Understandings:

1. Define and explain innate behaviour.

- This is a behaviour that is unaffected of the external stimuli and independent of the environment. Thus this is something that an organism is born with; therefore it is something that is inherited.

2. Explain reflexes.

- A reflex is basically a type of involuntary movement (and as we know involuntary movements are controlled by autonomic nervous system). So what does this reflex do? Well, first of all, receptors of some kind must detect a stimulus. A stimulus is any change in internal or external environment. Once the signal is detected, an action, usually a muscle or a gland, will be elicited.

So one cannot consciously think of doing a reflex, because then it would not be a reflex any more. When you hear someone shout "WATCH OUT!!!!!!!" one would naturally tend to defend your head or duck (yes the brain is selfish enough to tell the body to defend itself). Neat!

3. Explain what reflex arcs are.

- A reflex arc is nothing more than a pathway! What is my pathway to school? Well, it is from my home, to the bus, and walk to the school. Similarly, reflexes also have a pathway. It starts with a sensory neuron, to the relay neuron (not always but most of the time), to the motor neuron that signals the effector (muscle or gland).

In case you wondered, "relay" means "intermediate" so a relay neuron literally is in between a sensory and a motor neuron.

4. Define and explain learned behaviour.

- It is a behaviour that is acquired during their life. Humans are exceptional at this, possibly because of what we call "mirror neurons". These neurons are for imitating and knowing the intention of other people, and yes we do have exceptionally dense mirror neurons in our brain compared to other organisms.

But of course, one has to have the genes or the "innate" ability to receive and learn, so learned behaviour has innate behaviour as its basis.

5. Explain what it is meant by "learning".

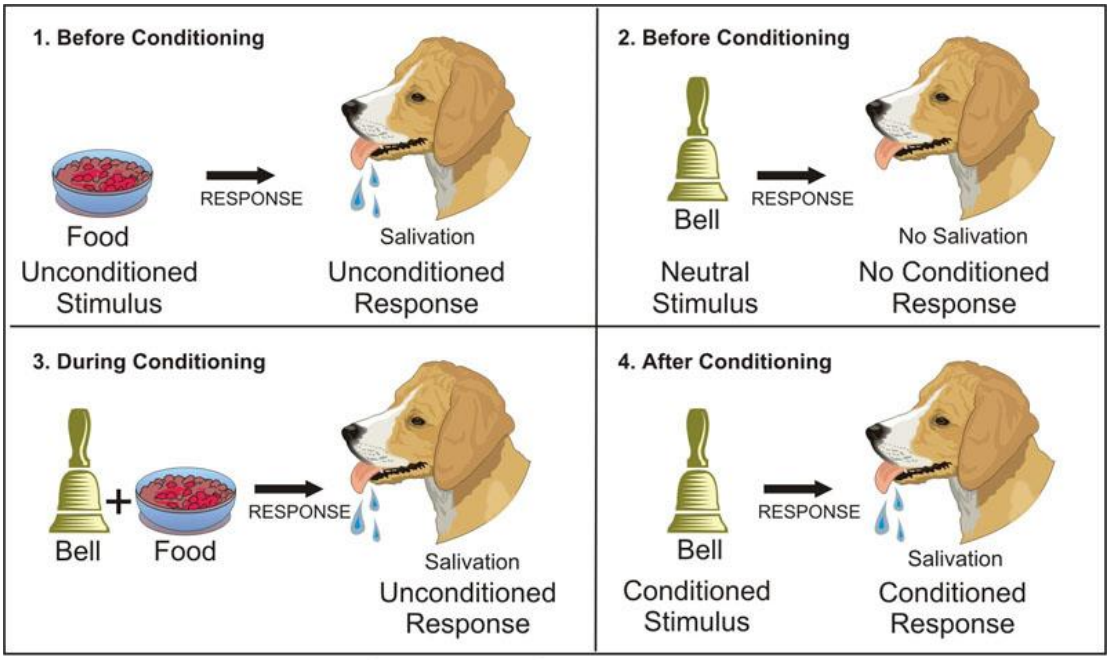
- Learning is essentially an act of acquiring a new skill, knowledge, values and even preferences. Even the simplest worms are able to change their behaviour according to the environment, but humans are very capable of learning higher order functions.

Learning is closely associated with memory, but not necessarily. Below, I am going to explain three types of learning.

6. Explain reflex conditioning.

- Reflex conditioning, more known as classical conditioning, can be thought as a learned reflex. A more formal definition is "A conditioning in which the conditioned stimulus is paired with and precedes the unconditioned stimulus until the conditioned stimulus alone is sufficient to elicit the response.

It is important to really understand how this works. The famous example is Pavlov's experiment with dogs. Dogs have an innate behaviour to salivate when they see food. This unlearned reflex is unconditional reflex. But Pavlov introduced a conditioned stimulus, which is the bell. If one rings the bell alone, dogs don't salivate. But when one rings the bell and then gives them food repeatedly, dogs associate the bell with food. Eventually, the bell with elicit saliva production. One has therefore connected a new neural pathway from the conditioned stimulus to a reflex of saliva production.



Classical Conditioning

7. Explain imprinting.

- Imprinting is any phase-sensitive learning. During a certain period, there is an automatic button that says "copy this" or "learn that" or "follow that". Gooselings follow any moving thing within 13h-16h. This does not take into regard of the consequences, thus although the imprinting of something may kill them, the gooselings would still do that.

8. Explain operant conditioning.
- Operant means "engineer" but in this case, it means that the organism itself is the "operator/engineer" of its body. This is more known as trial-and-error learning. The main difference between operant and reflex conditioning is that reflex conditioning is when a second party introduces a stimulus, while operant conditioning is solely the organism involved.

9. Explain memory.
- There are two types of distinct memories that work very differently, and you have heard about them.

Short term memory is a type of memory that lasts for 15-30 seconds, even barely a minute. This is basically the information that we are working on right now.

Long term memory is a type of memory that lasts for longer! More importantly, information becomes a physical thing in your brain through formation of new synapses. This is known as encoding. If you have noticed, a lot of terms in neuroscience are somehow related to computer science. Encoding, information accessing, storing, etc. Hippocampus is a crucial region that encodes information. It has been shown that patients with Alzheimer's have a significantly less dense hippocampus than a healthy brain.

This is an interesting topic but IB does not touch so deep in this. So if you want to read a bit more, follow this link: http://www.theguardian.com/education/2015/sep/16/what-happens-in-your-brain-when-you-make-a-memory

Applications and skills:

1. Explain the withdrawal reflex of the hand from a painful stimulus.
- A response to pain is an innate trait. If we feel a pain of something, our sensory neurons send the signal to relay neurons via dorsal root in our spinal cord, that in turn sends signal to motor neuron via ventral root to the effector.

2. Explain Pavlov's experiments into reflex conditioning in dogs.
- Explained above.

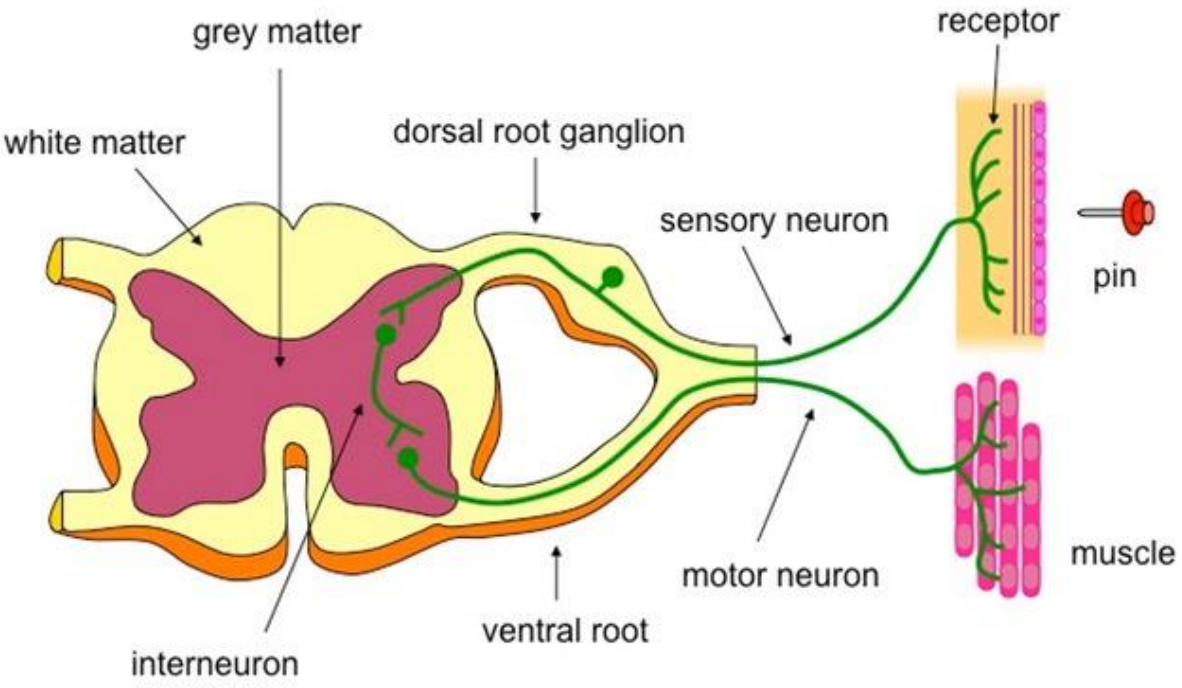
3. Explain the role of inheritance and learning in the development of birdsong.
- Studies have shown that both innate and learned were involved in birdsong. All birds were born with some innate song, but adapted to the surrounding (even songs of another species). The ability to learn for birds is crucial because birdsong is one of the crucial factors of mating.

4. Be able to analyse data from invertebrate behaviour experiments in terms of the effect on chances of survival and reproduction.
- Be sure to know two terms.

"Taxis" is a directional response to a stimulus. So it either moves towards (positive taxis) or away (negative taxis) from the stimulus.

"Kinesis" is an oscillational response to a stimulus. In other words, it is about how much you move, and does not have a direction. Have you ever noticed with ants where if you scare them (accidentally or deliberately) they suddenly move randomly? This would be a type of kinesis adapted for survival and losing the predator.

5. Be able to draw and labelling a diagram of a reflex arc for a pain withdrawal reflex.
- Only thing here to note is that interneuron is the same as relay neuron.



Also remember that sensory neuron passes through dorsal root (the back side) and motor neuron goes through the ventral root (the belly side).

TOK:

1. It is easy for us to guess how the behaviour of an animal might influence its chance of survival and reproduction. Is intuition a valid starting point for scientists?