

Force of attraction between to massive bodies

GRAVITY

Microgravity

**THERE IS GRAVITY IN
SPACE (JUST NOT MUCH)**

- ⦿ The more mass there is the more gravity there is
- ⦿ The closer two objects are together the more gravity there is between them
- ⦿ So...there is more gravity on your planet than orbiting it in space,
- ⦿ But...your planet does not have the same amount of gravity as Earth because it has a different mass

Earth's Gravity

- ◎ $g = 9.8 \text{ m/s}^2 = 32.2 \text{ ft/s}^2$
- ◎ Earth's Mass = $5.9 \times 10^{24} \text{ kg}$

Humans Need Gravity

⦿ Muscles

- Deteriorate without strenuous use (exercise)
- Some astronauts can not stand up when they return to earth—loss of muscle

⦿ Bones

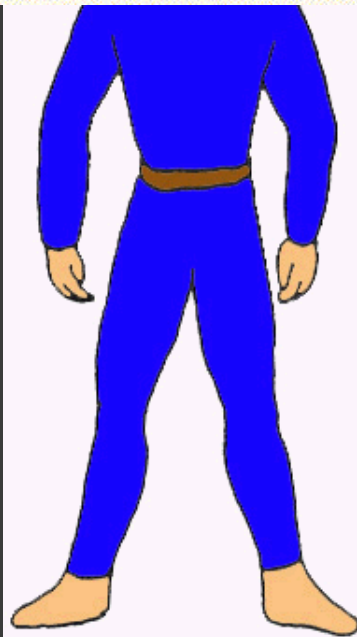
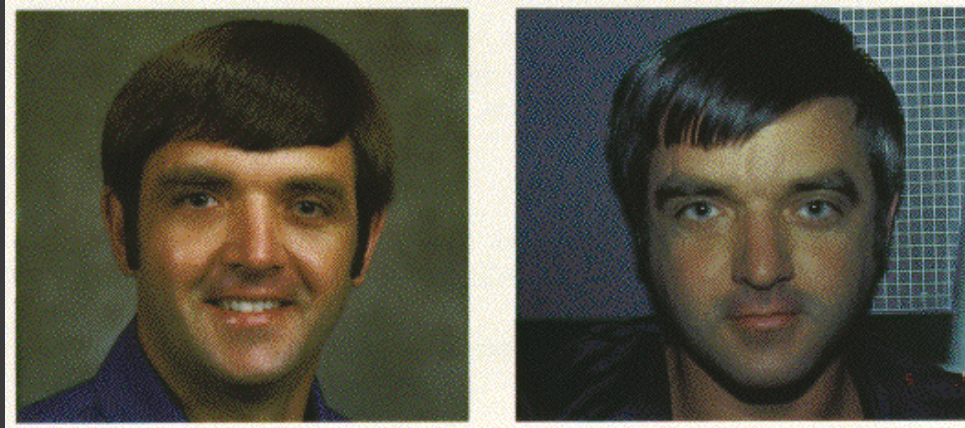
- Bones become less dense without strenuous use (exercise)
- Become brittle upon return to Earth (like osteoporosis)
- Takes 2 ½ times as long to regain the bone mass as it takes to lose it.

Humans Need Gravity

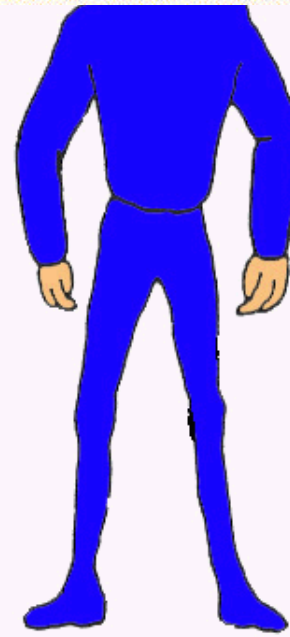
◎ Circulatory System

- Set up to pump blood harder to head because of the brain and pumping against gravity.
- In space face becomes puffy because of too much blood
- Heart enlarges to compensate for increased pressure
- Body compensates by eliminating fluids from the body (major dehydration)
- Results in lower amounts of blood in body
- Returns to normal soon after return to Earth

Puffy Face Syndrome



On Earth



In Space

Humans Need Gravity

- ◎ Vestibular System—sense of up/down
 - Controlled by fluid and sensory hairs in the inner ear
 - Gravity usually holds fluid level in the ear
 - In space fluid moves about freely
 - Body usually relies on eyes and inner ear to sense up/down
 - Info from these two sources contradicts itself in space causing nausea in many astronauts

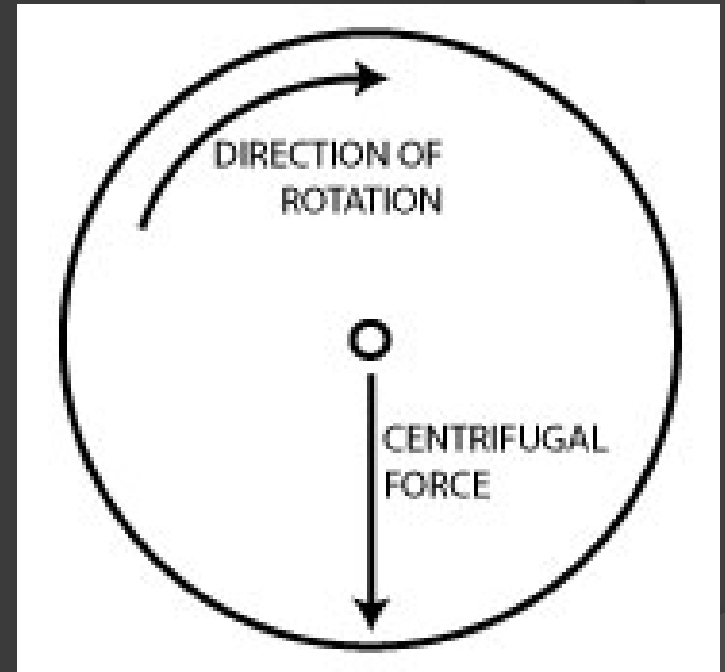
Because of these effects on the human
body...

- ⦿ You must provide Earth's level of gravity to your colonists so they can return to Earth if they want/need to and survive.

- ⦿ This is how...

Centrifugal Force

- Artificial Gravity can only be created through centrifugal force
- There is no such thing as a “gravity machine”
- Magnets can hold you to the floor, but they do not correct any other body system.



The Solution: The Torus

- ⦿ Bicycle wheel shaped structure which rotates
- ⦿ Rotation causes matter to be pulled outward
- ⦿ Out = Down In = Up
- ⦿ The radius of the structure and the speed at which it rotates create the gravity

