

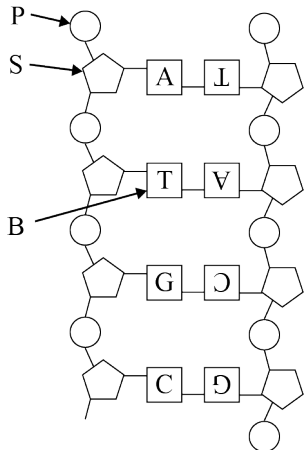
Assessment Schedule – 2015

Biology: Demonstrate understanding of gene expression (91159)

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<i>Demonstrate understanding</i> involves defining, using annotated diagrams or models to explain, and giving characteristics of, or an account of, gene expression.	<i>Demonstrate in-depth understanding</i> involves providing a reason as to how or why biological ideas and processes affect gene expression.	<i>Demonstrate comprehensive understanding</i> involves linking biological ideas and processes about gene expression. The explanation may involve justifying, relating, evaluating, comparing and contrasting, or analysing.

Evidence

Q	Expected Coverage	Achievement	Merit	Excellence
ONE (a)		<ul style="list-style-type: none"> • Describes a triplet. • Describes a codon. • Describes an anti-codon. • Describes start codon. • Describes stop codon. • Labelled drawing showing correct anti-parallel DNA section, sugars and phosphates. 	<ul style="list-style-type: none"> • Labelled drawing showing transcription and translation 4 components labelled. • Gives an explanation for the complementary nature of the relationship between triplet and codon, and how they interact during transcription. • Gives an explanation for the complementary nature of the relationship between codon and anti-codon, and how they interact through a ribosome. • Gives an explanation for the relationship between the codon and the amino acids, and how they interact through specific tRNA molecules. • Explains a start codons role in translation with the ribosome. • Explains a stop codon to signal end of translation / protein synthesis. 	<p>Comprehensively shows understanding of the interactions the formation of a protein. For example:</p> <ul style="list-style-type: none"> • Triplet 3 bases on DNA which codes for an amino acid. Triplet is complementary to the codon (eg ATC – UAG). • Codon – 3 bases on mRNA coding for a specific aa, complementary to anticodon portion of tRNA, (read by) ribosome. • Anticodon (is part of) tRNA molecule and it is carrying an amino acid to be dropped off, (ribosome continues to read codons). • Start codon is AUG and ribosome begins here and tRNA comes in, starts translation. • Stop codon(s) signal for ribosome to dissociate and translation finishes • How transcription and translation to-
(b)	<p>Triplet: Three consecutive nucleotide bases on the DNA strand. Each triplet is a group of three bases and codes for a specific amino acid.</p> <p>Codon: the sequence of three consecutive nucleotides on the mRNA strand.</p> <p>Anti-codon: three consecutive bases on a tRNA molecule that is complementary to mRNA codon.</p> <p>A triplet is 3 consecutive bases on the DNA strand. The processes of transcription involve attaching free nucleotides to the exposed DNA strand to make mRNA. A codon is 3 consecutive bases on the mRNA strand. One triplet is complementary to one codon.</p> <p>Translation is where the code sequence carried on the mRNA is used to create a functional protein.</p> <p>mRNA forms a complex with a ribosome, The ribosome is an organelle, which ‘reads’ mRNA bases in a code of three bases at a time. This is the codon on the mRNA.</p> <p>tRNA brings in amino acids – there is a different kind of tRNA for each amino</p>	<ul style="list-style-type: none"> • Describes the relationship between gene and polypeptide chain / protein. • Defines transcription. • Defines translation. 	<ul style="list-style-type: none"> • Gives an explanation for the complementary nature of the relationship between codon and anti-codon, and how they interact through a ribosome. • Gives an explanation for the relationship between the codon and the amino acids, and how they interact through specific tRNA molecules. 	<ul style="list-style-type: none"> • Stop codon(s) signal for ribosome to dissociate and translation finishes • How transcription and translation to-

	<p>acid.</p> <p>Three unpaired bases on the tRNA are known as an anticodon, and have a corresponding amino acid that attaches to it. They are complementary to a codon on the mRNA. Codon-anticodon ‘matches’ combine with base pairing, thus bringing the correct amino acid to the next part of the sequence and attaching to the polypeptide.</p> <p>A start codon initiates the translation. The start codon always codes for the amino acid methionine and is AUG.</p> <p>A stop codon ends translation which causes the ribosome to stop translating and release the mRNA and the polypeptide chain.</p> <p>Once the polypeptide chain is released from the ribosome, it ‘folds’ into a three-dimensional structure, becoming a functional protein.</p>			<p>gether enable a code to be read and a protein to be made.</p> <p>Discussion includes detail of the interactions such as the mRNA / template strand link, tRNA movement / specificity ribosome movement enzyme link from DNA to mRNA, AUG / MET Antiparallel diagram.</p>
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N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Provides any ONE statement from Achievement column.	Provides any TWO statements from Achievement column.	Provides any THREE statements from Achievement column.	Provides any FOUR statements from Achievement column.	Provides any THREE statements from Merit column.	Provides any FOUR statements from Merit column.	Provides the criteria for Excellence	Provides the criteria for Excellence including the final bullet point.

Q	Expected Coverage	Achievement	Merit	Excellence
<p>TWO</p> <p>(a)</p> <p>(b)</p>	<p>Gene mutation is a change in the base sequence of a gene (which results in a new allele).</p> <p>A metabolic pathway is a series of biochemical reactions that are connected by their intermediates: The reactants (or substrates) of one reaction are the products of the previous one, and so on / a series of (enzyme controlled) reactions for a cell to make what it requires.</p> <p>Because there is a series of biochemical reactions, each one usually controlled by an enzyme, there are multiple places where the end result can be affected.</p> <p>In most metabolic pathways the first compound in a pathway is converted to the next compound by the action of an enzyme. For example, in the simple pathway ornithine → citrulline → arginine, the conversion of compound ornithine to citrulline occurs because of the action of enzyme 1, and the conversion of citrulline to arginine occurs because of the action of enzyme 2.</p> <p>A gene mutation can occur which stops the function of enzyme 1, then the end product (arginine) cannot be made even if enzyme 2 is fully functional.</p> <p>OR a gene mutation can occur which stops the function of enzyme 2, then the end product (arginine) cannot be made even if enzyme 1 is fully functional.</p> <p>OR a gene mutation can occur which stops the function of enzyme 3, then the end product (arginine) cannot be made even if enzyme 1 and 2 are fully functional.</p> <p>Hence, there are three possible mutations that can affect the way in which arginine can be made, because the metabolic pathway has 3 points where different genes are controlling the outcome.</p> <p>A mutation to gene 1 can only affect enzyme 1, mutation to gene 2 only affects enzyme 2, and a mutation to gene 3 only affects enzyme 3. A specific gene makes a specific protein therefore genes are specific to their proteins.</p>	<ul style="list-style-type: none"> • Describes a gene mutation • Describes metabolic pathway. • Describes mutations prevent proteins from being made • Gives examples of gene mutations / or examples of mutagens • Describes that enzymes were made in protein synthesis. • Coded for by the gene. • Proteins / enzymes have correct shape. 	<ul style="list-style-type: none"> • Explains a metabolic pathway. • Explains how a gene mutation can affect a protein being made. • Explains why any 1 of the 3 mutations prevent arginine being made. • Explains one gene codes for one protein. Enzymes are proteins. • Explains that the mutation affects the shape / role / function of the protein. 	<ul style="list-style-type: none"> • Discusses why there are three mutations that can cause arginine not to be produced. The enzyme controlled series of biochemical reactions produces what the cell needs / arginine. Each gene is carrying the code for the synthesis of one of the enzymes. if there is a mutation (by deletion etc) in the gene you wont get the intermediates. For example if mutation in gene one ... etc. • Discusses why they concluded 'One Gene Codes for One Protein'. • Each mutation affected one gene which was coding for one protein. <p>Discussion includes detail such as</p> <p>A clear link between the gene carrying the code for the synthesis of each enzyme which includes example of how a named mutation may affect the role / shape</p>

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Provides any ONE statement from Achievement column..	Provides any TWO statements from Achievement column.	Provides THREE statements from Achievement column.	Provides FOUR statements from Achievement column.	Provides any THREE statements from Merit column.	Provides any FOUR statements from Merit column.	Provides criteria for Excellence.	Provides criteria for Excellence including final point

Q	Expected Coverage	Achievement	Merit	Excellence
THREE (a) (b) (c)	<p>Phenotype is the observable physical / characteristics of an organism.</p> <p>Genotype is the set of alleles in our DNA, which is responsible for a particular trait an individual possesses.</p> <p>Biologists use yarrow plants that have identical genotypes because if there are any changes to their phenotype, it can be attributed to environmental factors.</p> <p>The phenotype of an organism results from the interaction between the genotype and the environment. The phenotype is a composite of the genotype and environment.</p> <p>The expression of the genotype can be affected by the environmental conditions that exist internally or externally for an organism without the genotype itself being altered in any way.</p> <p>The genotype provides the instruction set for a particular protein or function, but this may not be able to be fully expressed / reach its maximum genetic potential if the environmental conditions work against it. E.g. plant height is controlled by both genotype and environment. If the cuttings taken from the yarrow grow to different heights at different elevations it must be due to an environmental factor such as temperature (or other appropriate factor). If they were all grown in optimal conditions, all three plants' genotype would be expressed fully / reach maximum genetic potential.</p>	<ul style="list-style-type: none"> • Describes genotype and phenotype • Describes plants grow differently due to environmental of temperature / other correct factor. • Describes the interaction between environment and genotype. • Describes that cutting have the same genome / alleles. • Describes that gene expression is when we make proteins according to the alleles we have. • Describes that growth is inhibited by decreasing temperature. 	<ul style="list-style-type: none"> • Explains why the biologists used genetically identical cuttings at different heights. • Explains why there is a difference between the phenotype and the genotype because of the environment. • Gives reasons how / why the phenotype is affected by the environment / temperature effect on protein / enzyme activity. • Explains the interaction between environmental factors, phenotype, and genotype. • Explains the genotype will always remain the same. • If the environment is a mutagen it will change the genotype and therefore the phenotype. • Explains some genes may be turned on / off more. 	<p>Discusses the effects of the genotype and the temperature on phenotype expression.</p> <ul style="list-style-type: none"> • E.g. the genotype of an organism may set the upper and lower limits for a trait whilst the environment determines where within this range the phenotype ends up. • how the environment would influence the yarrow plants genetic expression / proteins produced, or the proteins that are produced then expressing proteins to help with growth for example. • Genotype will stay the same so we expect phenotype to be solely influence by environment affecting rate of protein synthesis or role of proteins however there may be a change if a mutation occurs. <p>Discussion includes detail such as 2 environmental factors linked to gene expressions the numerical data to link their ideas.</p>

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Provides any ONE partial statement from Achievement column.	Provides any ONE statements from Achievement column.	Provides any TWO statements from Achievement column.	Provides all THREE statements from Achievement column.	Provides any TWO statements from Merit column.	Provides any THREE statements from Merit column.	Provides criteria for Excellence	Provides criteria for Excellence along with the final bullet point.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 13	14 – 19	20 – 24