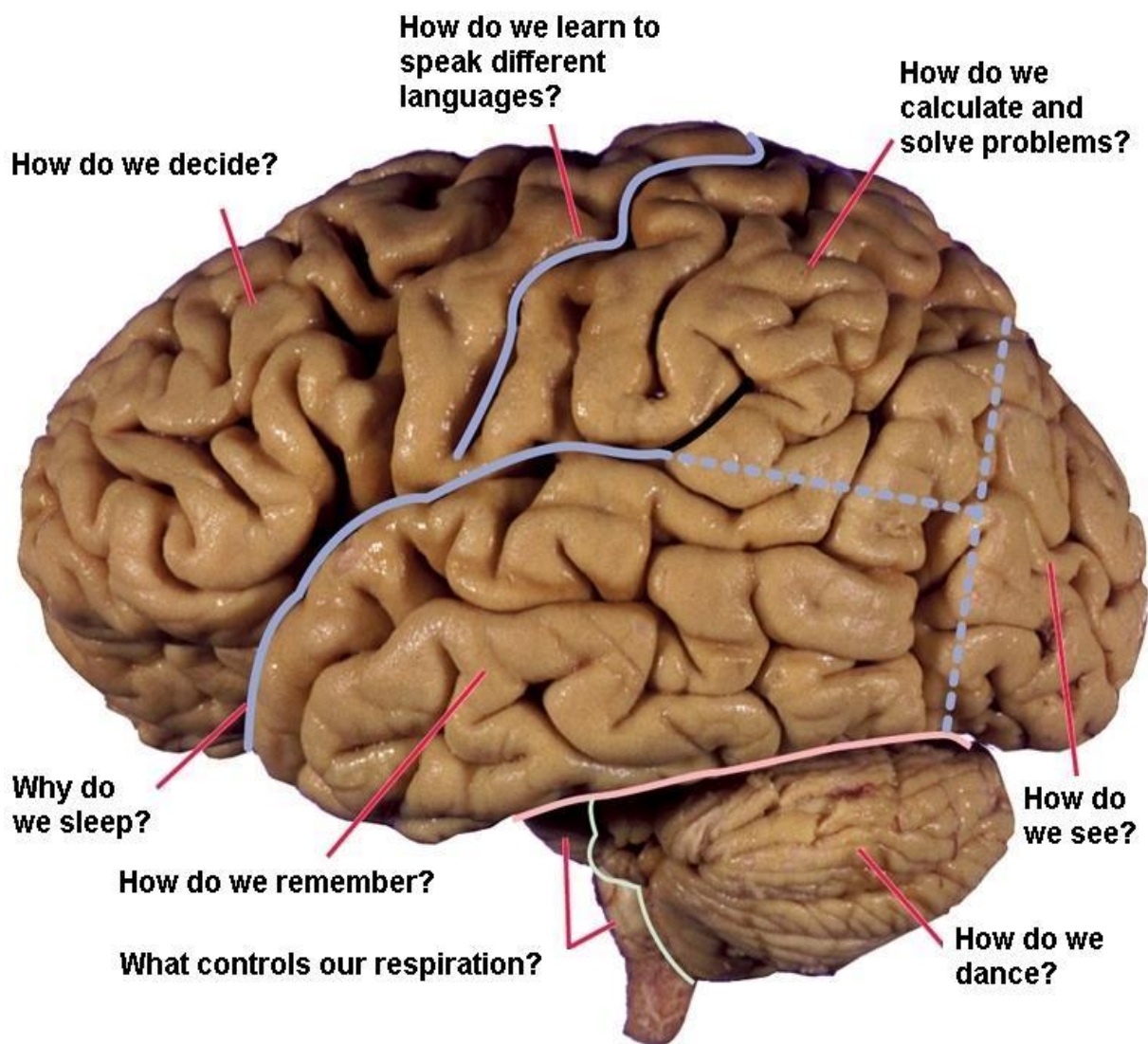


HUMAN BODY IN CONTEXT: THE NERVOUS SYSTEM AND THE BRAIN

TEACHERS'NOTES AND REFERENCES



Human body in context: the Nervous System and the Brain. Teachers' notes and references

Main teaching objectives about the nervous system

1. outline the need for communication systems within humans to respond to changes in the internal and external environment.
2. outline the role of sensory receptors in humans in converting different forms of energy into nerve impulses.
3. describe the structure of a sensory neuron and a motor neuron, and outline their functions in a reflex arc.
4. describe and explain the transmission of an action potential in a myelinated neuron. (The importance of sodium and potassium ions in the impulse transmission should be emphasised.)
5. explain the importance of the myelin sheath (saltatory conduction) and the refractory period in determining the speed of nerve impulse transmission.
6. outline the roles of synapses in the nervous system in determining the direction of nerve impulse transmission, and in allowing the interconnection of nerve pathways.

Language

All scientific terminology is in italics. Example:

The cells that carry messages throughout the nervous system are called *neurons*. Because the messages take the form of electric signals, they are known as *impulses*. Neurons can be classified into three types according to the directions in which these impulses move. *Sensory neurons* carry impulses from the *sense organs* to the *brain* and the *spinal cord*. *Motor neurons* carry impulses from the *brain* and *spinal cord* to *muscles* or *glands*. *Interneurons* (*connector neuron* or *association neuron*) connect sensory and motor neurons and carry impulses between them.

Translation into Catalan (underlined) and Spanish (underlined and italics) is both encouraged and provided not only for scientific words but also for supporting language. Example:

It insulates (aïlla aisla) neurons from each other

It speeds up (accelera acelera) impulses

Language frames are provided to help students. Example:

Before I began to read about the nervous system I thought that...

First of all...

I found out that...

Additionally...

Following this...

Consequently...

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Some activities may help students with the content, for example

Place your bets!!

The aim of this activity is to predict and activate prior knowledge about Nervous system.

This could be done at the beginning of the unit and then repeated after the lesson

	RIGHT	WRONG	BET	LOSS	GAIN
Nervous impulse takes the form of electric signals					
Impulses cross from one neuron to the next					
The cerebrum is part of the brain					
The nervous impulse is bidirectional					
The nervous system coordinates the body functions					
The nervous system responds to internal changes					
TOTAL					
Grand Total:					

Procedure:

- In pairs students read the statements and decide if they are right or wrong. They tick (✓) the box in the appropriate column.
- Depending on how sure they are they bet a number (BET column). You can suggest the numbers (e.g. 25, 50, 75, 100).
- Don't answer any question about vocabulary or content while students are deciding their bets.
- When checking the answers students write the number they bet in the Loss or Gain column. Then they add the numbers in each column and put a total. Finally, subtract the totals and get the Grand Total.

Which pair has the largest number?

This other sort of vocabulary exercise could help students guess the content of a text. For example, before reading paragraph 4 on the Nervous impulse the teacher could write the following words in the blackboard and ask the students what they could be related to:

electrical activity across the membrane flow of electrical charges mV movement of ions

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This is an optional vocabulary exercise to complete at the middle of the unit.

<u>Catalan/Spanish</u>	English Word	Meaning
<u>Cervell</u> <i>cerebro</i>		Organ that controls the body.
<u>Nervis</u> <i>nervios</i>		Fibres that carry information around the body. Nerves are formed from bundles of neurons (nerve cells).
<u>Òrgan</u> <i>òrgano</i>		A part of an organism that is made out of different tissues and has an important job.
<u>Homeòstasi</u> <i>homeòstasis</i>		The way our bodies keep certain factors constant (such as temperature and water levels).
<u>Resposta</u> <i>respuesta</i>		The action taken by a processing centre as a reaction to a stimulus.
<u>Estímul</u> <i>estímulo</i>		A change in the environment of something.
	effector cell	A cell that does something in response to a stimulus. Examples include muscle cells and secretory cells in glands.
	effector organ	An organ that does something in response to a stimulus.
	hormone	A chemical messenger produced by glands in the body and carried in the bloodstream.
	receptor cell	A cell that detects a stimulus.
	sense	Detecting a stimulus.
	sense organ	An organ that is involved with detecting a stimulus.
	central nervous system	Contains the brain and spinal cord and is responsible for coordinating the body's responses to stimuli.
	CNS	Short for central nervous system.
	impulse	An electrical signal carrying information which travels along neurons (nerve cells).
	motor neuron	Neuron that carries impulses to effector cells from the CNS.
	neuron	A cell that can carry an electrical current (impulse).
	peripheral nervous system	The nerves that connect the central nervous system to effectors and receptors.
	PNS	Short for peripheral nervous system.
	sensory neuron	Neuron that carries impulses from receptor cells to the CNS.
	spinal cord	Thick column of nerves leading out of the brain and running through the centre of the spine.







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Activities

Activities are rated according to three degrees of difficulty:

1. One star (*): easy. Compulsory for all students
2. Two stars (**): moderate difficulty. Compulsory for all students
3. Three stars (***): challenging. Optional (for fast finishers)

Activities symbols

					
Internet	listening	speaking	thinking	writing	experiment

Key to activities

Introduction

 Warming up activity

Activity 1.  [Click on the brain!\(*\)](#)

Activity 2. [Become an assistant doctor\(**\)](#)



A Reading B Listening C Eating D Speaking

Activity 3. [Decide the damage and show it in the brain picture. Explain the symptoms to your partner. \(*\)](#)



Activity 4. [Using the words below write a paragraph about what you didn't know about the nervous system and what you have just learned \(*\)](#)



Activity 5. [Explain to your partner what you have learnt about the nervous system\(**\)](#)



Activity 6. [Now listen to your partner's explanation in English and complete this chart \(**\)](#)



Activity 7. [Reading comprehension. Analysing action and resting potential \(***\)](#)



- 1 There are more positively charge ions outside the axon than inside. There are negatively charged proteins inside the axon but none outside.

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2 The positive ions are attracted into the negatively charged interior. Also there are many Na^+ ions outside and few inside, and so they diffuse quickly down the concentration gradient.

3 It becomes negative.

4 a A – sodium channels open, B – sodium channels shut, C – potassium channels open, D – potassium channels shut, E – ion pumps push sodium out of the axon and potassium into it.

b 1 ms

c W – resting, X – depolarisation, Y – repolarisation, Z – action potential

Activity 8.  [Challenge your senses\(*\)](#) [Click on](#)

Activity 9. [Use the drawing to explain the role of myelin. \(*\)](#)

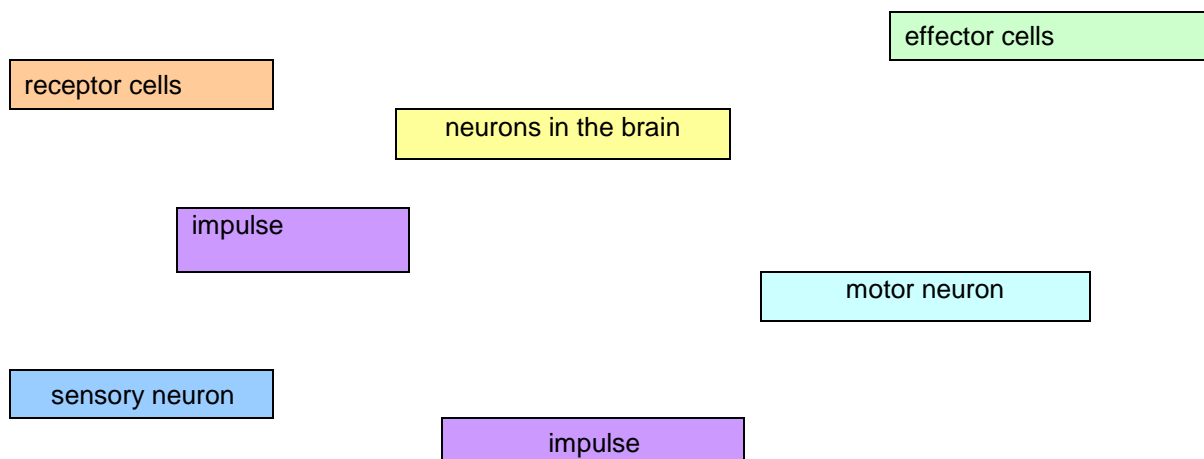


Activity 10. [Draw a diagram relating nerve impulse and myelin. Draw a poster relating receptors, centres and effectors. Explain your diagram and poster to a partner\(**\).](#)



The teacher may use a prior exercise to help students with the relation between receptors, centres and effectors

Imagine someone is crossing a street and stops suddenly because he/she sees a car. Connect the boxes to show the route impulses take when he/she sees a danger and suddenly stops. Write each step.



1.

2.

3.

4.

5.

6.

Activity 11. [Now listen to your partner's explanation and complete this chart\(**\)](#)



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[Activity 12. Match each drawing with the speed you think an impulse travels through the neuron\(***\)](#).

A = 80 m/s C = 120 m/s B = 75 m/s D = 100 m/s E = 10 m/s



The fastest neurons are those that have the widest axons and myelin sheaths.

[Activity 13. Build up a vocabulary with compound scientific words\(*\)](#)



[Activity 14. Make groups of four. In pairs choose either the synapse or the reflex arc\(**\)](#)



[Activity 15. Reflexes \(**\)](#)

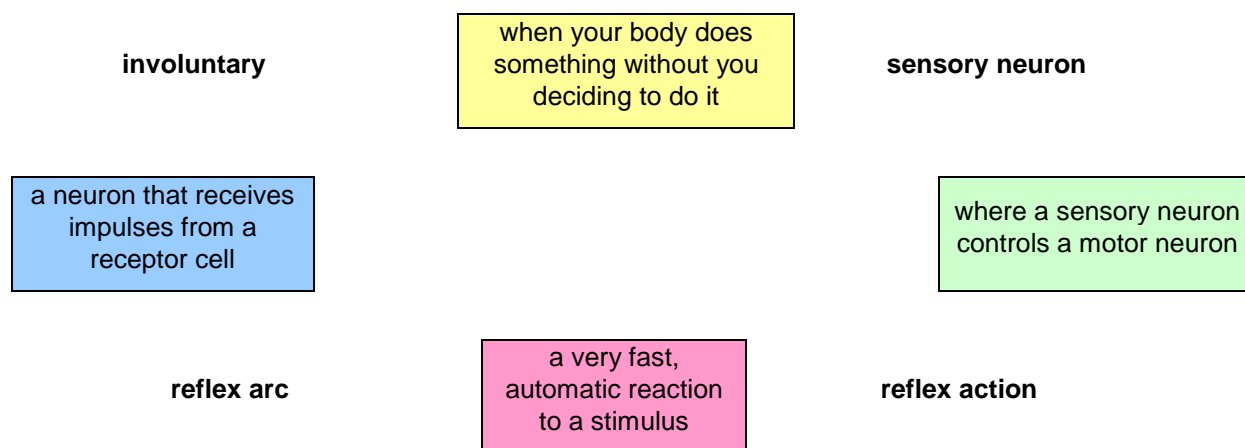


1. reflex arc
2. They are covered in a fatty substance called myelin.
3. It insulates neurones from each other. It speeds up impulses.
4. stimulus – receptor – effector – response
5. arm
6. There are fewer synapses in the reflex arc for the arm (drawing B)
7. interneurone

The teacher may use a prior exercise to help students with the reflex arc and reflex action

The aim of this exercise is to clearly distinguish between both concepts.

Using the words and the boxes explain the knee-jerk reflex. Explain the sort of neurons involved in the knee-jerk reflex



[Activity 16. Neuron speed \(***\)](#)



- 1 a B
- b the distance travelled by the impulse, the time it took
- c correctly plotted graph (diameter on x-axis).
- d the thicker the axon, the faster the impulse speed
- e C
- f It is not sheathed in myelin.
- g crossing synapses slows impulses down.

2 $(2 \times 0.0005) + (1.4/100) = 0.0150$ seconds or 15.0 ms.

3 The more neurons the slower the impulse speed since impulses slow down slightly at the synapses between one neuron and the next.

4 $2 \times 10^{-5} \text{ mm} = 2 \times 10^{-8} \text{ m}$.
 0.5 milliseconds = 5×10^{-4} seconds.
 speed = distance \div time.
 speed = $2 \times 10^{-8} \div 5 \times 10^{-4}$
 speed = 4×10^{-5} metres/second.

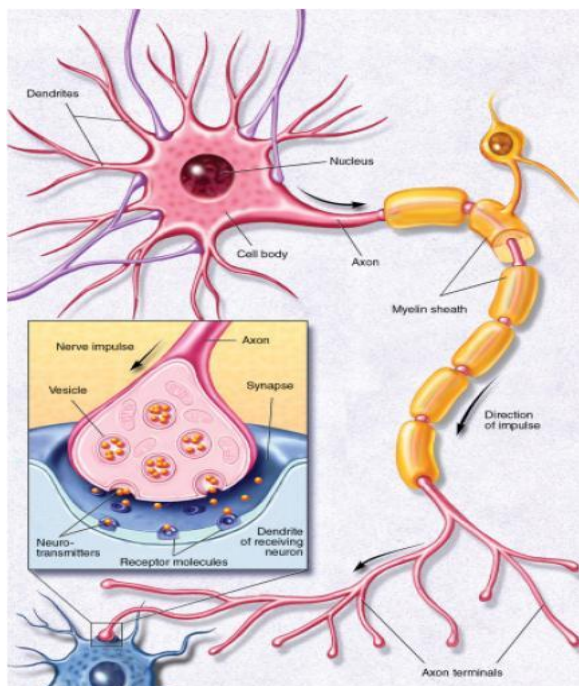
[Activity 17. Matching and classifying\(**\)](#)



1 a impulse b dendrite c nerves d myelin e threshold f neuron g brain h axon i synapse j neurotransmitter

2. Only synapse and impulse are processes

[Activity 18. Relating and explaining\(*\)](#)



- 1.
2. Transmission of nervous impulse
3. It is a process but students may consider the synapse as an anatomical part.

Activity 19. Crossword, wordsearch and word bank. (**)



1. Crossword

Across:

- 1. message that takes the form of electric signals (impulse)
- 3. cell that carry messages throughout the nervous system (neuron)
- 4. chemicals used by one neuron to signal another (neurotransmitters)
- 8. region where impulses are able to cross from one neuron to the next (synapse)

Down:

- 2. minimum level of a stimulus that is required to activate a neuron (threshold)
- 5. connect sensory and motor neurons and carry impulses between them (interneuron)
- 6. the largest part of the neuron (axon)
- 7. inside of the neuron becomes again negative (repolarized)
- 9. The inside of the neuron becomes more positive than the outside (depolarized)
- 10. short branched extensions from neurons (dendrite)

Q	E	M	O	I	Q	J	J	U	V	H	H	Y	U	H	R
K	V	E	F	F	E	C	T	O	R	S	V	G	U	Y	I
Z	A	X	O	T	V	F	T	F	V	K	E	T	Y	P	V
V	P	C	M	U	S	C	L	E	I	I	C	S	I	O	N
V	O	H	K	E	C	F	B	H	V	N	A	W	F	T	W
C	R	E	C	E	P	T	O	R	E	E	P	E	R	H	T
V	A	T	A	C	F	E	E	A	A	I	I	A	R	A	N
A	T	C	L	S	M	J	H	G	I	I	L	T	W	L	T
F	E	B	K	H	A	I	R	D	E	4	N	G	T	A	R
D	J	L	A	I	D	H	N	L	V	E	L	L	J	M	Y
G	J	V	A	V	Q	B	C	F	E	E	A	A	E	U	O
P	R	O	C	E	S	S	I	N	G	C	E	N	T	R	E
H	N	W	K	R	A	F	H	C	A	N	A	D	H	N	S

3. The words are: cerebellum, dendrite, nerve, neuron, synapse, reflex, brain, impulse, unidirectional and myelin.

The hidden message is: the synapse is unidirectional

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[Activity 20. Nervous coordination\(* and **\)](#)



1. a stimulus – TV guide; receptor cells – retina of eye; response – switches on TV; effector cells – muscles of his hand
- b. stimulus – music; receptor cells – cochlea of ear; response – switches
- 2.a brain and spinal cord labelled
- b any two peripheral nervous system nerves labelled
- c a line leading from a finger along a nerve of the peripheral nervous system and up into the brain. Arrow head should be added pointing away from the finger
3. a sensory (lower neurone)
- b motor (higher neurone)
- c motor (higher neurone)
- d sensory (lower neurone)

[Activity 21. Go to sleep! \(*\)](#)

wave a: alpha wave b: betha

[Activity 22. Alzheimer's disease. Click and learn about the unhealthy brain. \(***\)](#)



Open answers

[Activity 23. Describe the functions of the cerebrum, cerebellum and medulla oblongata in the](#)

[brain. Use the words from this list\(*\)](#)



Open answers

[Activity 24. Compare the neurons in the diagram and explain the effect of drugs on a drug addict.\(**\)](#)



Open answers

[Activity 25. Discover your brain. Find the website and do the activity\(**\)](#)

[Activity 26. Sex Differences in the Brain\(**\)](#)

[Activity 27. Sheep brain dissection: the anatomy of memory\(***\)](#)



Additional listening exercise: the human brain [humanbrain.wav](#)



Some samples of students' vocabulary lists and answers to exercises

Name: Laia

Age: 16

Date: 7th March 2008

Norwich

^{the}
4. Nerve Impulse (p. 12 to p. 15)

- due: es deu a...
- displays: mostra
- behaviour: comportament
- reaches: arribar
- sight: vista (ser vista)
- rush: precipitar-se
- blink: parpallejar
- lining: alinear-se
- windpipe: tràquea
- coughing: tossir
- bright: enlluernador
- aware: ser conscient
- arrangements: disposició

Allent

7th March 2008

Nonwishi

- The nervous system image : Tereza

- Activity 1

TOUCH — parietal lobe

VISUAL RECOGNITION — visual cortex

PRaise — frontal lobe

TASTE — parietal lobe

SCENT DETECTION — temporal lobe

VOICE RECOGNITION — Broca's area, auditory cortex,
Wernicke's area

PROBLEM-SOLVING — Frontal lobe

LOVE — frontal lobe

- Activity 2

2.2: A → watching

B → listening

C → eating

D → speaking

- Activity 2.3

The central sulcus is in the motor area, this person might be able to move

Activity 3

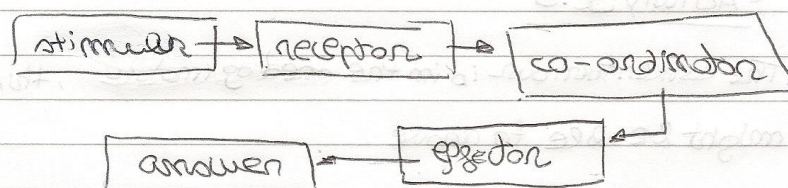
The damage is in the vision area, this person might not be able to see, he will be blind.

- Activity 7

- 1- Because Na^+ ions go out of the neuron and potassium ions let in.
- 2- Because the interior is negative and attract the sodium positive ions.
- 3- It becomes negative again.

- Activity 15

- 1- The reflex arc
- 2- It makes them faster and accelerates the movements. The impulse jumps from node to node instead of moving continuously along the membrane, it increases the speed of the impulse.
- 3- It insulates neurons from each other. It speeds up impulses.
- 4.



Albert
7th March 2008
Norwich

Activity 17

neuron — a cell, usually consisting of a cell body, axon, and dendrites that transmits nerve impulses and is the basic functional unit of the nervous system.

synapse — a chemical that carries messages between neurotransmitter different nerve cells between nerve cells and muscles.

dendrite — a branched extension of a nerve cell, neuron that receives electrical signals from other neurons and conducts those signals to the cell body.

synapse — j

brain — g

axon — h

impulse — a

nerve — c

myelin — d

threshold — e

Ana, 17 years

The nervous system maze: Terrassa ← 7th March 2008

Norwich

Activity 1

Touch - parietal lobe

Visual recognition - visual cortex

Praise - frontal lobe

Taste - parietal lobe

Scent detection - temporal lobe

Love - frontal lobe

Voice recognition - Broca's area / auditory cortex / Wernicke's area

Problems resolving - frontal lobe

Activity 2

2.2 A - watching:

B - listening

C - eating

D - speaking

2.3 He has difficulty in walking because his tumor is in the motor area.

Activity 3

I think the damage is in the vision area. This person may have difficulty in watching.

Activity 7

1. I don't know

2. Because inside is negative, and it attracts the Na^+ .

3. It becomes negative again

Activity 15

1. reflex arc

2. they are faster because they are protected.

3. - It speeds up impulses

- It insulates neurons from each other

4. stimulus → receptor → co-ordinator → effector → answer

Activity 17

- 1.1. a) Impulse
- b) dendrite
- c) nerves
- d) myelin
- e) threshold
- f) neuron
- g) brain
- h) axon
- i) neurotransmitter ↙
- j) synapse ↘

Cristina

16

→ The nervous system maze. Where are you?

- Terrassa

→ Activity 1

- Touch → Parietal lobe

- Visual Recognition → Visual cortex

- Praise → Frontal lobe

- Taste → Parietal lobe

- Scent Detection → Temporal lobe

- Love → Frontal lobe

- Voice Recognition → Broca's Area

↳ Auditory Cortex

↳ Wernicke's Area

- Problem-Solving → Frontal lobe

→ Activity 2

A → Looking, seeing

B → Moving, ~~sitting~~ and hearing

C → Eating

D → Talking, speaking

→ Activity 3

- I think the damage is in the motor area

- This person may have difficulty in movement.

- Because the cancer tumour is in the area of this person might not be able to move.

→ Activity 7

1. - Because the nerves impulses cause movements of ions across the cells membrane of a neuron.
2. Because the Na^+ goes to neutralize (the cell's) inside.
3. It becomes negative once again.

→ Activity 15

1. Reflex arc
2. Are covered with myelime
3. a)
b)
c)
d)

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SELF-ASSESSMENT FOR STUDENTS

	Objectives UNIT 1 – 10. The Cerebrum. The Cerebral Cortex	I have studied AND/OR revised this	I have to look at this again
	Give some examples of receptors and effectors.		
	Understand that information is carried between receptors and effectors.		
	Explain that drugs and toxins can affect how well impulses can get across synapses.		
	Describe what motor neurons and sensory neurons do.		
	Recall the parts of a neuron.		
	Know what impulses are and how they travel.		
	Understand the function of myelin.		
	Know what synapses are and how they work.		
	Describe simple reflexes and how they work.		
	List some examples of simple reflexes in humans.		
	Recall what some of the different parts of the brain do.		
	Explain what memory is and how we can study it.		
	Describe what learning is and how it occurs.		

List the 3 areas that you understood and/or remembered best:

- 1.
- 2.
- 3.

List the 4 areas that you understood least, or remembered worst!

- 1.
- 2.
- 3.
- 4.

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This is an additional exercise about multiple intelligences.

Learn about Right Brain vs. Left Brain()**

vs.(=versus en front a frente a)

Try to predict the meaning of the following words and expressions. Use the dictionary if necessary

whole-brained

scholastic subjects

downplaying

accuracy

focus on

Most individuals have a distinct preference for one of these styles of thinking. Some, however, are more whole-brained and equally adept at both modes. In general, schools tend to favor left-brain modes of thinking, while downplaying the right-brain ones. Left-brain scholastic subjects focus on logical thinking, analysis, and accuracy. Right-brained subjects, on the other hand, focus on aesthetics, feeling, and creativity

Definition of left and right brain

This theory of the structure and functions of the mind suggests that the two different sides of the brain control two different "modes" of thinking. It also suggests that each of us prefers one mode over the other.

Experimentation has shown that the two different sides, or hemispheres, of the brain are responsible for different manners of thinking. The following table illustrates the differences between left-brain and right-brain thinking:

Left Brain	Right Brain
Logical	Random
Sequential	Intuitive
Rational	Holistic
Analytical	Synthesizing
Objective	Subjective
Looks at parts	Looks at wholes

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REFERENCES

All crosswords provided by: www.TheTeachersCorner.net

Nervous system pictures from The Brain Atlas by Harvard Medical School

<http://www.med.harvard.edu/AANLIB/home.html>

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www.factworld.info – the forum for across the curriculum teaching portal – put your flag here, reports, materials, information. Ethical English and Share Your World are available on this site. There is also free simple text software here.

www.bbc.co.uk – the BBC website – education

<http://www.nc.uk.net/index.html> National Curriculum UK (standards for examples of children's work and lesson plans and attainment targets for achievement descriptors).

www.scienceacross.org Science Across the World – database of contacts, and bank of 16 exchange project resources in multiple languages.

www.bbsrc.ac.uk British Biotechnology and Biological research council great resources free in the 'downloads' section.

www.ase.org.uk Association for Science Education – resources