

Edexcel (B) Biology A-level

Topic 7 - Modern Genetics

Definitions and Concepts

7.1 - Using gene sequencing

DNA amplification - The production of many copies of DNA from a small starting amount.

DNA profiling - A method of comparing DNA sequences by splitting DNA sections into fragments and comparing the fragments with each other for genetic identification or determining genetic relationships.

Gene sequencing - The process of determining the specific order of nucleotides in a sequence of DNA.

Genome - All of the genetic information within an organism.

Genomics - The study of the structure and function of the genome.

Polymerase Chain Reaction (PCR) - A laboratory technique used to amplify DNA using Taq polymerase, primers, free nucleotides and a buffer.

7.2 - Factors affecting gene expression

DNA methylation - The addition of methyl groups to DNA molecules as a method of epigenetic modification.

Epigenetic modification - Heritable changes to gene expression brought about without changing the original sequence of bases that compose the DNA molecule.

Gene expression - The transcription (and often subsequent translation) of genes.

Histone acetylation - The addition of negative acetyl groups to histones which loosens their binding to DNA, allowing for transcription.

Histone deacetylation - The removal of negative acetyl groups from histones which means the histone proteins can bind more tightly to DNA which restricts transcription.

Histone modification - Changes made to histone proteins through the addition or removal of chemical groups which affect gene expression.

Histone proteins - Positively charged proteins which bind to and package DNA and can be a target of epigenetic modification.

Non-coding RNA - RNA molecules which have been transcribed but are not translated to produce proteins.

Post-transcriptional modification - The production of mature mRNA from pre-mRNA through splicing.

Transcription factors - Proteins which bind to regulatory regions of DNA and control DNA transcription.

7.3 - Factors affecting gene expression

Induced pluripotent stem cells (iPS cells) - Pluripotent stem cells produced artificially by the reprogramming of somatic cells through the introduction of genes.

Multipotent stem cell - A type of stem cell which has the ability to differentiate into any cell type within a certain tissue in the body.

Pluripotent stem cell - A type of stem cell which has the ability to differentiate into any cell type in the body.

Stem cell - An undifferentiated cell that can divide indefinitely to produce a given range of specialised cells.

Totipotent stem cell - A type of stem cell which has the ability to differentiate into any type of cell in the body or in the placenta.

7.4 - Gene technology

DNA ligase - An enzyme which catalyses the formation of phosphodiester bonds between DNA fragments which is used to join Okazaki fragments in the lagging strand during replication. DNA ligase can be used to join fragments cut by restriction endonucleases during genetic engineering.

Gene gun - A method of injecting DNA combined with metals into a cell (typically a plant cell) using propulsion.

Knockout mice - Laboratory mice which have had gene(s) removed or inactivated and are used in studies to identify the function of the knockout genes and the effect of harmful mutations in those genes.

Marker genes - Specific detectable genes which are inserted along with other genes during the creation of a transgenic organism so that the organisms which successfully took up the other genes can be identified.

Recombinant DNA - Artificially modified DNA which is made by the combination of genes from different sources.

Replica plating - A technique used to produce multiple near-identical arrangements of organisms on agar plates from a single plate for comparisons. This is particularly useful in recombinant DNA technology to test for antibiotic resistance marker genes by including antibiotics in one of the new plates.

Restriction endonucleases - Enzymes which break double stranded DNA at specific sequences which are used in genetic engineering.


M E G A
L E C T U R E

Transgenic organism - An organism which has had foreign genetic material inserted into its genome.

Vector (gene technology) - A carrier such as a virus or gene gun which is used for insertion of foreign DNA into an organism.