

KS 4 Science/Biology Homeostasis

Living and Working in Space



Homeostasis!

Homeostasis is all about maintaining a stable internal environment in the body. The brain and other organs prefer conditions to be kept within narrow ranges. For this, we have different types of **receptors** to monitor the internal and the external environment.

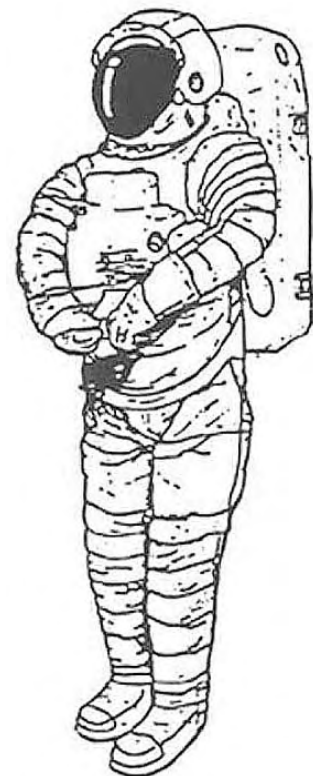
Cells in the human body work best at 37°C. This is the optimum temperature for most enzymes to work properly. Cells require a fairly narrow pH range and a regular supply of water oxygen and nutrients. Because waste products from cellular reactions are toxic, these need to be removed.

Maintaining these conditions is difficult enough on Earth, but what about conditions in Space? The astronaut must take his environment with him!

Go to the '**In Space**' gallery and look for the space suit displays.

What does the space suit do?

Protects from	<input type="text"/>
	<input type="text"/>
Supplies	<input type="text"/>
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Removes	<input type="text"/>
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KS 4 Science/Biology

Homeostasis



Living and Working in Space

The space suit is pressurised. What happens if the space suit is not pressurised?

There are two devices next to the skin of the astronaut. What do they do?

Why are these sensors important?

On Earth, how do you
Keep cool

Keep warm

How is the temperature in the space suit controlled?

Go to the '**You Are Not Built For Floating**' section

The human body responds to microgravity in many ways. Some changes occur quickly and some take longer. The brain and organs are fooled into thinking internal conditions have changed and try to correct them. This can have serious effects for an astronaut on a long mission.

Short term effects
take

Medium Term effects
take

Long term effects
take



Fit For Space

So, just how fit does an astronaut have to be? Of course, physical fitness is important but there are other abilities that our astronauts need.

Go to the **Into Space** gallery.

Why do astronauts need fast reaction speeds?

Activity - test your reaction speeds. Test yourself three times and calculate an average. Record your results in the table.

	Reaction Speed Level 1	Reaction Speed Level 2
1		
2		
3		
Average		

Why do astronauts need good colour vision?

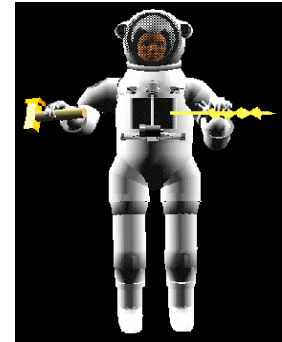
Activity - test your colour vision. What can you see?

KS 4 Science/Biology/PE
Health and fitness
Response to the Environment



Living and Working in Space

Astronauts need good communication skills. When might non-verbal communication be important?



Activity - shape building. How long did it take you to communicate the shape to your partner?

During take off, the human body is subjected to high G- forces. What effect do you think this has on the cardiovascular and musculoskeletal systems?

Cardiovascular

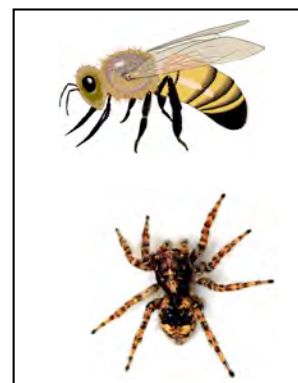


Musculoskeletal

What sort of effect would take off have on the hormone system and urinary system?



Activity - are you calm in a crisis? Test your reactions to visual cues. Which images caused the greatest reactions?



KS 4 Science/Biology/PE
Health and fitness
Response to the Environment



Living and Working in Space

Microgravity has some very serious effects on overall health. Using your own knowledge fill in the function of these systems under normal conditions. What is the effect of microgravity? There is more than one effect for some systems.

System	Gravity	Microgravity
Skeletal		
Cardiovascular		
Circulatory		
Excretory		
Sensory		
Immune		
Pulmonary		
Thermoregulation		

KS 4 Science/Biology/PE
Health and fitness
Response to the Environment



Living and Working in Space

When the body is no longer subjected to the forces of gravity, the effect is similar to being confined to bed. What will happen to cardio pulmonary fitness?

How long do astronauts spend exercising when in space?

Short missions

Long missions

What sort of equipment do astronauts use to exercise?

Why are elastic resistance bands used?

Now try some of the activities in **tranquillity Base** to see what sort of astronaut you would make.





Research In Space

Scientific experiments on the space station can help ease life for people living in space and on Earth.

Research in space focuses on the behaviour of processes in microgravity. The space shuttle crew always brings new experiments to the International Space Station.

Research is divided into several areas:

Bioastronautics is research on how the human body behaves during longer stays in space.

Earth science involves observing the Earth from space to view phenomena such as floods and volcanic eruptions.

Biotechnology is concerned with cells, tissue and biological materials.

Biology covers research on how conditions in space influence the development of living organisms.

Space product development mostly involves practical applications of the sciences, principally to develop new materials and medicines.



KS 4 Science/Biology How Science Works

Living and Working in Space



Go to the 'In Space' gallery

Why do scientists want to carry out experiments in space?



What is the glove box for?



What do microgravity experiments tell us?

What has been discovered from Life Science experiments?

What creatures have been studied in space?

Cell Growth

Astronauts have mission targets whilst in space. With the current interest in longer missions and bases on both the moon and eventually mars, sustainability is an important issue. Being able to produce enough food is very important.

Gravity influences how plants grow. Plants produce hormones called **auxins**. These tell the different parts of the plant which way to grow in response to light, water and gravity.

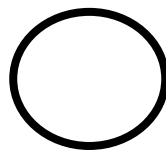


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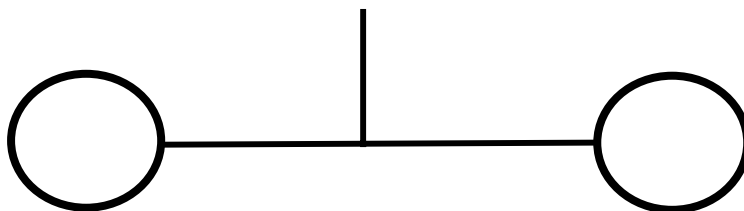
Go to the 'Gravity Garden' exhibit.

What happens to the way the plants grow when different gravity situations are simulated?

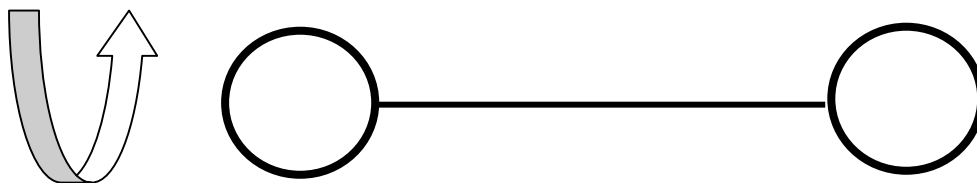
No movement



Centripetal force - merry go round



Ferris wheel.



Respiration

There is another good reason for growing green plants on longer missions. Plants carry out a very important function when they are exposed to the correct wavelength of light. What is this process called?

Here is the equation. Fill in the blanks.



<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
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KS 4 Science/Biology
Health, Nutrition, Digestion
Living and Working in Space



Sustaining the Organism

An astronaut needs to carry out all the normal processes of a human organism, but does them in a confined and at times hostile environment. Let's look at a few of the 'characteristics of all living things' and see how they need to be adapted to the space environment.

Go to the '**In Space**' gallery

Nutrition

Astronauts need a similar number of calories and as good a nutrient balance in space as they do on Earth. However, micro gravity causes a few problems.

In what form is most of the food?

What are the types of food that the astronauts have available to them?

What foods can they only have occasionally?

Listen to the Helen Sharman interview for the answers to the next questions



KS 4 Science/Biology Health, Nutrition, Digestion

Living and Working in Space



Are there differences in types of food between Russian and American space stations?

Why is the astronaut's sense of taste affected?

Are their particular nutrients they might need to increase?

How much fluid should astronauts drink?

Is digestion affected by weightlessness?

Try and put together a 'balanced diet' from the foods on display. What might be missing?



Dealing with Waste

Human biological waste is a big problem. Fluid balance is disrupted and the kidneys work harder. What waste products do the kidneys produce?

**KS 4 Science/Biology
Health, Nutrition, Digestion**

Living and Working in Space



How does the space toilet work?



What useful products do the astronauts get from processing the waste from the space toilet?

Hygiene.

How do astronauts keep clean in space?



Rest

Is sleep affected by microgravity?

Do astronauts snore more in space or on Earth?



Do you still want to be an astronaut?!