



# SPACEFLIGHT INDUCED DECONDITIONING:

*PARALLELS WITH CLINICAL MEDICINE AND GERIATRICS*

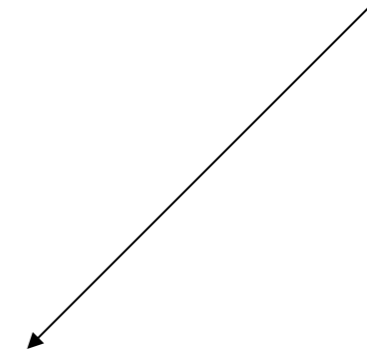
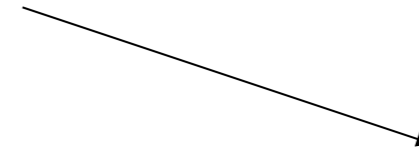
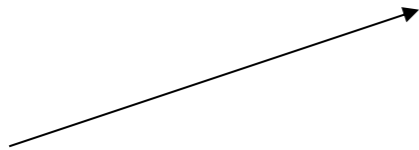
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European Innovative Partnership Active & Healthy Aging  
*Falls Prevention Task Force*



# Our Life Long Fight Against Gravity





# The Gravity Dilemma



Space  
( $\mu\text{g}$ )



Launch  
(3g)



Re - entry  
(1.6g)

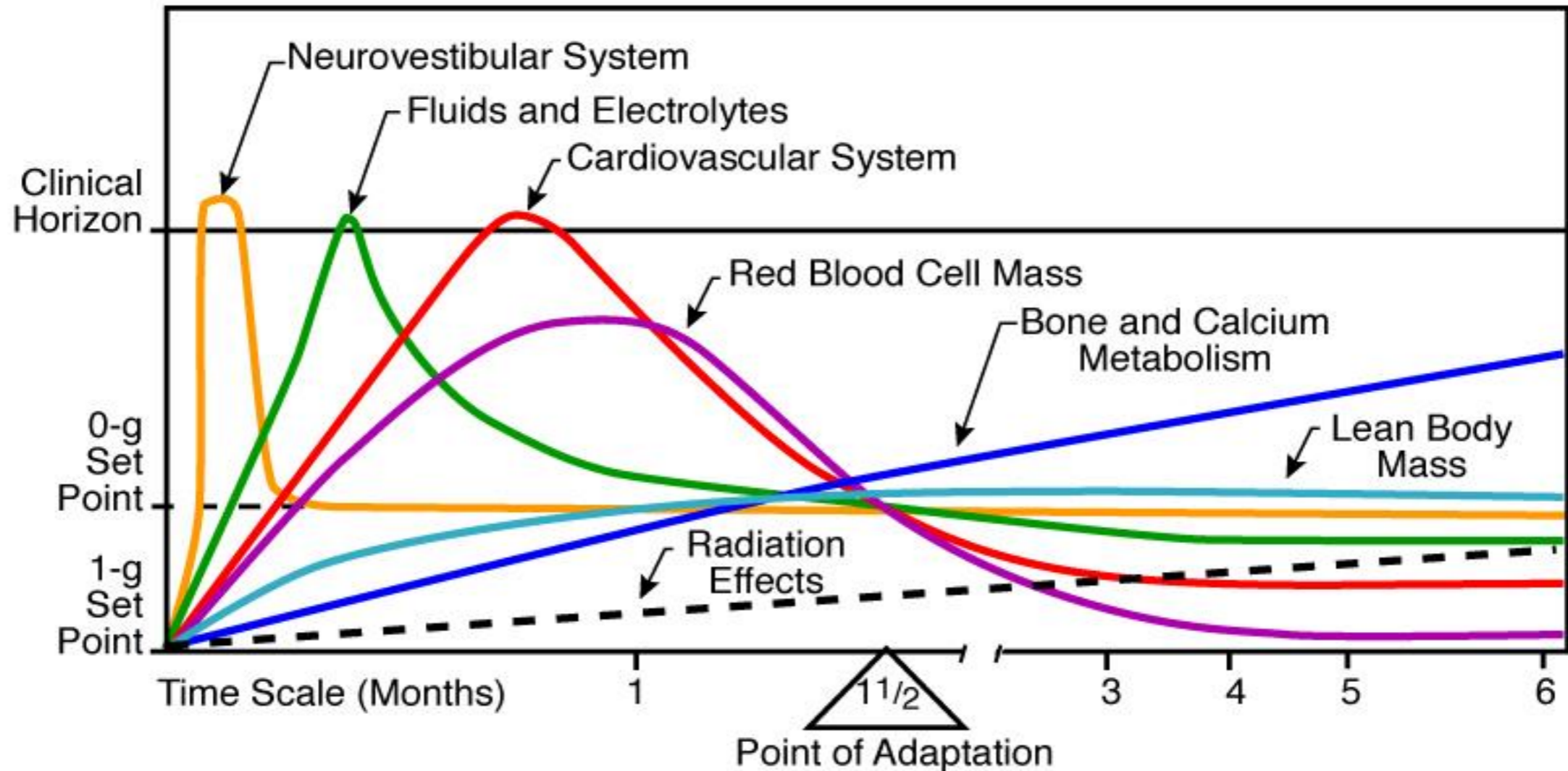


Earth  
( $\mu\text{rg}$ )



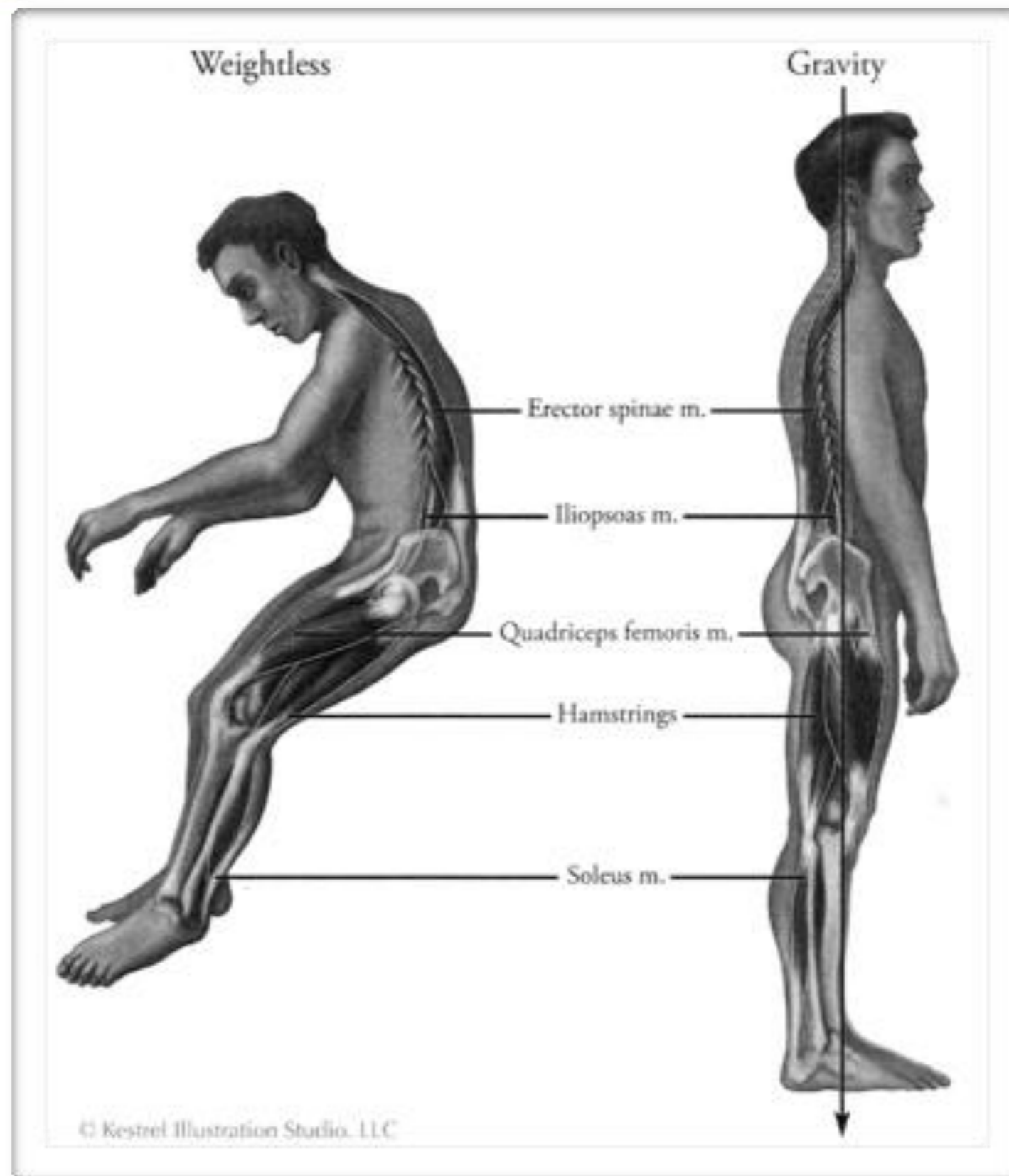


# Deconditioning Time Course

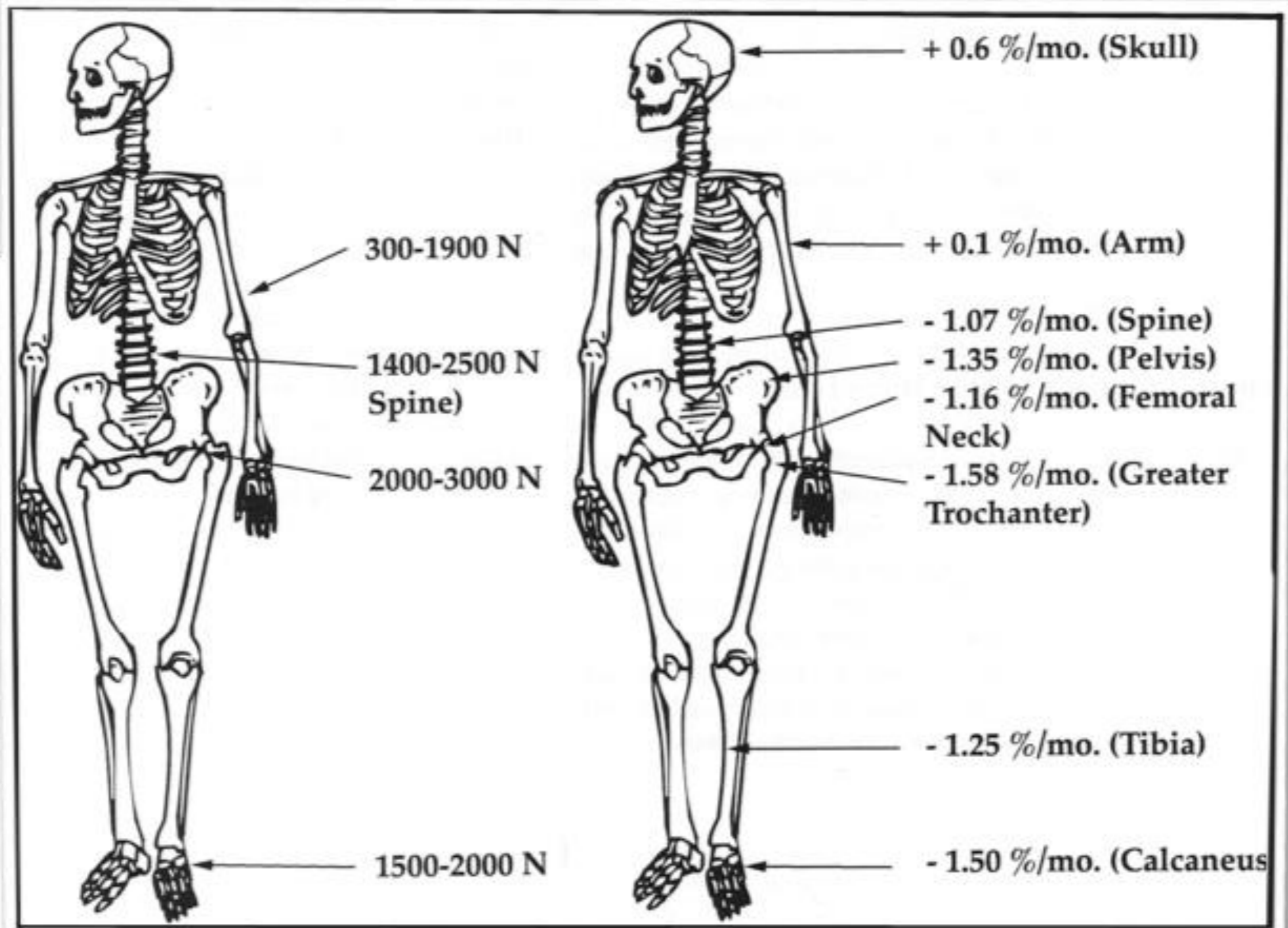


***Each physiological system acclimates to microgravity at a different rate***

# Muscles Affected in Microgravity

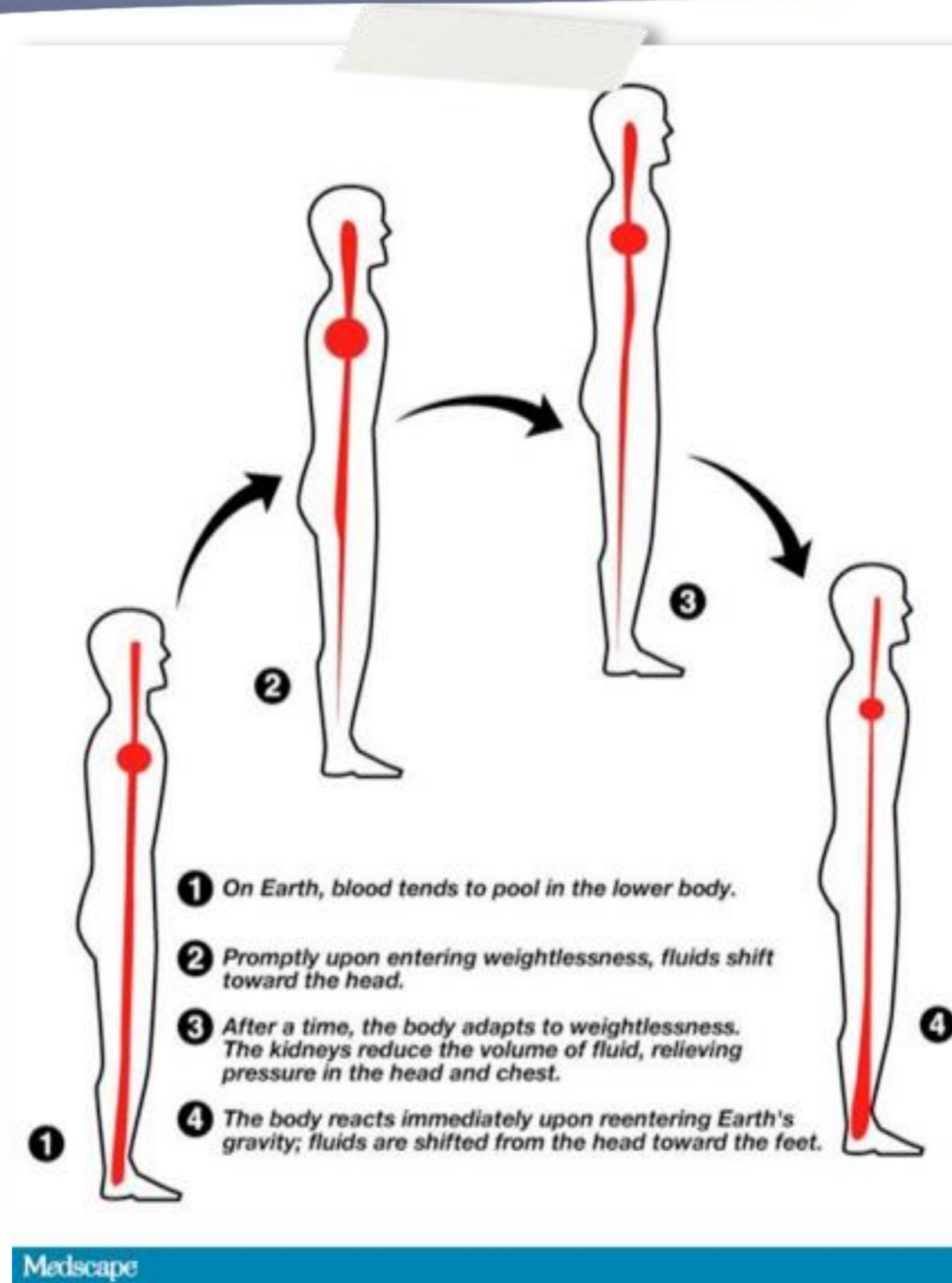


# Bone Loss in Space





# Fluid Shifts in the Body



# Orthostatic Intolerance





# Simulating Orthostatic Challenge

Head up Tilt



Lower body negative suction



HUT

+

⇒ **Presyncope**

LBNP



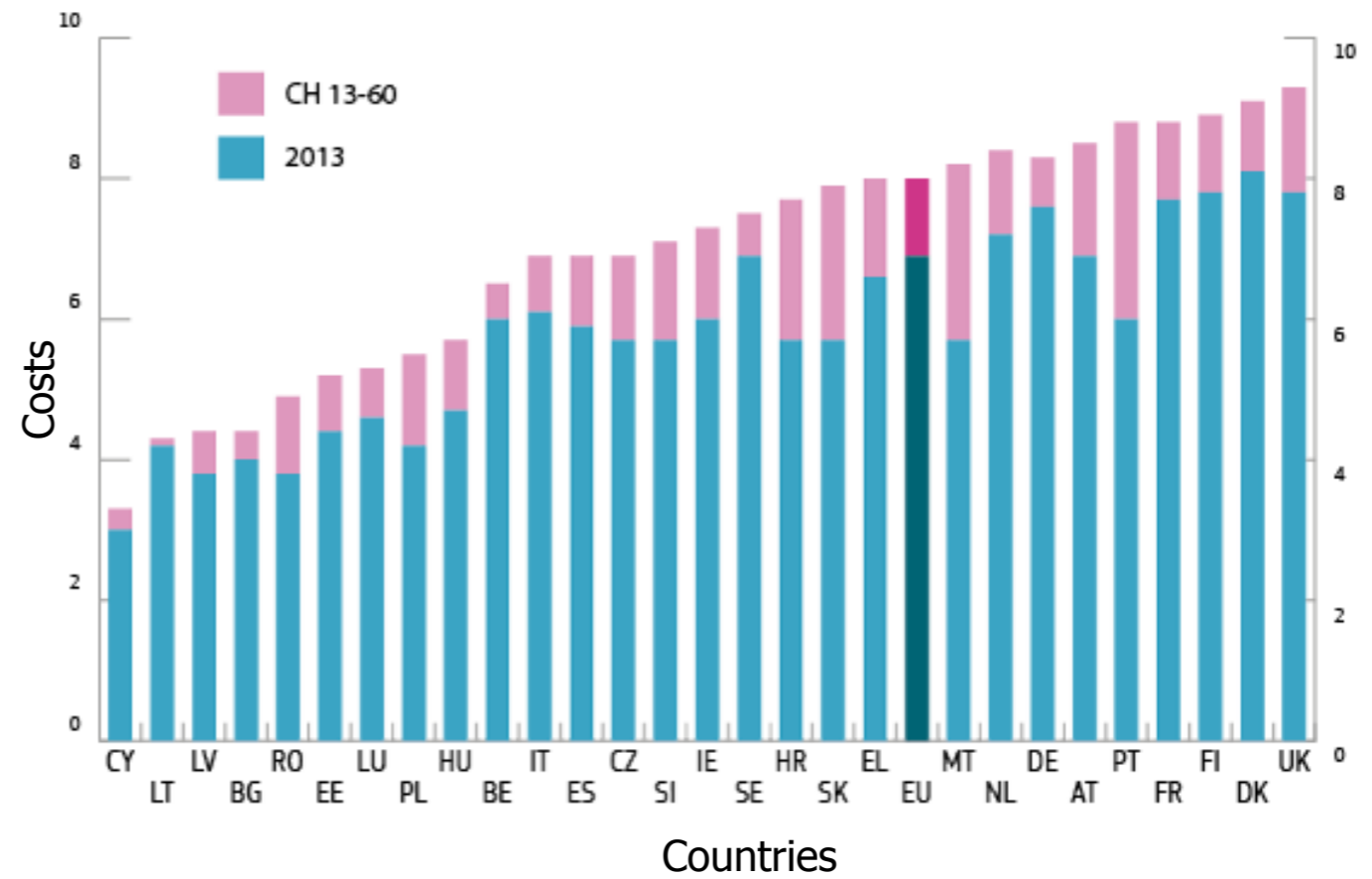




# Aging and Healthcare Costs Trends



*EU Aging Report, Brussels*



*EU Aging Report, Brussels*

# Syncope in Older Persons



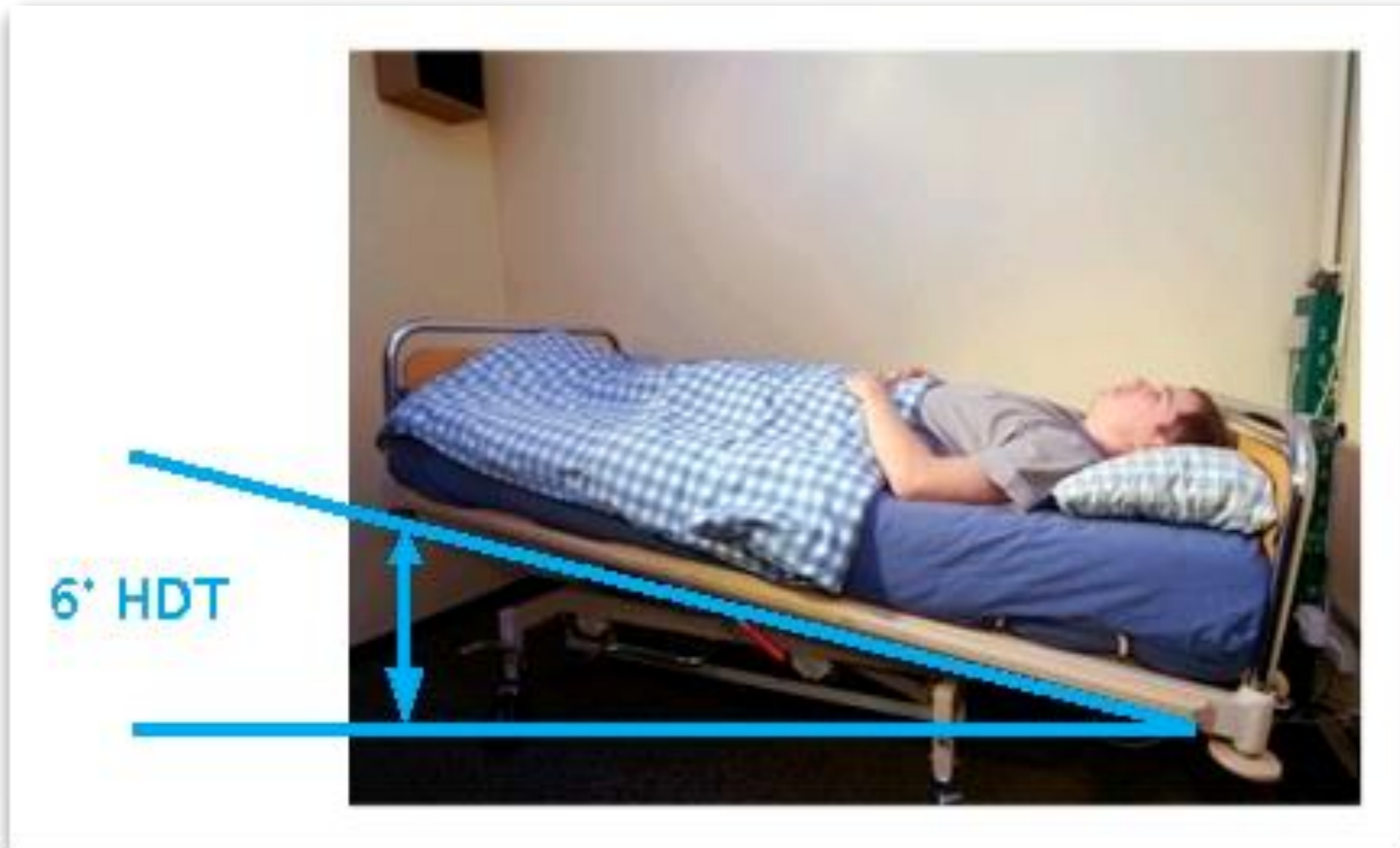


# Immobilization in Older Persons





# Bedrest Simulates Spaceflight Deconditioning







# 6° Head-down Bedrest Immobilization



ESA ©

# Frailty: A Vicious Cycle



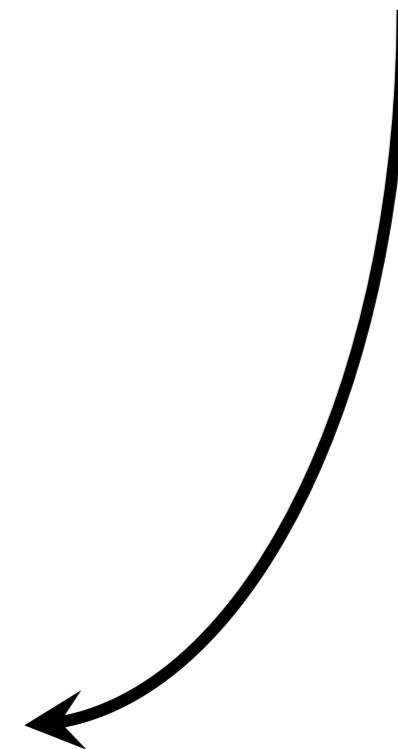
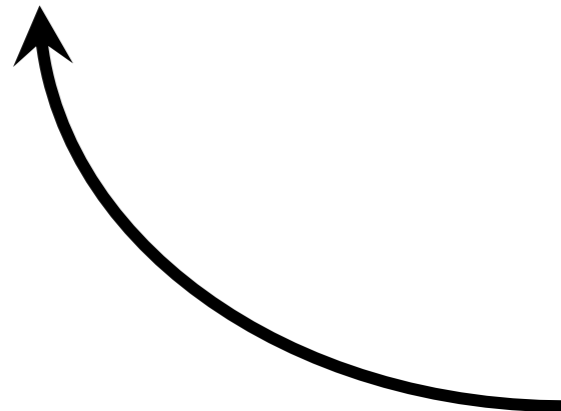
**Immobilization**

**further**



**De-conditioning**

**Falls / Fear of falling**



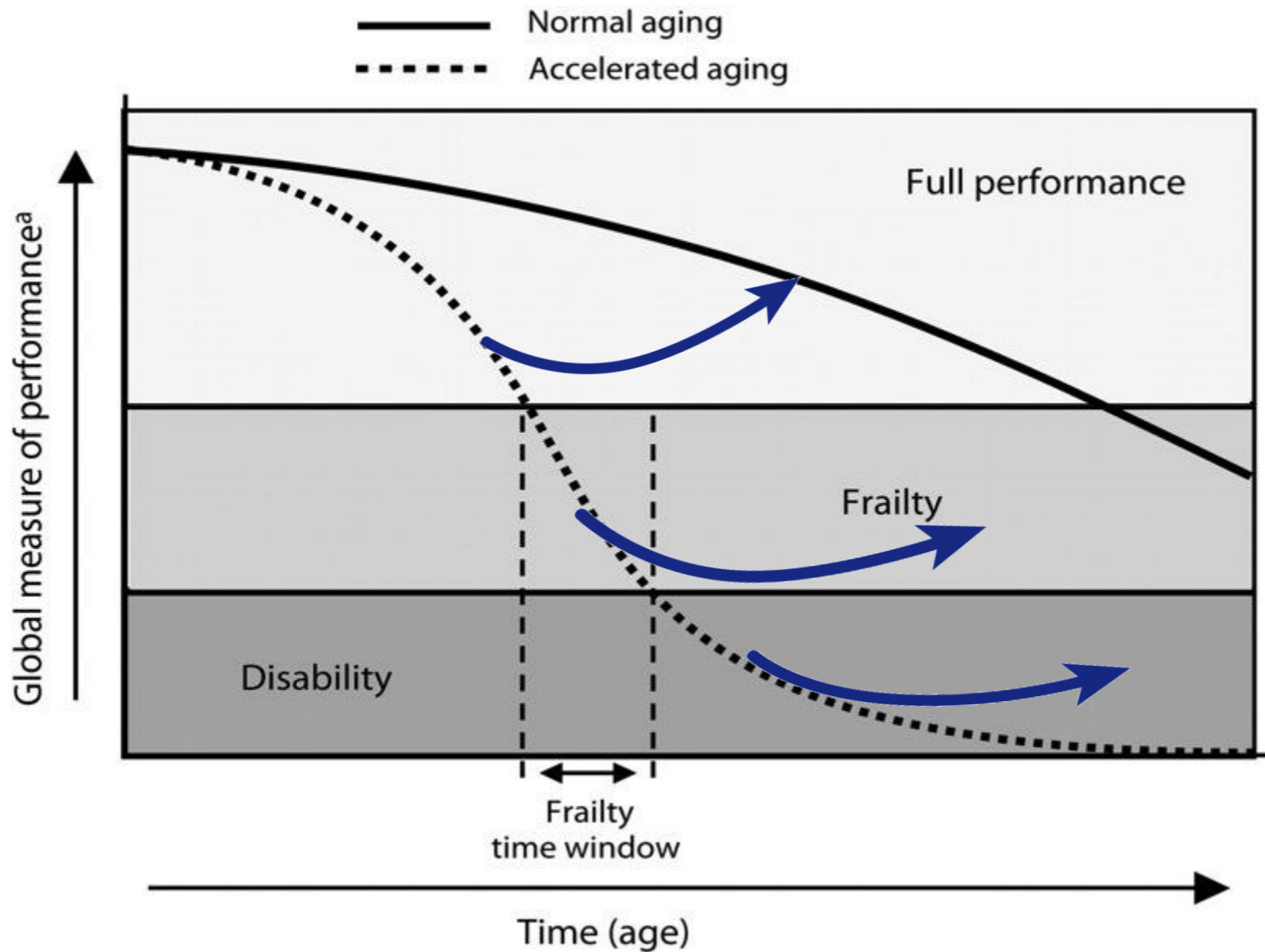




# Hospitalization in Older Persons

- 65+ year old patients → 40 % acute hospitalizations
- Poor outcomes:
  - ... high 1 year mortality
  - ... 30 % functional decline
  - ... high re-admission rates
  - ... higher home healthcare usage

# Aging, Interventions and Recovery



*Singh et al. (2008). Mayo Clinic Proceedings, 83(10), 1146-1153.*

- Keeping ambulatory persons mobile
- Getting bed-confined persons re-mobilized





## Many studies: Ambulatory care



**Lack of bedrest immobilization studies  
& care strategies in older persons**





# Manual Physiotherapy





# Exercising During Bedrest



Koryak YA (2015) *Int J Sports Exerc Med* 1:006



# Exercising in Space



?

NASA ©



# Running while Lying Down



Prof Joern Rittweger, DLR, running in the supine position (DLR ©)

# Vibration Exercise



Powerplate©)



# Resistive Vibration Exercise During Bedrest



ESA©)



# Resistive Vibration Exercise During Bedrest



ESA©)



# Acute Immobilization → Active and Healthy Aging



Immobilization Screening



Active & Healthy Aging



Behavioral Change



Interventions



Discharge Management



„Buddies“



# Impact and Outcomes



## MACRO LEVEL

Improving geriatrics care  
Saving in healthcare costs



## MESO LEVEL

Regional Falls prevention initiatives  
Establishing community based structures



## MICRO LEVEL

Falls prevention in older persons  
Effectiveness of interventions



*„International co-operation for Space life Sciences knowledge sharing & development in Africa“*

**International Academy of Astronautics (IAA):**  
Commission 2 – Space Life Sciences Study Group Report