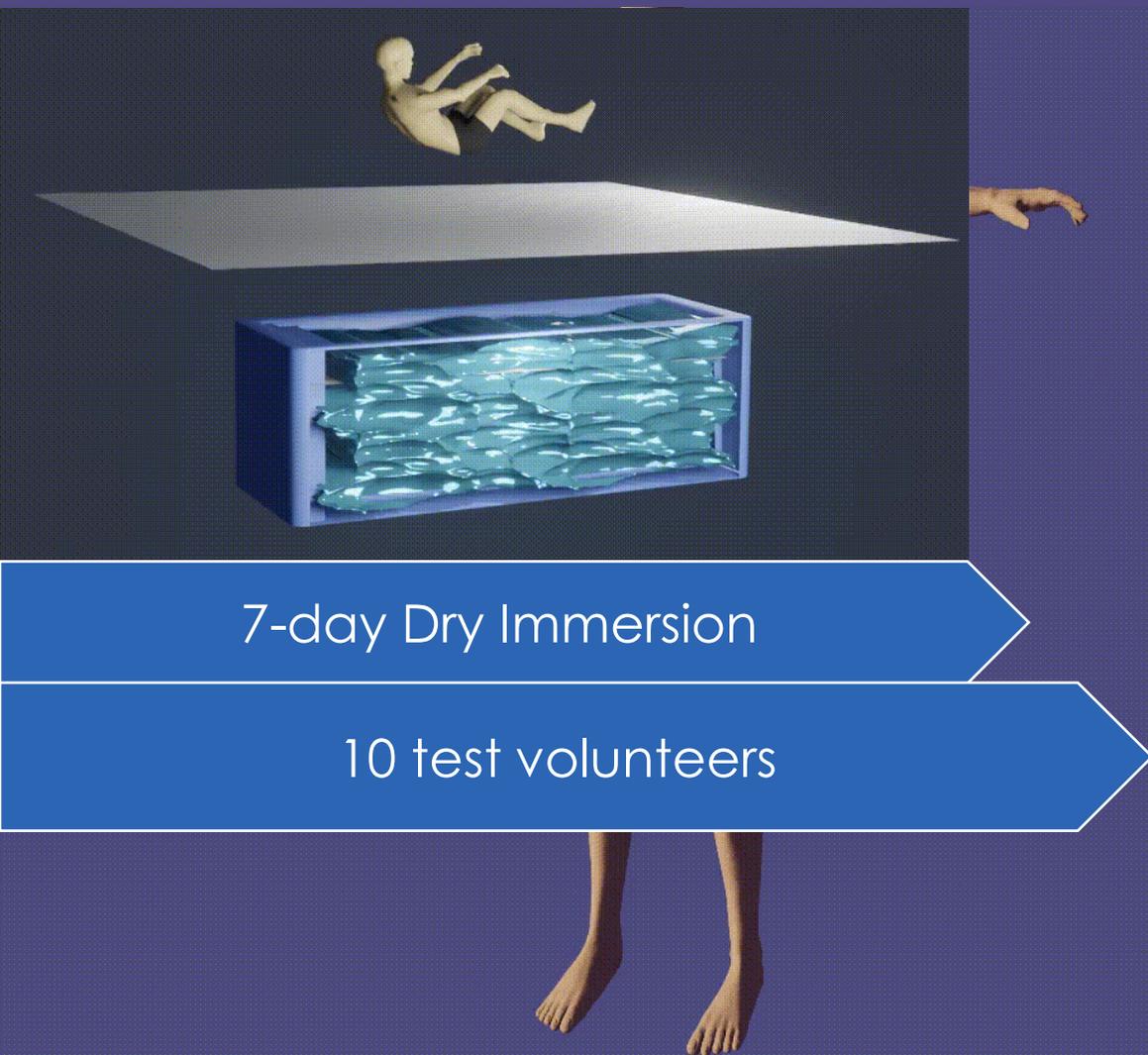
reduction of peripheral vascular resistance

## A new "challenge" to modern society is hypodynamia and how it is related to adaptive changes in space



## What have we already done?

### The design of the research



**2 sessions per day** daily for 7 days of DI

the scheme of applying the electrodes **the same for the two sessions**

2 electrodes (with an area of 38.5 to 74.25 cm<sup>2</sup>) were applied to each stimulated muscle group:

**Important!**

it was the muscle group that was stimulated and not one specific muscle

one electrode - to the distal extreme third of the muscle group

the second – to the proximal extreme third of the muscle group

Contact us:  
[finegold@yandex.ru](mailto:finegold@yandex.ru) Head of Department



НАУЧНЫЙ ЦЕНТР МИРОВОГО УРОВНЯ  
**ПАВЛОВСКИЙ ЦЕНТР  
ИНТЕГРАТИВНАЯ  
ФИЗИОЛОГИЯ**  
МЕДИЦИНЕ, ВЫСОКОТЕХНОЛОГИЧНОМУ ЗДРАВООХРАНЕНИЮ  
И ТЕХНОЛОГИЯМ СТРЕССОУСТОЙЧИВОСТИ

