40. Why do we need energy and calorie-dense foods?

- Energy is needed to maintain core temperature
- Energy is needed about looking for food
- Energy needed to move, breath, think

41. Energy stores

- Fat stores
- Fat layers around the organs
- Fat layers underneath the skin

Paragraph: 8

In this paragraph you may be asked questions from the following topics:

- Dietary factors (Topic 1, Chapter: 1.3)
- Energy from food - calories (Topic 1, Chapter: 1.3)
- Features of a good study (Topic 1, Chapter: 1.3)
- Brain (Topic 8)
- Brain imaging (Topic 8, Chapter: 8.3)

42. What factors should be controlled in this study?

- Age and gender
- Activity
- Lifestyle
- Diet

43. Suggest why a large number of people must be involved in a study.

- Reliable/ representative data/study
- Because there is large variation between individuals

44. There are various ways of investigating brain structure and function. Describe how scans from magnetic resonance imaging (MRI) may be used to investigate the brain.

- Identification of location
- Size of area affected
- Reference to blood vessels (oxygen supply)
- Idea of monitoring treatment

45. Suggest how fMRI was able to show that certain areas in the brain became more active when people saw/ate high calorie foods.

- Idea that fMRI can allow brain activity to be seen in real time
- Idea that fMRI uses radio waves/magnetic field
- Increase supply of oxygenated blood in active areas [active areas use more oxygen thus more deoxygenated blood is produced]
- That reflects/does not absorb fMRI signals [if deoxygenated then more signal absorbed]
- Idea of seen as a white area [area lights up or is a different colour]
- Idea of comparison with and without high calorie foods

46. There are various ways of investigating brain structure and function. Compare the use of computed tomography (CT) with magnetic resonance imaging (MRI) for studying brain structure.

- Idea of comparative image clarity [image resolution: higher in MRI and lower in CT, MRI offers more detail]
- CT therefore can only identify larger structures and MRI can identify smaller structures
- Reference to tissue identified
- MRI uses radio waves/magnetic field, and CT uses x-rays
- Idea of both give 2D/3D images
- Limitations of MRI or CT [MRI is noisy, need to keep still, not so good for people with metal implants]
- Idea of images for both are at one point in time
- MRI is more expensive than CT

54. Explain the advantages of using MRI scanning to identify specific regions compared to using CT scanning.

- MRI gives better resolution
- Therefore, more detail can be seen
- No use of X-rays
- Therefore, safer/less risk of mutation
- Therefore, can be used more often

55. fMRI scanning is another way of collecting information about the brain. Explain how fMRI scanning would help neuroscientists to identify the part of the brain involved in controlling a voluntary action such as eating a high calorie food.

- Increased neural activity of cerebrum
- More oxygen needed so increase in blood flow/oxyhaemoglobin
- Less radio waves/signal absorbed

56. Obesity has been linked with cardiovascular disease. Explain what is meant by the term cardiovascular disease.

- Disease of the heart / blood vessels
- Description of effect e.g. narrowing of lumen, high blood pressure, atherosclerosis, thrombus, reduces blood supply

57. Obesity has been linked with the development of atherosclerosis. Describe atherosclerosis?

- When the endothelial lining of the artery is damage, there is inflammatory response
- Thus, accumulation of WBCs
- Which cause the build-up of cholesterol / lipids
- This is atheroma
- Then calcium ions and fibres build up on the atheroma
- This forms the plaque

Also, see questions discussed above: 25, 26, 45, 46, 47, 48

Paragraph: 14

Circuitry = A system of circuits performing a particular function

In this paragraph you may be asked questions from the following topics:

- Energy from food - calories (Topic 1, Chapter: 1.3)
- Habituation (Topic 8, Chapter: 8.6)
- Dopamine (Topic 8, Chapter: 8.7)

66. "Over time the reward circuity adapts", this is one form of habituation. Describe the process that occurs at a synapse that leads to habituation.

A description that makes reference to four of the following:

- Repeated stimulus decreases {sensitivity / permeability} of pre-synaptic membrane / calcium channels not opening
- So fewer / no Ca^{2+} ions move into pre-synaptic neuron
- So fewer / no vesicles move towards / fuse with pre-synaptic membrane
- So less / no neurotransmitter released / can diffuse across gap
- Action potential / depolarization less likely to occur in post-synaptic neuron

Paragraph: 15

Tuck = Turn to

Commercialised = Manage or exploit in a way designed to make a profit

In this paragraph you may be asked questions from the following topics:

- Fibre (Topic 1 and 4)
- Studies (Topic 1, Chapter: 1.3)
- Drug trials / Clinical Studies (Topic 4, Chapter: 4.4)
- Dopamine (Topic 8, Chapter: 8.7)
- Neurones (Topic 8, Chapter: 8.1)

See questions discussed above on studies, trials, dopamine (reward system), the nervous system, how it communicates.

Paragraph: 26

Edible = Fit to be eaten; consumable

Stave it off = To stop something bad from happening

In this paragraph you may be asked questions from the following topics:

- Prokaryote (Topic 3, Chapter: 3.1)
- Gram-positive and Gram-negative bacteria (Topic 6, Chapter: 6.2)
- Bacteria structure (Topic 6, Chapter: 6.2)
- Research using animal models (Topic 8, Chapter: 8.3)
- Animal ethics (Topic 8, Chapter: 8.6)
- Genetically modified organisms (Topic 8, Chapter: 8.7)

91. Is E.Coli Gram positive or negative?

- It is Gram negative

92. Describe the difference between a gene and the genome

- Gene is a length of DNA that codes for a polypeptide
- Genome is a complete set of DNA, introns and exons

93. Give the name of the type of enzyme that would be used to insert the gene into the DNA of the bacterium

- Ligase/ Integrase

94. Describe how the genetically modified bacteria would use the genes inserted to produce the corresponding proteins.

- Transcription of DNA to mRNA
- Translation of mRNA/ protein synthesis on ribosomes

In this paragraph you may be asked questions from the following topics:

- Digestion (Topic 2, Chapter: 2.3)
- Prokaryote (Topic 3, Chapter: 3.1)
- Bacteria structure (Topic 6, Chapter: 6.2)
- Immune response (Topic 6, Chapter: 6.3)
- How to prevent infections (Topic 6, Chapter: 6.6)
- How nerve cells transmit impulses (Topic 8, Chapter:8.1)
- Neurones (Topic 8, Chapter: 8.1)
- The brain (Topic 8, Chapter: 8.3)

99. When a nerve impulse reaches a synapse, calcium ions enter the neurone through the pre-synaptic membrane. This causes a neurotransmitter, such as acetylcholine, to be released. Describe and explain the sequence of events that occurs at the synapse, after a neurotransmitter has been released.

- Diffuses across gap
- Bind to receptors on post-synaptic membrane
- Idea of gated channels opening so sodium ions travel through post-synaptic membrane
- Causing a depolarisation
- If sufficient present an action potential is set up in post-synaptic membrane
- Details such as temporal or spatial summation
- Idea that allows coordination/one-way flow of information
- Idea that it allows integration in post-synaptic cell
- Neurotransmitter broken down by enzyme
- So that do not get prolonged action potential in post synaptic membrane (make receptors available again)
- Credit reference to fate of products e.g. reabsorbed through pre-synaptic membrane or to be re-synthesised into neurotransmitter substance

- Lactic acid produced from anaerobic respiration
- Lactic acid inhibits enzymes/toxic

104. Explain how the structure of the cell surface membrane of a motor neurone is related to the conduction of a nerve impulse along its axon.

- Phospholipid bilayer
- Idea of its hydrophobic properties inhibit movement of ions across membrane
- Na^+ gated channel present
- To allow Na^+ to enter during depolarisation/to open when local currents occur
- K^+ channels
- To allow K^+ to diffuse
- Sodium-potassium pump
- To export Na^+ /import K^+
- Role of pump in neurone membrane
- Idea that only parts of the membrane may be involved e.g. nodes of Ranvier (salutatory condition)

105. Describe how macrophages ingest the bacteria

- Reference to phagocytosis/endocytosis/engulfing
- Credit details of phagocytosis (e.g. formation of pseudopodia/membrane extensions around bacteria/cytoplasmic streaming/binding to bacteria)
- Reference to bacterium inside a vacuole/vesicle/phagolysosome

106. How can bacteria cells in the gut affect all those responses listed in paragraph 30.

- By producing proteins that mimic human hormones and proteins
- By affecting cell responses
- By affecting the production of dopamine and serotonin

Paragraph: 31

Robust = Strong and healthy

Circadian = Of biological process recurring naturally on a twenty-four-hour cycle, even in the absence of light fluctuations.

108. What is inflammation?

- Response of body tissues to harmful stimuli in this case damaged cells
- Vasodilation: leads to greater blood flow to the area, resulting in redness and heat.
- Vascular permeability: endothelial cells become "leaky" from either direct endothelial cell injury or via chemical mediators.
- Fluid, proteins, red blood cells, and white blood cells escape from the blood vessels and leak out

109. Describe the process of inflammation.

- Reference to (accumulation of) white blood cells in (damaged area)
- Build-up of cholesterol in damaged area
- Reference to build up of calcium salts / fibrous tissue / fibrin / platelets
- Reference to formation of atheroma / plaque
- Reference to loss of elasticity (of artery) / narrowing of lumen
- Idea that this process is self–perpetuating

110. What shapes the gut flora composition?

- Genetics
- Maternal diet
- Mode of delivery

111. State the levels of organisation:

- Cell, tissue, organ, organ system, organism

112. Give one difference between an organ and a tissue.

- Organ has many functions and the tissue has one
- Organ gas many/several cell types/tissues, tissues has one/fewer cell types

113. Suggest one way in which tissues and organs are similar.

- both have cells working together /for same function

Paragraph: 33

In this paragraph you may be asked questions from the following topics:

- Prokaryote (Topic 3, Chapter: 3.1)
- Bacteria structure (Topic 6, Chapter: 6.2)
- Animal ethics (Topic 8, Chapter: 8.6)
- Genetically modified organisms (Topic 8, Chapter: 8.7)

117. Describe the ethical issues concerning the use of animals in research.

- Utilitarian argument, better to test on animals than on humans
- The benefits to humans must outweigh harm done of other animals

118. Suggest two reasons why some people might have objections to the use of rats in this investigation.

- Idea of rats have rights (lack of consent given)
- Rats may be harmed
- The samples may not be sufficient for a reliable investigation
- Idea that rat genome may not be like human genome, so investigation has no potential medical application

119. Scientist are encouraged to use non-animal alternatives in their research. Name one non-animal alternative that can be used in research and give an advantage of this alternative method.

- Tissue Culture/ Computer modelling
- More ethical/ no animals harmed

120. Explain why the treatments are tested on mice?

- They need to find out if it is safe / toxic
- If it is effect
- Because it is unethical to first try it on humans

143. Define microbiota.

- All the microorganisms that live in the human gut

144. Define microbiome.

- The genetic material of all microbes that live in the human body

145. How do microbes communicate with the nervous system?

- They produce proteins that mimic neurotransmitters

146. State the levels of organisation:

- Cell, tissue, organ, organ system, organism

147. Give one difference between an organ and a tissue.

- Organ has <u>many</u> functions, tissue has <u>one/fewer</u>
- Organ has <u>many/several cell types/tissues,</u> tissue has <u>one/fewer</u>

148. Suggest one way in which tissues and organs are similar.

- Both have cells <u>working together/for the same function</u>

149. What makes any neurotransmitter release to be short lived?

- Reuptake molecules cause the absorption of dopamine to the pre-synaptic membrane
- Enzymes (monoamine oxidase) causes the breakdown of neurotransmitters

<u>Paragraph: 41</u>

Hunched = Arch; hump

150. What is broth?

- A bacterial culture
- Liquid
- In which the desired bacteria are suspended in a liquid nutrient medium

151. What is a neurochemical?

- A small organic molecule or peptide
- That participates in neural activity.
- Includes neurotransmitters and other molecules such as psychopharmaceuticals and neuropeptides, that influence the function of neurons.

Paragraph: 42

Paltry = Very small

In this paragraph you may be asked questions from the following topics:

- DNA (Topic 2, Chapter: 2.4)
- Gene expression and development (Topic 3, Chapter: 3.3)
- DNA profiling (Topic 6, Chapter: 6.1)

152. The first part of the study involved the amplification of DNA to give large enough samples for analysis. Describe how small samples of DNA can be amplified.

- Reference to polymerase chain reaction/PCR
- Polymerase enzyme added
- Idea of need for primers and nucleotides
- 90-98°C, then 50-65 °C, then 70-75 °C
- Idea that cycle needs to be repeated several times/to make several copies of DNA

153. Name one technique that could be used to analyse the amplified DNA samples.

- DNA profiling/fingerprinting/gel electrophoresis

154. Suggest how the scientists who conducted the study had their results accepted by other scientists

- Idea of work appearing in a scientific journal or being presented at a conference
- Idea that validity or reliability is considered
- By another scientists/ref to peer review

- Idea that T helper cells would be destroyed/killed/burst by virus particles leaving cell
- Idea that more T helper cells would become infected

196. Explain how the glycoprotein enables HIV to infect human cells.

- This glycoprotein is gp120
- Used for attachment to CD4 molecules/receptors/antigens
- On T helper cells/lymphocytes

197. Describe how the process of phagocytosis leads to the destruction of bacteria.

- Cell membrane folds around bacteria to form a vesicle inside the cell
- Lysosomes containing enzymes / lysozyme fuse with the vesicle
- Contents of lysosomes digest bacteria

Also, see questions from other sections on inflammation, bacteria, the immune system and the brain.

Paragraph: 50

Unwieldy = difficult to move because of its size, shape or weight

Controversial = Giving rise or likely to give rise to controversy or public disagreement

In this paragraph you may be asked questions from the following topics:

- Dopamine (Topic 8, Chapter: 8.7)
- Serotonin (Topic 8, Chapter: 8.7)

198. "The majority of the serotonin – originate in the intestine", serotonin is important in health and wellbeing. An imbalance of serotonin can lead to depression. An individual with symptoms of depression may have low serotonin levels in the brain. Describe how low serotonin levels can affect the transmission of impulses in the brain.

- Serotonin is a neurotransmitter / there will be less neurotransmitter
- Less serotonin results in fewer depolarisations of post synaptic membranes