**Formative Homeostasis Test – Answers**

Section A: MC

1. M 2. M 3. L 4. M 5. M 6. K 7. J 8. J 9. L

Note on Q8

* L is incorrect, as this is the not the cause of PD, but result of it – which leads to the cause of Bradykinesia

Section B: Short Answer

1 (a)

These protein masses seem to randomly collect around the dendrites of various nerve cells in the brain. By doing this they would slowly begin to disrupt the communication of existing nerve cells preventing the axon terminals of one cell from passing a clear and direct message through the synapse to the next cell’s dendrites. This may stop the cell from sending messages down pathways that it was once able to send.

1(b) (i)

The length of the dendrites seem to grow by 25units every 10 years.

1(b) (ii)

It seems to stunt their growth and length.

1(b) (iii)

With the reduction in dendrite length with Alzheimer’s, some nerve pathways will be damaged preventing further use. It also seems that the dendrites are less branched – which also will mean less connections with other cells and therefore loss of nerve pathways. Memories that were once stored in a healthy brain, will not be lost or partially lost due to damaged nerve pathways.

1(c)

Nerve pathways in the hippocampus rely on ACh as the mode of passing the message from one nerve cell to the next through the synaptic cleft. Each time memory is accessed it relies on ACh to utilize that pathway. If ChAT is reduced, the brain cells are no longer able synthesis ACh. Slowly, over time, there will less and less of this available to the cells and they will lose their ability to communicate with other cells. Over time, nerve pathways involved in memory will become un-functional and will lead to memory loss.

2(a)

It will increase.

2(b)

This will trigger the body to produce more thyroxine. With more thyroxine the cells of the body will begin to increase their metabolism in response. The effect of this will be an overall increase in the temperature of the body, as metabolism generates heat. This will help to raise and maintain the set body temperature at 37.5 degrees C (new normal set temp).

2(c)

Vasodilation is a dilation (expanding) of the blood vessels. This allows more blood to flow through and allows the blood vessels to be close to the surface of the skin. This allows for increased rate of heat loss from the blood through the surface of the skin and helps to drop the overall temperature of the body.

3(a)

1. Thyroid gland
2. Thyroid gland
3. Hormonal

3(b)

The body has a normal operating threshold from calcium levels in the blood. When a stimulus causes an increase in calcium, the body employs negative feedback which effectively response in such a way to return calcium levels back to the normal operating threshold. It does this by detecting the increase in calcium levels and producing a response – in this case hormonal. The effector gland (thyroid) secretes calcitonin which causes calcium to come out of the blood and be deposited in the bone. The effect is to bring calcium blood levels back down to normal and so reverse the effect of the stimulus.

3(c)

Any two of:

* Hormones act slowly; nerves act fast
* Hormones are not targeted; nerves are specifically targeted
* Hormones travel through the blood stream; nerve signals travel through electrochemical impulse
* Hormones have longer term effects; nerves have immediate effects

4 (a)

pH that is either too high or too low will have adverse effects on cell metabolism by denaturing enzymes.

4(b)

By breathing harder and faster the excess CO2 will be expelled from the blood. With a drop in CO2, the pH will begin to rise (become *less* acidic).

5(a)

Motor nerve.

This cell type begins with a cell body and dendrites at the end of the cell where the electrical message originates. There extends a long narrow structure from the cell body called the axon that carries the message to the pituitary gland. The axon is covered in a myelin sheath that protects and insulates the axon. The message then continues to the small axon terminals that branch off the end of the axon.

5(b)

Anti-diuretic hormone

5(c)

ADH causes a response in the nephron cells that makes the nephron more permeable to water. The effect is that more water is reabsorbed from the nephron back into the surrounding blood vessels, and this then causes the body to conserve water and urinate less.

5(d)

Coffee is a diuretic. It will interfere with the action and effect of the anti-diuretic hormone on the nephron cells. The coffee diuretic will cause the nephron cells to be less permeable to water, meaning less will be reabsorbed back into the blood. This will cause the body to get rid of water through urine unnecessarily (or, when it actually is trying to conserve it under normal action of ADH as a response to the original drop in blood water levels. This could lead to further dehydration and prevent the flow response from actually doing negative feedback to correct the imbalance.

6(a)

The data shows there is greater pupil diameter size in the teenage years, and that this gradually declines through mid-life and old age.

6(b)

A person has their greatest pupil size during their teenage years.s

6(c)

Examples of controlled variables (any two):

* Ensuring roughly equal numbers of each gender throughout the ages
  + This would prevent skewing the data if in fact it turned out the females have different pupil diameters to males (eg. what if all the old age candidates were male?!)
* Same degree of darkness for each test
  + The level of light/dark directly affects pupil dilation. If this changed between tests it would not be a fair comparison.
* The amount of time in the dark before taking the test (allowing pupils to adjust)
  + If some were test immediately after experiencing dark, then the pupils may not be fully dilated yet. This would have to be consistent to make sure the pupils for each test were as max diameter possible.
* Same measuring device or method in each case
  + This would be crucial to ensure there was now skew or random errors – especially considering the small amount of distance being measured and the small differences.
* Accurate proof of age for each person
  + If ages were not controlled/verified the data may not be giving accurate picture of the link between age and pupil diameter.

6(d)

Fairly imprecise. The graph shows a lot of variation/scatter around the mean at any given point – the data plots are widely spread out and not closely bunched together.

6(e)

Older people will generally have poorer eyesight in the dark, due to the fact that their pupil is not generally as dilated (lets less light in).

Section C: Extended Response

Type 1 diabetes is an endocrine condition where destroyed pancreatic cells can no longer produce the hormone insulin. The body itself is responsible for destroying these cells with its own immune system. When healthy these cells secrete insulin into the blood to allow the individual to do glucose regulation negative feedback to balance blood sugar levels. When these cells are destroyed the body has no other way of producing insulin

A patient with this condition is liable to experience a number of symptoms, and if left untreated they can be life threatening. Symptoms can include excessive thirst feelings and excessive urination. This can also lead to headaches, feeling tired, and dizzy. Due to the fact that the body does not make its own insulin, medication must be taken in order to supplement this several times a day.

In a normal body, glucose can be regulated by insulin and glucagon. When glucose levels in the blood rise above normal (hyperglycaemic) insulin is released to help reduce these back to normal Insulin does this by simulating glycogenesis, which creates glycogen by using up glucose, and inhibiting glycogenolysis and gluconeogenesis which are two processes that generate glucose in the blood. When sugar levels fall too low in the blood (hypoglycaemic), glucagon does the opposite to insulin (works against it), and so increasing glucose levels. Between the two of them, these two hormones work to balance glucose levels in the blood by giving negative feedback when blood sugar is too high or too low.