The brain

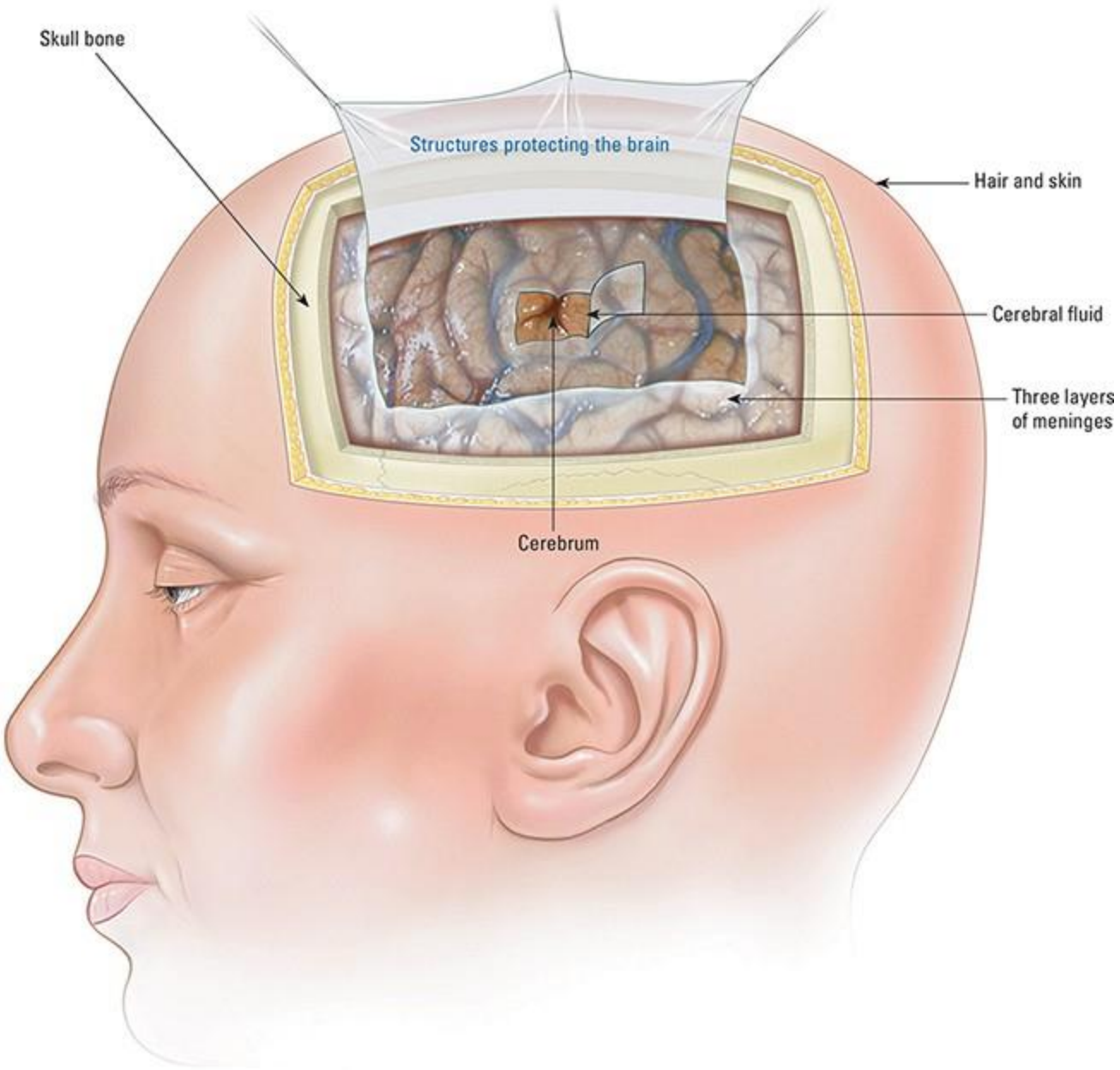
Protecting the brain

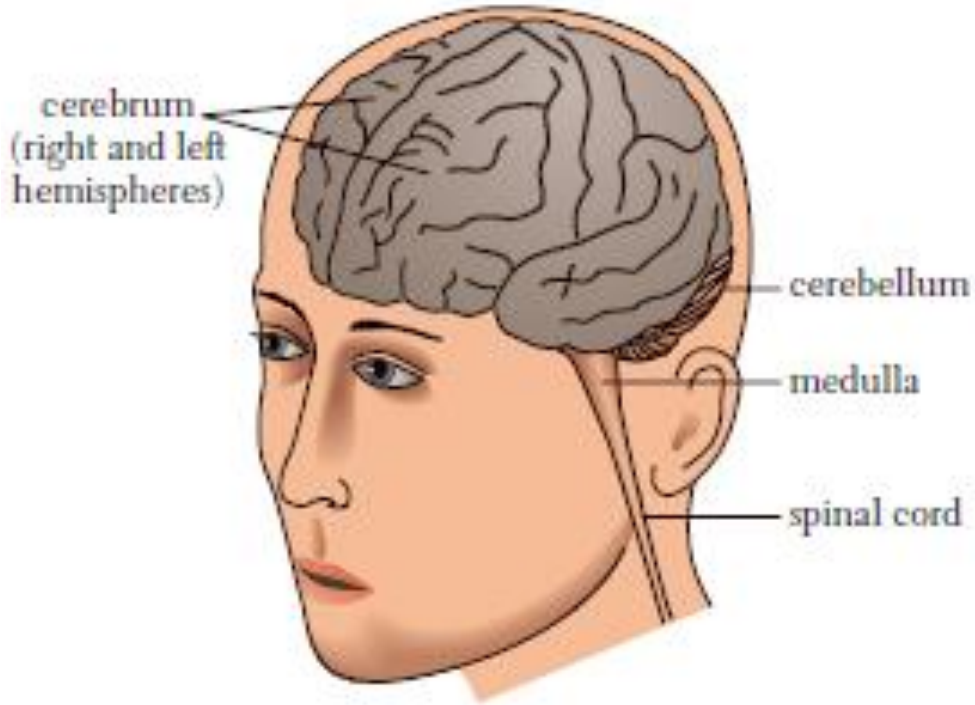
- **Skull**
  Protects it from physical injury

- **Meninges**
  Three layers of connective tissue

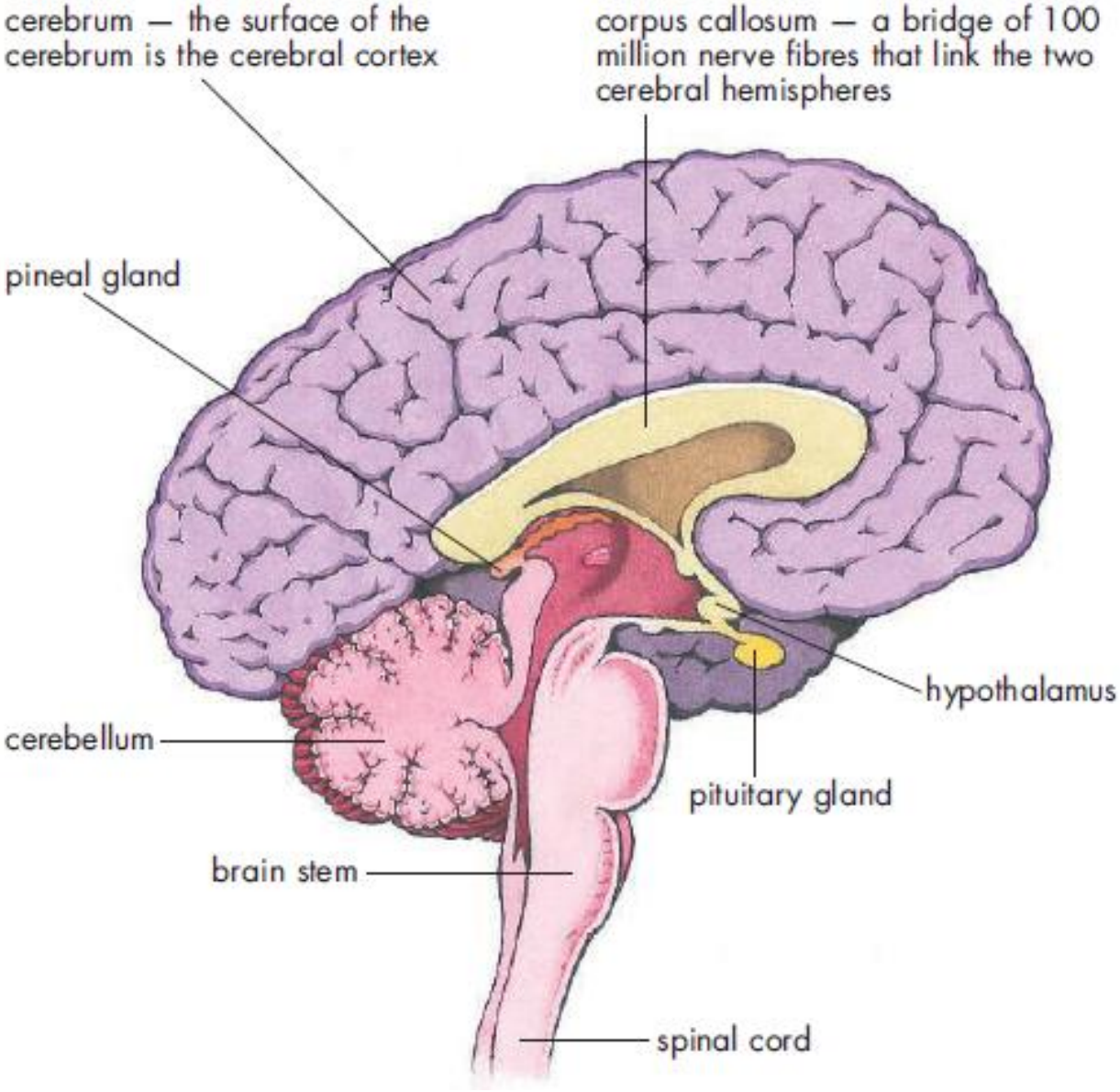
- **Cerebral fluid (cerebrospinal fluid-CSF)**
  Cushions it against bumps, knocks and shocks

The spinal cord too is protected by a bony case, the backbone, and cushioned by cerebrospinal fluid.


Skull bone
Structures protecting the brain
Hair and skin
Cerebral fluid
Three layers of meninges
Cerebrum



The human brain


cerebrum — the surface of the cerebrum is the cerebral cortex
corpus callosum — a bridge of 100 million nerve fibres that link the two cerebral hemispheres
pineal gland
hypothalamus
cerebellum
pituitary gland
brain stem
spinal cord

Parts of the brain and their functions

Part	Description	Function
Cerebrum	• makes up 90% of the brain's volume • grey and wrinkly	• controls memory • speech and thought • all conscious actions, such as walking, running and speaking
Cerebellum	• back of the brain, underneath the cerebrum • wrinkly surface • pink in colour	• controls balance coordinates • complex muscle action (jumping, kicking, walking without falling over, cycling)
Brain stem (sometimes called the Medulla)	• connects directly to the spinal cord	• controls the activities in our body that we don't think about, (unconscious actions) including breathing, heart rate and digestion

Colour of the cerebrum

- grey
  because it contains a lot of grey matter (the cell bodies)

and

- a little white matter (the myelin sheath that protects axons)

The cerebrum is responsible for complex thoughts.

Part of the cerebrum	Function
right side	artistic, musical, intuitive and perceptual abilities
left side	language, learning mathematics and logical thinking
sensory areas	receiving and interpreting impulses from sense organs
motor areas	control muscles
association areas	memory and thinking

Left or right

Learning and memory are linked.

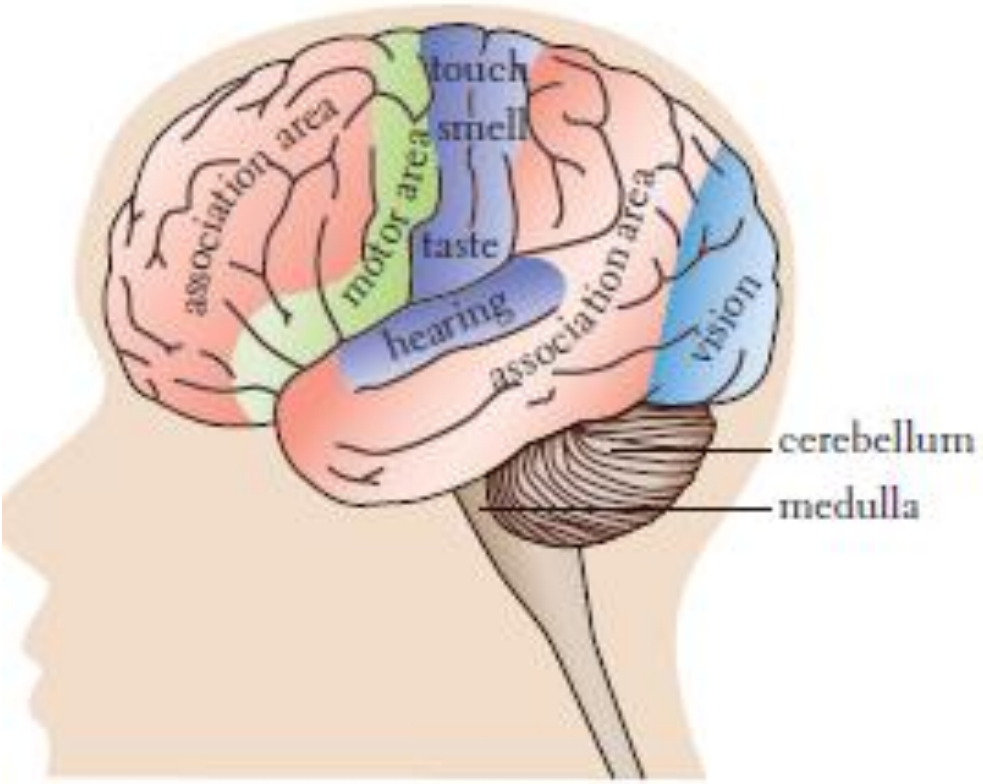
The way that you approach the learning of different tasks and information can be influenced by how you use the left and right cerebral hemispheres.

Some people will use one side of their brain for a particular activity in *some* situations.

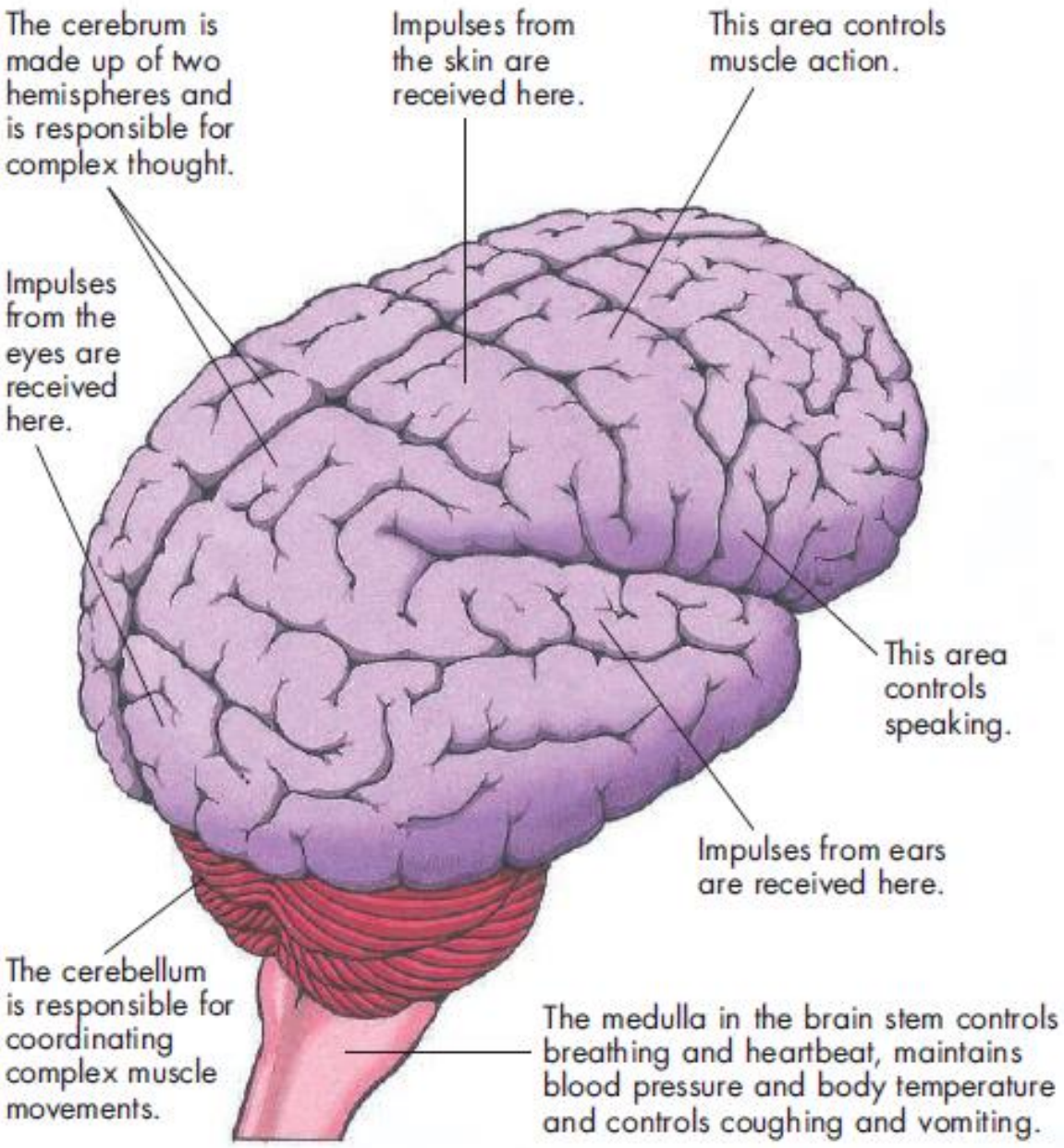
Others feel more `comfortable' using one side of the brain for a particular activity in *all* situations.

Left mode and right mode indicators

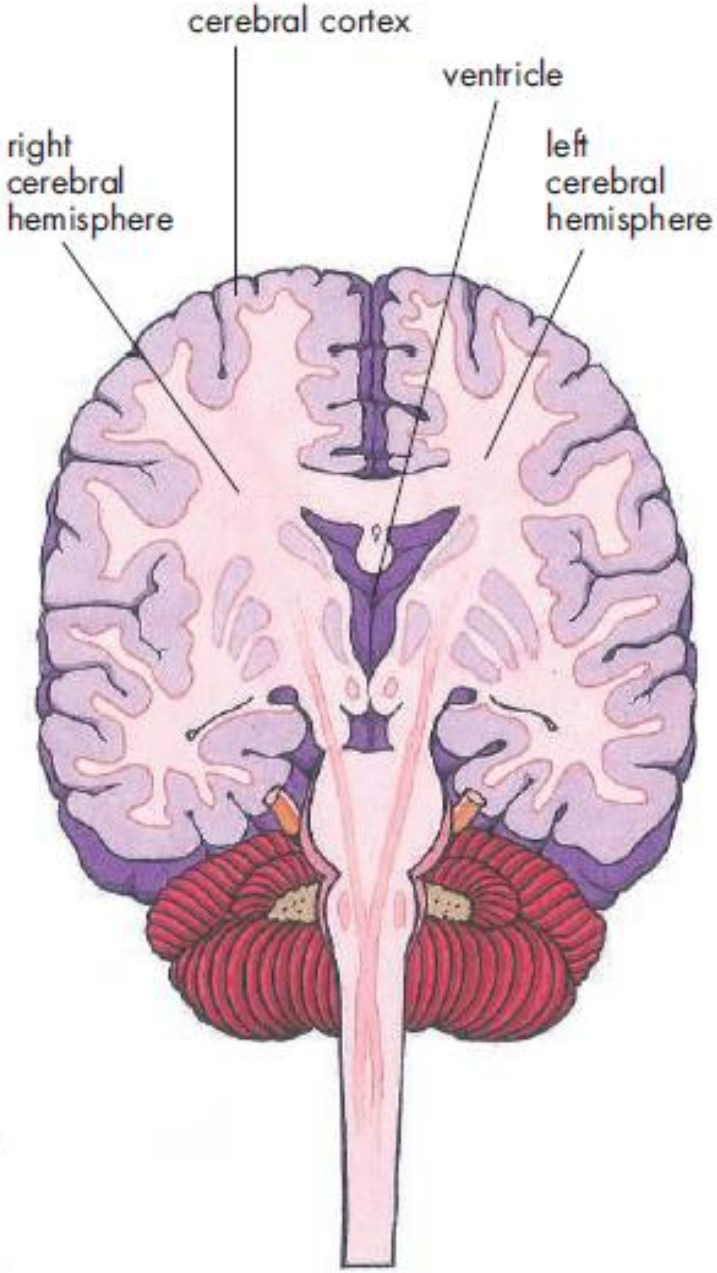
The left hemisphere:	The right hemisphere:
processes language, numbers and symbols	processes pictures and images
likes to *tell* how	likes to *show* how
responds to being told what to do	responds to being shown what to do
solves problems sequentially	solves problems with hunches
prefers talking and writing	prefers essay tests
reads articles first	sees pictures first
follows instructions step by step	plays it by 'ear'
is punctual and organised	is intuitive
is a mismatcher (looks for differences)	is a matcher (looks for similarities)
controls feelings	is free with feelings
follows directions	is creative



The cerebrum controls many functions



The human brain. Have you used yours today?


cerebral cortex
ventricle
right cerebral hemisphere
left cerebral hemisphere

Sensory memory:

- information from the senses which is stored briefly in the brain
- provides you with an awareness of where you are in relation to objects and the space around you
- lasts only a few seconds and depends only on vision
- this information is stored in the outside layer of the cerebrum called the **cerebral cortex**

For example, imagine you are staying the night at a friend's house. When you turn off the light, you should be able to find your way to the bed easily because the layout of the room will remain imprinted on your cerebral cortex long enough for you to get into bed.

Short-term memory processes information that you have just received.

This type of memory, however, has a very limited time span.

Long-term memory processes information that has been selected for `storage' over time.

Hippocampus (part of the brain stem)transfers information from short-term memory to long-term memory and back again.

Investigation 1.7 (page 23)

Brain dissection

AIM To investigate the structure of a brain

You will need:
a semi-frozen sheep's brain
dissecting board
dissecting instruments (scalpel, forceps, scissors)
plastic ruler
paper towel
gloves

CAUTION
Handle dissecting instruments with care and ensure they are placed in a sterilising solution after use. Wear gloves throughout the dissection and wash your hands thoroughly at the end.

Place the brain so that the cerebral hemispheres are at the top of the board and the brain stem is at the bottom.

Identify the external features of the brain: the cerebral hemispheres, cerebellum and brain stem.

Use your forceps and try to lift the meninges (membranes protecting the brain). You may be able to observe the cerebral fluid between these membranes and the hemispheres.

Carefully observe the overall appearance of each structure and, using a plastic ruler, measure its size (length, width and height). Include this information in a table.

Brain structure	Appearance			
	Colour	Texture	Other features	Size
Cerebrum				
Cerebellum				
Brain stem				

Draw a diagram of the sheep's brain, labelling the external features.

On your diagram, identify and label the part of the brain that controls the sheep's:

- heart rate
- balance required for walking
- ability to locate its lamb.

Using your scalpel, cut the brain in half between the right and left hemispheres, and separate the two cerebral hemispheres.

Draw a cross-section of the brain. Be sure to label it!
Now, make a second cut down through the back of one of the hemispheres to see inside the cerebellum and brain stem.

Discussion

1. Which structures contain the grey and white matter?

2. Which part of the sheep's brain is the biggest?

1 Investigate the effect of caffeine, marijuana or alcohol on the CNS and report your findings.

2 Research and report on one of the following disorders of the nervous system:
Parkinson's disease, Alzheimer's disease, epilepsy.
Outline the signs, symptoms and treatments for the disease you have chosen.

3 The blue-ringed octopus is one of the most deadly sea creatures. **Investigate** how its poison can paralyse the nervous system.

4 Investigate the differences in brain structure of humans, gorillas, dolphins and dogs.