**Responses**

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| 1 | Taxis | A simple response whose direction is determined by the direction of the stimulus |
| 2 | Kinesis | A non-directional response to a stimulus which brings about increased random movements |
| 3 | Tropism | A growth movement of a part of a plant in response to a directional stimulus |
| 4 | IAA | Indoleacetic acid (IAA) is an auxin – a plant growth factor which is produced in small quantities. It controls plant cell elongation. It causes elongation of shoot cells but inhibits elongation in root cells. |
| 5 | Plant growth factors | Hormone-like substances which control plant responses to external stimuli. They exert their influence by affecting growth and they may be made by cells located throughout the plant rather than in particular organs. They can affect the tissues that release them. eg indoleacetic acid (IAA) |
| 6 | Photo- | A prefix meaning light |
| 7 | Geo- | A prefix meaning gravity |
| 8 | Chemo- | A prefix meaning chemical |
| 9 | Rheo- | A prefix meaning movement |

**Nervous System**

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| 10 | CNS | The brain and spinal cord |
| 11 | Peripheral nervous system | Pairs of nerves that originate from either the brain or spinal cord to the rest of the body. Divided into the sensory and motor nervous system. |
| 12 | Neurone | Specialised cells adapted to rapidly carrying electrochemical changes called nerve impulses from one part of the body to another eg sensory, motor and intermediate |
| 13 | Sensory neurons | Neurones which carry nerve impulses from receptors towards the CNS (an intermediate or motor neurone) |
| 14 | Motor neurons | Neurones which carry nerve impulses away from CNS (an intermediate or relay neurone) to an effector |
| 15 | Intermediate or relay neurons | A neurone which is a co-ordinator which transmit impulses between neurons, for example, from the sensory neurone to the motor neurone in the spinal cord. |
| 16 | Stimulus | A detectable change in the internal or external environment of an organism |
| 17 | Response | The result of a stimulus on an organism |
| 18 | Receptor | A cell or organ which detects a stimulus |
| 19 | Effector | A cell, tissue, organ or system which responds to a stimulus |
| 20 | Coordinator | The link between a sensory neurone and motor neurone in the spinal cord |
| 21 | Reflex arc | Pathway of neurones involved in a reflex: Stimulus 🡪 receptor 🡪 sensory neurone 🡪 intermediate (relay) neurone 🡪 motor neurone 🡪 effector 🡪 response. |
| 22 | Somatic/Voluntary Nervous System | A division of the motor nervous system which carries nerve impulses to body muscles and is under voluntary (conscious) control |
| 23 | Autonomic | A division of the motor nervous system which carries nerve impulses to glands, smooth and cardiac muscle and is not under voluntary control (subconscious) |
| 24 | Sympathetic | An autonomic pathway which stimulates effectors and so speeds up an activity |
| 25 | Parasympathetic | An autonomic pathway which inhibits effectors and so slows down an activity (parachute…) |
| 26 | Pacinian corpuscle | A sensory receptor which responds to change in mechanical pressure |
| 27 | Stretch-mediated Na+ channels | A special type of sodium channel which is found at the sensory neurone ending at the centre of the Pacinian corpuscle. Their permeability to sodium changes when they are deformed by stretching. |
| 28 | Photoreceptors | Light receptor cells of the mammalian eye found on the innermost layer, the retina. Two types: rod and cone cells. They act as transducers by conserving light energy into the electrical energy of a nerve impulse. |
| 29 | Retina | The innermost layer of the mammalian eye containing photoreceptors. |
| 30 | Rod cells | Cells in the retina which transduce light energy into a generator potential, based on intensity of light received. They respond to low-intensity light and give low visual acuity. Absent in the fovea. |
| 31 | Cone cells | Cells in the retina which transduce light energy into a generator potential, based on wavelength of light received. There are three different types, each responding to a different range of wavelength of light. Mainly concentrated in the fovea. Not sensitive to low-intensity light but give good visual acuity. |
| 32 | Retinal convergence | Many rods connected to one bipolar cell |
| 33 | Visual acuity | Ability to resolve fine detail |
| 34 | Visual sensitivity | Ability to detect low light intensity |
| 35 | Fovea | The point receives the highest intensity of light because light is focused by the lens on the part of the retina opposite the pupil. Cone cells are found here. |
| 36 | Blind spot | The point of entry of the optic nerve on the retina which is insensitive to light. |
| 37 | Optic nerve | Nerve which transmits impulses to the brain from the retina at the back of the eye |
| 38 | Nerve impulse | A self-propagating wave of electrical disturbance theta travels along the surface of an axon membrane |
| 39 | Na+ K+ Pump | A carrier protein which actively transports 2 potassium ions into the axon and 3 sodium ions out of the axon. |
| 40 | Resting potential | A potential difference of -65mV found inside a resting neurone relative to its outside, which results in the axon being polarised. |
| 41 | Generator potential | A nervous impulse produced by a sensory receptor following transduction (or conversion) of one form of energy into electrical energy |
| 42 | Threshold value | The minimum level of stimulus needed to trigger an action potential |
| 43 | Action potential | A temporary reversal of the charges across the axon membrane which increase from -65mV to +40mV, depolarising the membrane |
| 44 | Polarised | Condition used to describe the axon when the inside of an axon is negatively charged relative to the outside (at the resting potential usually around 65mV). This is established because sodium ions are actively transported out of the axon and potassium ions actively transported into the axon by the sodium-potassium pump. The outward movement of sodium ions is greater than inward movement of potassium ions which means there are more sodium ions in the tissue fluid surrounding the axon than in the cytoplasm and more potassium ions in the cytoplasm than in the tissue fluid which creates an electrochemical gradient. Most of the gates in the channels that allow the potassium ions to diffuse back out of the axon are open, while most of the gates in the channels that allow sodium ions to diffuse back into the axon are closed. |
| 45 | Voltage gated channels | Channels in the axon membrane which change shape, and hence open or close, depending on the voltage across the membrane. |
| 46 | Depolarised | Condition used to describe the part of the axon membrane when the inside of the membrane has a positive charge of around +40mV (when an action potential is happening). This occurs because of a stimulus which causes some sodium voltage-gated channels in the axon membrane opening and sodium ions diffusing into the axon along their electrochemical gradient. More sodium channels open, causing an even greater influx of sodium ions by diffusion. |
| 47 | Hyperpolarisation | When the inside of the axon is more negative (relative to the outside) than the usual. Caused because voltage-gated potassium channels open and the electrical gradient that prevented further outward movement of potassium ions is now reversed causing more potassium ion channels to open. The outward diffusion of these potassium ions causes a temporary overshoot of the electrical gradient. |
| 48 | Repolarisation | When the resting potential of -65mV is re-established the axon is described as this. This happens because the closable gates on the potassium ion channels now close and the activities of the sodium-potassium pumps once again cause sodium ions to be pumped out and potassium ions in. |
| 49 | Refractory period | Time period after an action potential when it is impossible for a further action potential to be generated because inward movement of sodium ions is prevented because the sodium voltage-gated channels are closed. Means that impulses are propagated in one direction only, allows discrete impulses and limits the number of action potentials. |
| 50 | All-or-nothing principle | An action potential is exactly the same size, regardless of the size of the stimulus, providing it reaches the threshold value. |
| 51 | Dendrons | Extensions of the cell body which subdivide into smaller branched fibres, called dendrites, that carry nerve impulses towards the cell body |
| 52 | Axon | A single long fibre that carries nerve impulses away from the cell body |
| 53 | Cell body | Contains all of the usual cell organelles, including a nucleus and large amounts of RER (associated with production of proteins and neurotransmitters). |
| 54 | Schwann cells | wrap themselves around the axon many times, so that layers of their membranes build up around it. They protect the axon and provide electrical insulation. They also carry out phagocytosis (the removal of cell debris) and play a part in nerve regeneration. |
| 55 | Node of Ranvier | Constrictions (gaps) between adjacent Schwann Cells where there is no myelin sheath (2-3µm long and every 1-3mm in humans). |
| 56 | Myelin sheath | Covering to the axon and is made up of the membranes of the Schwann cells wrapped around a neurone which helps speed up impulse transmission |
| 57 | Synapse | The point where the axon of one neurone connects with the dendrite of another or an effector: they help coordinate activities and are unidirectional. |
| 58 | Cholinergic synapse | A synapse which links neurones to neurones or neurones to other effector organs, in which the neurotransmitter is acetylcholine, often found in peripheral NS. May be excitatory or inhibitory. Motor, sensory or intermediate neurones may be involved. |
| 59 | Adrenergic synapse | A synapse in which the neurotransmitter is noradrenaline (epinephrine in the US), found in some synapses in the sympathetic system |
| 60 | Neurotransmitter | A chemical which is secreted by a neurone within the nervous system to stimulate a target cell |
| 61 | Hormonal or endocrine system | A communication system which transports hormones via the plasma to produce a slow, long-lasting response in the target cells |
| 62 | Chemical mediators | Chemicals eg histamine, prostaglandins, released by some mammalian cells which have an effect on other nearby cells |
| 63 | Acetylcholine | A neurotransmitter used at a cholinergic synapse. Released from synaptic vesicles in presynaptic neurones when an action potential reaches the synaptic knob. This neurotransmitter diffuses across the synaptic cleft and binds to specific receptor proteins on the postsynaptic neurone which leads to a new action potential in the postsynaptic neurone. |
| 64 | Presynaptic neurone | Neurone that releases the neurotransmitter from synaptic vesicles when an action potential arrives at the end of it and causes calcium ion protein channels to open and calcium ions to influx in. |
| 65 | Postsynaptic neurone | Neurone which has receptor sites that the neurotransmitter binds to after diffusing across the synaptic cleft. |
| 66 | Presynaptic knob | The swollen portion of the presynaptic neurone. |
| 67 | Synaptic cleft | The 20-30nm wide gap which is found between the presynaptic and postsynaptic neurone. |
| 68 | Synaptic vesicle | Contain the neurotransmitter in the presynaptic neurone. The influx of calcium ions causes them to fuse with the presynaptic membrane, releasing neurotransmitter into the synaptic cleft. |
| 69 | ACh Receptors | Found on the postsynaptic neurone of a cholinergic synapse where acetyl choline is the neurotransmitter. As acetylcholine binds to receptor sites on sodium ion protein channels in the membrane it causes the sodium ion protein channels to open, allowing sodium ions to diffuse in rapidly down a concentration gradient, setting up a new action potential in the postsynaptic neurone. |
| 70 | Acetylcholine esterase enzyme | The enzyme which breaks down acetylcholine into choline and ethanoic acid (acetyl), removing it from the synaptic cleft (to prevent it continually stimulating the post-synaptic membrane). |
| 71 | Excitatory synapses | Synapses that produce new action potentials when the neurotransmitter binds with the receptor proteins. The neurotransmitter binds to and causes sodium ion channels on the postsynaptic neurone to open (Na+ ions move in) causing a new action potential. |
| 72 | Inhibitory synapses | Synapses which make it less likely that a new action potential will be created on the postsynaptic neurone. The neurotransmitter binds to and causes chloride ion channels on the postsynaptic neurone to open (Cl- ions move in) and causes potassium channels to open (K+ ions move out) making the inside of the postsynaptic membrane more negative and therefore less likely that a new impulse will be created. |
| 73 | Summation | Can either be spatial or temporal. Allows a build up of neurotransmitter which enables low-frequency action potentials to trigger a new action potential in the postsynaptic neurone. |
| 74 | Spatial summation | a number of presynaptic neurones together release enough neurotransmitter to exceed the threshold value of the postsynaptic neurone and therefore trigger a new action potential |
| 75 | Temporal summation | one presynaptic neurone releases neurotransmitter many times over a short period- if the concentration of neurotransmitter exceeds the threshold of the postsynaptic neurone a new action potential will be triggered. |
| 76 | Neuromuscular junction | The point at which a motor neurone meets a skeletal muscle fibre. Only excitatory synapses. |

**Controlling Heart Rate**

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| 77 | Myogenic | Contraction is initiated from within the muscle itself, rather than by nervous impulse from outside (neurogenic). |
| 78 | SAN | A distinct group of cells (pacemaker) within the right atrium of the heart where the initial stimulus for contraction originates. It has a basic rhythm of stimulation that determines the beat of the heart. |
| 79 | AV Node | A second group of cells which lies between the atria. After a short delay, it conveys a wave of electrical excitation between the ventricles along the Purkinje tissue. |
| 80 | Bundle of His | The structure that is made of the Purkinje tissue that conducts the wave through the atrioventricular septum to the base of the ventricles. |
| 81 | Purkinje fibres | Specialised muscle fibres which convey the wave of electrical excitation between the ventricles and then releases the wave of excitation causing the ventricles to contract quickly at the same time from the bottom of the heart upwards. |
| 82 | Medulla oblongata | Region of the brain which controls the heart rate. It has two centres – one which increases heart rate that is linked to the SAN by the sympathetic NS and one which decreases heart rate that is linked to the SAN by the parasympathetic NS. |
| 83 | Pressure receptors | Occur within the walls of the carotid arteries and the aorta. If blood pressure is higher than normal these receptors transmit more nervous impulses to the centre in the medulla which decreases heart rate. If blood pressure is lower than normal these receptors transmit more nervous impulses to the centre in the medulla which increases heart rate. |
| 84 | Chemo receptors | Occur within the walls of the carotid artery and are sensitive to changes in pH of the blood (due to changes in CO2 concentration). If pH decreases (higher concentration of CO2) these receptors increase the frequency of nervous impulses to the centre in the medulla that increases heart rate, leading to more carbon dioxide being removed. |

**Muscle Contraction**

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| 85 | Skeletal muscle | Attached to bone and acts under voluntary, conscious control. |
| 86 | Smooth muscle | Found in the walls of blood vessels and the gut – not under conscious control. |
| 87 | Cardiac muscle | Found exclusively in the heart – not under conscious control. |
| 88 | Sarcolemma | The fine transparent tubular sheath which envelops the fibres of skeletal muscles. |
| 89 | Sarcoplasm | The cytoplasm and nuclei which muscle fibres share. It is mostly found around the circumference of the fibre. Within this there is a large concentration of mitochondria and endoplasmic reticulum. |
| 90 | Sarcoplasmic reticulum | A large vesicle in a contracting muscle cell which contains the Ca2+ ions to allow the troponin to bind and filaments to slide |
| 91 | Multi-nucleated | Contain more than one nucleus |
| 92 | Myofibrils (muscle fibres) | A microscopic muscle fibre containing sarcoplasm and showing striped isotropic and anisotropic bands of actin and myosin |
| 93 | Actin | A globular protein whose 2 molecules are arranged into long chains that are twisted around one another to form a helical strand. |
| 94 | Myosin | Made of a fibrous protein arranged into a filament made up of several hundred molecules (the tail) and a globular protein formed into two bulbous structures at one end (the head). |
| 95 | Tropomyosin | Forms long thin threads that are wound around actin filaments. |
| 96 | A Band | Ansiotropic bands (dark) where thick and thin filaments overlap. |
| 97 | I Band | Isotropic bands (light) where thick and thin filaments do not overlap. |
| 98 | H zone | The centre of each A-band where there is a lighter-coloured region |
| 99 | Z line | The centre of each I-band. |
| 100 | Sarcomere | The distance between two adjacent Z-lines (the centres of adjacent I bands). Sarcomeres shorten and the pattern of light and dark band changes when a muscle contracts. |
| 101 | Contraction | When a muscle undergoes this process the following happen: the I band becomes narrower, the Z-lines move closer together and the H-zone becomes narrower. |
| 102 | Globular heads | Part of myosin that attaches to binding site on actin filaments (when tropomyosin no longer blocks it). The head of myosin can change angle which is necessary for the sliding filament mechanism of muscle contraction. |
| 103 | Myosin binding site | Found on the actin molecule – can be blocked by tropomyosin. |
| 104 | Ca2+ | Causes the tropomyosin molecule to change shape and pull away from the binding sites on the actin molecule. |
| 105 | ATP | Required to provide the energy for the myosin head to resume to its normal position. |
| 106 | Phosphocreatine | A store is found in muscle that provides a reserve supply of phosphate, which can immediately recombine with ADP to re-form ATP. |
| 107 | Slow twitch | Adapted for aerobic respiration and contract more slowly and provide less powerful contractions but can contract for long periods. Adapted to endurance work. |
| 108 | Fast twitch | Adapted for anaerobic respiration and can contract more rapidly and produce powerful contraction but only for a short period. Adapted for intense exercise. |
| 109 | Myoglobin | a red protein containing haem, which carries and stores oxygen in muscle cells. It is structurally similar to a subunit of haemoglobin. |
| 110 | Sliding filament theory | A process which explains how muscles contract, involving actin and myosin molecules sliding past each other |

**Principles of Homeostasis**

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| 111 | Homeostasis | The maintenance of a constant internal environment |
| 112 | Control mechanism | A set of self-regulating stages comprising of: optimum point, receptor, coordinator, effector and feedback loop |
| 113 | Ectotherm | An animal which gains its heat from outside their body, i.e. its environment eg reptiles |
| 114 | Endotherm | An animal which gains its heat from metabolic activities inside its body eg birds, mammals |
| 115 | Vasodilation | Widening the diameter of arterioles near the surface of the skin, so that warm blood passes close to its surface via capillaries |
| 116 | Vasoconstriction | Narrowing the diameter of arterioles near the surface of the skin, so that less blood volume passes close to its surface via capillaries, retaining heat |
| 117 | Hypothalamus | Part of the brain next to the pituitary gland; the control centre for the ANS eg controls temperature, water balance |
| 118 | Second messenger model | The way a non-lipid-soluble hormone eg glucagon or adrenaline acts on a cell, by triggering production of an intermediary ‘second’ messenger eg cyclic AMP by activating adenyl cyclase |
| 119 | Type 1 diabetes | Insulin dependent, due to body being unable to produce insulin. It normally begins in childhood due to an autoimmune response whereby the body’s immune system attacks the β cells of the islets of Langerhans. |
| 120 | Type 2 diabetes | Insulin independent- due to glycoprotein receptors on body cells losing responsiveness to insulin (or it could also be due to inadequate supply from the pancreas). Usually develops in people over the age of 40 years. |
| 121 | Gluconeogenesis | Happens in the liver - conversion of non-carbohydrates (e.g. glycerol and amino acids) into glucose; literally ‘glucose-new-manufacture’. Happens when glycogen supply is exhausted. |
| 122 | Glycogenolysis | Happens in the liver - breakdown of glycogen to glucose – ‘breaking down glycogen’. Happens when blood glucose level is lower than normal. |
| 123 | Glycogenesis | Happens in the liver - conversion of glucose into glycogen – ‘making glycogen’. Happens when blood glucose level is higher than normal. |
| 124 | Negative feedback | When the feedback causes the corrective measures to be turned ‘off’, so returns the system to its original or (normal) level |
| 125 | Positive feedback | When the feedback causes the corrective measures to be turned ‘on’, so makes the system deviate even further from its original or (normal) level |
| 126 | Osmoregulation | The homeostatic control of the water potential of the blood. |
| 127 | Nephron | The functional unit of the kidney – there are about one million tubular structures in each kidney. |
| 128 | Fibrous capsule | An outer membrane which protects the kidney |
| 129 | Cortex | A lighter coloured outer region made up of renal (Bowman’s) capsules, convoluted tubules and blood vessels |
| 130 | Medulla | A darker coloured inner region made up of loops of Henle, collecting ducts and blood vessels |
| 131 | Renal pelvis | A funnel-shaped cavity that collects urine into the ureter |
| 132 | Ureter | A tube that carries urine to the bladder |
| 133 | Renal artery | Supplies the kidney with blood from the heart via the aorta |
| 134 | Renal vein | Returns blood to the heart via the vena cava |
| 135 | Renal (Bowman’s) capsule | The closed end at the start of the nephron. It is cup-shaped and surrounds a mass of blood capillaries known as the glomerulus. The inner layer of the renal capsule is made up of specialized cells called podocytes. |
| 136 | Proximal convoluted tubule | A series of loops surrounded by blood capillaries which are adapted to reabsorb substance into the blood by having walls made of epithelial cells which have microvilli. |
| 137 | Loop of Henle | A long, hairpin loop that extends from the cortex into the medulla of the kidney and back again which is surrounded by blood capillaries. |
| 138 | Descending limb of loop of Henle | Narrow, with thin walls that are highly permeable to water. The filtrate progressively loses water by osmosis at it moves down this limb. |
| 139 | Ascending limb of loop of Henle | Wider, with thick walls that are impermeable to water. Sodium ions are actively transported out of this limb which creates a lower water potential in the region of the medulla between the two limbs. |
| 140 | Distal convoluted tubule | A series of loops surrounded by blood capillaries. Its walls are made of epithelial cells, but it is surrounded by fewer than the proximal tubule. It makes final adjustments to the water and salts that are reabsorbed and to control the pH of the blood by selecting which ions to reabsorb. The permeability of its walls are altered under the influence of various hormones. |
| 141 | Collecting duct | A tube into which a number of distal convoluted tubules from a number of nephrons empty. It is lined by epithelial cells and becomes increasingly wide as it empties into the pelvis of the kidney. It is permeable to water and so as the filtrate moves down it the water passes out of it by osmosis. |
| 142 | Afferent arteriole | A tiny vessel that ultimately arises from the renal artery and supplies the nephron with blood. The afferent arteriole enters the renal capsule of the nephron where it forms the glomerulus. |
| 143 | Glomerulus | A many-branched knot of capillaries from which fluid is forced out of the blood. They recombine to form the efferent arteriole. |
| 144 | Efferent arteriole | A tiny vessel that leaves the renal capsule. It has a smaller diameter than the afferent arteriole and so causes an increase in blood pressure within the glomerulus. It carries blood away from the renal capsule and later branches into the blood capillaries. |
| 145 | Blood capillaries | A concentrated network of capillaries that surround the proximal convoluted tubule, the loop of Henle and the distal convoluted tubule and from where they reabsorb mineral salts, glucose and water. They merge together into venules and then into the renal vein. |
| 146 | Ultrafiltration | Filtration assisted by blood pressure - process by which glomerular filtrate is formed due to the afferent arteriole having a larger diameter than the efferent arteriole which causes a build up of hydrostatic pressure causing water, glucose, urea and mineral ions to be squeezed out of the capillary into the renal (Bowman’s) capsule. Blood cells and proteins cannot pass across into the renal capsule as they are too large. |
| 147 | Reabsorption of water | Process by which all of the glucose and most other valuable molecules are reabsorbed as well as water in the proximal convoluted tubule. Sodium ions are actively transported out of cells lining the convoluted tubule into blood capillaries which carry them away. This causes sodium ions to move by facilitated diffusion down a concentration gradient from the lumen of the proximal convoluted tubule into the epithelial lining cells. It moves through via co-transport through carrier proteins, each of which carries another molecules (glucose, amino acids or chloride ions) along with the sodium ions. The molecules that have moved via co-transport then diffuse into the blood. |
| 148 | Counter-current multiplier | When two liquids flow in opposite directions past one another, the exchange of substance between them is greater than if they flow in the same direction next to each other. The counter-current flow means that the filtrate in the collecting duct with a lower water potential meets interstitial fluid that has an even lower water potential, meaning the water potential gradient exists for the whole length of the collecting duct. |
| 149 | Osmoreceptors | Cells in the hypothalamus of the brain detect a change in water potential |
| 150 | ADH (antidiuretic hormone) | If a decrease in water potential is detected, more of this hormone is produced by the pituitary gland and it makes the walls of the distal convoluted tubule and collecting duct more permeable to water, meaning less water leaves the body and urine is more concentrated. |