**Little Heath Sixth Form**

**Biology**

Personal Learning Checklist

**Student Name: ……………………….…………………………………..………**

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| **Unit Name:**  **Control in cells and organisms** | **Unit Code:**  **BIOL5** |
| *Minimum Target Grade:* | *Aspirational Target Grade:* |

*KEY:* ***Red =*** *with difficulty* ***Amber*** *= not sure* ***Green*** *= yes*

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| **GCSE Re-Cap** | |  | **Red** | **Amber** | **Green** |
| **B2 Keeping Healthy** | * Homeostasis – maintaining a constant internal environment * Water balance in the body and role of the kidneys, role of ADH * Principles of negative feedback | |  |  |  |
| **B5 Growth and development** | * Protein synthesis | |  |  |  |
| **B6 Brain and Mind** | * Behaviour – simple & complex * Simple reflexes and reflex arcs * Nervous system Vs hormonal system * Peripheral & central nervous system * Structures and function of a motor neurone * Structures and function of synapses * Effect of drugs on synapses | |  |  |  |
| ***B7 Further Biology*** | * Homeostasis – body temperature – incl. Vasodilation/vasoconstriction * Homeostasis – blood glucose concentration * Genetic testing – FISH | |  |  |  |

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| **Knowledge/specification content (skills are highlighted in bold)** | | **Red** | **Amber** | **Green** | **To address this before the exam I will:-** |
| 3.5.1  Survival and response | Organisms increase their chance of survival by responding to changes in their environment. |  |  |  |  |
| Tropisms as responses to directional stimuli that can maintain the roots and shoots of flowering plants in a favourable environment. |  |  |  |  |
| Taxes and kineses as simple responses that can maintain a mobile organism in a favourable environment. |  |  |  |  |
| A simple reflex arc involving three neurones. The importance of simple reflexes in avoiding damage to the body. |  |  |  |  |
| 3.5.1  Control of heart rate | The role of chemoreceptors and pressure receptors, the autonomic nervous system and effectors in controlling heart rate. |  |  |  |  |
| 3.5.1  Receptors | The basic structure of a Pacinian corpuscle as an example of a receptor. The creation of a generator potential on stimulation. |  |  |  |  |
| The Pacinian corpuscle should be used as an example to illustrate the following.  • Receptors only respond to specific stimuli  • Stimulation of receptor membranes produces deformation of stretch-mediated sodium channels, leading to the establishment of a generator potential. |  |  |  |  |
| Differences in sensitivity and visual acuity as explained by differences in the distribution of rods and cones and the connections they make in the optic nerve. |  |  |  |  |
| 3.5.2  Principles | Nerve cells pass electrical impulses along their length. They stimulate their target cells by secreting chemical neurotransmitters directly on to them. This results in rapid, short-lived and localised responses. |  |  |  |  |
| Mammalian hormones are substances that stimulate their target cells via the blood system. This results in slow, long-lasting and widespread responses. |  |  |  |  |
| Histamine and prostaglandins are local chemical mediators released by some mammalian cells and affect only cells in their immediate vicinity. |  |  |  |  |
| In flowering plants, specific growth factors diffuse from growing regions to other tissues. They regulate growth in response to directional stimuli. The role of indoleacetic acid (IAA) in controlling tropisms in flowering plants. |  |  |  |  |
| 3.5.2  Nerve impulses | The structure of a myelinated motor neurone. |  |  |  |  |
| The establishment of a resting potential in terms of differential membrane permeability, electrochemical gradients and the movement of sodium and potassium ions. |  |  |  |  |
| Changes in membrane permeability lead to depolarisation and the generation of an action potential. The all-or-nothing principle. |  |  |  |  |
| The passage of an action potential along non-myelinated and myelinated axons, resulting in nerve impulses. |  |  |  |  |
| The nature and importance of the refractory period in producing discrete impulses. |  |  |  |  |
| Factors affecting the speed of conductance: myelination and saltatory conduction; axon diameter; temperature. |  |  |  |  |
| 3.5.2  Synaptic transmission | The detailed structure of a synapse and of a neuromuscular junction. |  |  |  |  |
| **Candidates should be able to explain**  **• unidirectionality**  **• temporal and spatial summation**  **• inhibition.** |  |  |  |  |
| The sequence of events involved in transmission across a cholinergic synapse and across a neuromuscular junction. |  |  |  |  |
| **When provided with information, candidates should be able to predict and explain the effects of specific drugs on a synapse.** |  |  |  |  |
| Recall of the names and mode of action of individual drugs will **not** be required. |  |  |  |  |
| 3.5.3  The sliding filament theory of muscle contraction | Gross and microscopic structure of skeletal muscle. The ultrastructure of a myofibril.  The roles of actin, myosin, calcium ions and ATP in myofibril contraction. |  |  |  |  |
| The roles of calcium ions and tropomyosin in the cycle of actinomyosin bridge formation. |  |  |  |  |
| 3.5.3  Muscles as effectors | The role of ATP and phosphocreatine in providing the energy supply during muscle contraction. |  |  |  |  |
| The structure, location and general properties of slow and fast skeletal muscle fibres. |  |  |  |  |
| 3.5.4  Principles | Homeostasis in mammals involves physiological control systems that maintain the internal environment within restricted limits. |  |  |  |  |
| The importance of maintaining a constant core temperature and constant blood pH in relation to enzyme activity. |  |  |  |  |
| The importance of maintaining a constant blood glucose concentration in terms of  energy transfer and water potential of blood. |  |  |  |  |
| 3.5.4  Temperature  control | The contrasting mechanisms of temperature control in an ectothermic reptile and an endothermic mammal. |  |  |  |  |
| Mechanisms involved in heat production, conservation and loss. |  |  |  |  |
| The role of the hypothalamus and the autonomic nervous system in maintaining a constant body temperature in a mammal. |  |  |  |  |
| 3.5.4  Control of blood glucose concentration | The factors that influence blood glucose concentration. |  |  |  |  |
| The role of the liver in glycogenesis and gluconeogenesis. |  |  |  |  |
| The role of insulin and glucagon in controlling the uptake of glucose by cells and in activating enzymes involved in the interconversion of glucose and glycogen. The effect of adrenaline on glycogen breakdown and synthesis. |  |  |  |  |
| The second messenger model of adrenaline and glucagon action. |  |  |  |  |
| Types I and II diabetes and control by insulin and manipulation of the diet. |  |  |  |  |
| 3.5.5  Principles | Negative feedback restores systems to their original level. |  |  |  |  |
| The possession of separate mechanisms involving negative feedback controls departures in different directions from the original state, giving a greater degree of control. |  |  |  |  |
| Positive feedback results in greater departures from the original levels. |  |  |  |  |
| Positive feedback is often associated with a breakdown of control systems, e.g. in temperature control. |  |  |  |  |
| **Candidates should be able to interpret diagrammatic representations of negative and positive feedback.** |  |  |  |  |
| 3.5.5  Control of  mammalian oestrus | The mammalian oestrous cycle is controlled by FSH, LH, progesterone and oestrogen. |  |  |  |  |
| The secretion of FSH, LH, progesterone and oestrogen is controlled by interacting negative and positive feedback loops. |  |  |  |  |
| **Candidates should be able to interpret graphs showing the blood**  **concentrations of FSH, LH, progesterone and oestrogen during a given oestrous**  **cycle.**  **Changes in the ovary and uterus lining are not required**. |  |  |  |  |
| 3.5.6  The genetic code | The genetic code as base triplets in mRNA which code for specific amino acids. |  |  |  |  |
| The genetic code is universal, non-overlapping and degenerate. |  |  |  |  |
| The structure of molecules of messenger RNA (mRNA) and transfer RNA (tRNA). |  |  |  |  |
| **Candidates should be able to compare the structure and composition of DNA,**  **mRNA and tRNA**. |  |  |  |  |
| 3.5.6  Polypeptide  synthesis | Transcription as the production of mRNA from DNA. The role of RNA polymerase. |  |  |  |  |
| The splicing of pre-mRNA to form mRNA in eukaryotic cells. |  |  |  |  |
| Translation as the production of polypeptides from the sequence of codons carried by mRNA. The role of ribosomes and tRNA. |  |  |  |  |
| **Candidates should be able to**  **• show understanding of how the base sequences of nucleic acids relate to the amino acid sequence of polypeptides, when provided with suitable data**  **• interpret data from experimental work investigating the role of nucleic acids.** |  |  |  |  |
| Recall of specific codons and the amino acids for which they code, and of specific experiments, will **not** be tested. |  |  |  |  |
| 3.5.6  Gene mutation | Gene mutations might arise during DNA replication. The deletion and substitution of bases. |  |  |  |  |
| Gene mutations occur spontaneously. The mutation rate is increased by mutagenic agents. Some mutations result in a different amino acid sequence in the encoded polypeptide. Due to the degenerate nature of the genetic code, not all mutations result in a change to the amino acid sequence of the encoded polypeptide. |  |  |  |  |
| The rate of cell division is controlled by proto-oncogenes that stimulate cell division and tumour suppressor genes that slow cell division. A mutated proto-oncogene, called an oncogene, stimulates cells to divide too quickly. A mutated tumour suppressor gene is inactivated, allowing the rate of cell division to increase. |  |  |  |  |
| 3.5.7  Most of a cell’s DNA is not translated | Totipotent cells are cells that can mature into any body cell. |  |  |  |  |
| During development, totipotent cells translate only part of their DNA, resulting in cell specialisation. |  |  |  |  |
| In mature plants, many cells remain totipotent. They have the ability to develop in vitro into whole plants or into plant organs when given the correct conditions. |  |  |  |  |
| Totipotent cells occur only for a limited time in mammalian embryos. Multipotent cells are found in mature mammals. They can divide to form only a limited number of different cell types. |  |  |  |  |
| Totipotent and multipotent stem cells can be used in treating some genetic disorders. |  |  |  |  |
| **Candidates should be able to**  **• interpret data relating to tissue culture of plants from samples of totipotent cells**  **• evaluate the use of stem cells in treating human disorders.** |  |  |  |  |
| 3.5.7  Regulation of transcription and translation | Transcription of target genes is stimulated only when specific transcriptional factors  move from the cytoplasm into the nucleus. |  |  |  |  |
| The effect of oestrogen on gene transcription. |  |  |  |  |
| Small interfering RNA (siRNA) as a short, double-strand of RNA that interferes with the expression of a specific gene. |  |  |  |  |
| **Candidates should be able to**  **• interpret data provided from investigations into gene expression**  **• interpret information relating to the use of oncogenes and tumour suppressor genes in the prevention, treatment and cure of cancer**  **• evaluate the effect on diagnosis and treatment of disorders caused by hereditary mutations and those caused by acquired mutations.** |  |  |  |  |
| 3.5.8  Gene cloning and transfer | Fragments of DNA can be produced by  • conversion of mRNA to cDNA, using reverse transcriptase  • cutting DNA at specific, palindromic recognition sequences using restriction endonucleases  • the polymerse chain reaction (PCR). |  |  |  |  |
| Fragments of DNA produced by any of the above methods can be used to clone genes by in vivo and in vitro techniques. |  |  |  |  |
| In vivo cloning. The use of restriction endonucleases and ligases to insert a gene into vectors, which are then transferred into host cells. The identification and growth of transformed host cells to clone the desired DNA fragments. The importance of “sticky ends”. |  |  |  |  |
| In vitro cloning. The use of the polymerase chain reaction (PCR) to clone directly. |  |  |  |  |
| The relative advantages of in vivo and in vitro cloning. |  |  |  |  |
| The use of recombinant DNA technology to produce transformed organisms that benefit humans.  **Candidates should be able to**  **• interpret information relating to the use of recombinant DNA technology**  **• evaluate the ethical, moral and social issues associated with the use of recombinant**  **technology in agriculture, in industry and in medicine**  **• balance the humanitarian aspects of recombinant DNA technology with the opposition from environmentalists and anti-globalisation activists.** |  |  |  |  |
| 3.5.8  Gene therapy | The use of gene therapy to supplement defective genes. |  |  |  |  |
| **Candidates should be able to evaluate the effectiveness of gene therapy.** |  |  |  |  |
| 3.5.8  Medical diagnosis | The use of labelled DNA probes and DNA hybridisation to locate specific genes. |  |  |  |  |
| Once located, the base sequence of a gene can be determined by  • restriction mapping  • DNA sequencing. |  |  |  |  |
| Many human diseases result from mutated genes or from genes that are useful in one context but not in another, e.g. sickle cell anaemia. |  |  |  |  |
| DNA sequencing and the PCR are used to produce DNA probes that can be used to screen patients for clinically important genes. The use of this information in genetic counselling, e.g. for parents who are both carriers of defective genes and, in the case of oncogenes, in deciding the best course of treatment for cancers. |  |  |  |  |
| **Candidates should understand the principles of these methods. They should be aware that methods are continuously updated and automated.** |  |  |  |  |
| 3.5.8  Genetic  fingerprinting | An organism’s genome contains many repetitive, non-coding base sequences. The probability of two individuals having the same repetitive sequences is very low. |  |  |  |  |
| The technique of genetic fingerprinting in analysing DNA fragments, that have been cloned by PCR, and its use in determining genetic relationships and in determining the genetic variability within a population. |  |  |  |  |
| **Candidates should be able to**  **• explain the biological principles that underpin genetic fingerprinting techniques**  **• interpret data showing the results of gel electrophoresis to separate DNA fragments**  **• explain why scientists might use genetic fingerprints in the fields of forensic science, medical diagnosis, animal and plant breeding.** |  |  |  |  |

**Grade tracking:**

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*Note: You should discuss this checklist regularly with your subject teacher/mentor*