

Exercise walk-through

5.10

The brain, imaging and brain chemistry (statements 8.13–8.16)

Pearson Edexcel · International A-Level · Biology

Four stages, one purpose

Stage	Where	Yield
Glycolysis	cytoplasm	2 ATP + 2 reduced NAD
Link reaction	matrix	CO ₂ + reduced NAD
Krebs cycle	matrix	ATP + reduced NAD + reduced FAD
Oxidative phosphorylation	cristae	most ATP; O ₂ to water

Recombinant DNA: cut, paste, select

Cut : the same restriction enzyme opens plasmid and gene



Paste : complementary sticky ends sealed by DNA ligase



Transform : heat shock carries plasmids into bacteria



Select : antibiotic marker - only transformants survive

Check yourself

Your turn

Why is the human insulin gene made from mRNA before inserting into bacteria?

- ☐ A. bacteria cannot splice introns, and mature mRNA has none
- ☐ B. mRNA is more stable than DNA
- ☐ C. mRNA is double-stranded and easier to cut
- ☐ D. restriction enzymes only cut RNA

Exercises 2.1·2.3

2.1 Name the region of the brain that controls balance and coordination. [1]

2.2 State which imaging method shows brain ACTIVITY rather than structure. [1]

2.3 Name the neurotransmitter lacking in Parkinson's disease. [1]

Exercises 2.1·2.3

2.1 Name the region of the brain that controls balance and coordination. [1]

2.1 The cerebellum.

2.2 State which imaging method shows brain ACTIVITY rather than structure. [1]

2.2 fMRI (accept PET).

2.3 Name the neurotransmitter lacking in Parkinson's disease. [1]

2.3 Dopamine.

Exercise 3.1

3.1 The table lists five brain regions. Complete it by matching each region to its function, and state which two regions work together in osmoregulation.

Region	Function
Cerebral hemisphere	?
Cerebellum	?
Hypothalamus	?
Pituitary	?
Medulla oblongata	?

Exercise 3.1

3.1 The table lists five brain regions. Complete it by matching each region to its function, and state which two regions work together in osmoregulation.

Region	Function
Cerebral hemisphere	?
Cerebellum	?
Hypothalamus	?
Pituitary	?
Medulla oblongata	?

[6]

3.1 Cerebral hemispheres - voluntary movement, sensation, thought; cerebellum - balance and coordination of movement; hypothalamus - thermoregulation and osmoregulation (monitors water potential); pituitary - secretes hormones under hypothalamic control (e.g. ADH); medulla - heart rate and breathing centres. Osmoregulation: hypothalamus detects, pituitary releases ADH.

Exercises 3.2-3.3

3.2 Explain why L-Dopa relieves the symptoms of Parkinson's disease while injected dopamine does not, naming the barrier involved and the conversion that occurs. [4]

3.3 A researcher wants to identify which brain areas are active when a person performs a memory task. Compare the suitability of MRI, fMRI and PET for this investigation, choosing one and justifying the choice. [5]

Exercises 3.2-3.3

3.2 Explain why L-Dopa relieves the symptoms of Parkinson's disease while injected dopamine does not, naming the barrier involved and the conversion that occurs. [4]

3.2 Dopamine cannot cross the blood-brain barrier - it is a charged, polar molecule; L-Dopa is an amino-acid derivative transported across by carrier proteins; inside the brain, DOPA decarboxylase converts L-Dopa to dopamine, restoring transmission in the surviving pathways.

3.3 A researcher wants to identify which brain areas are active when a person performs a memory task. Compare the suitability of MRI, fMRI and PET for this investigation, choosing one and justifying the choice. [5]

3.3 MRI shows structure only - it cannot show which regions are active. fMRI records oxygenated-blood flow to active regions in real time, and the task can be switched on and off to compare states. PET also shows activity via tracer uptake and could work, but requires injecting a radioactive tracer and gives lower spatial resolution. Choice: fMRI - non-invasive activity mapping with good resolution.