**Topic 3.1: Genes**

**Essential Idea: Every living organism inherits a blueprint for life from its parents.**

**Statements & Objectives:**

**3.1.U1 A gene is a heritable factor that consists of a length of DNA and influences a specific characteristic.**

Define gene.​

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

**3.1.U2 A gene occupies a specific position on a chromosome.**

Define gene locus.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

**3.1.U3 The various specific forms of a gene are alleles.**

Define allele.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

List two examples of genes with multiple alleles.

**(List**: Give a sequence of brief answers with no explanation.)

State a similarity between alleles of the same gene.​

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

**3.1.U4 Alleles differ from each other by one or only a few bases.**

State the difference between alleles of the same gene.​

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

**3.1.U5 New alleles are formed by mutation.**

State the source of new alleles of a gene.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Describe a base substitution mutation.

**(Describe**: Give a detailed account)

**3.1.U6 The genome is the whole of the genetic information of an organism.**

Define genome.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

State the size in base pairs of the human genome.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

**3.1.U7 The entire base sequence of human genes was sequenced in the Human Genome Project.**

Define “sequence” in relation to genes and/or genomes.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

State the aim of the Human Genome Project.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Outline two outcomes of the Human Genome Project.​

(**Outline** Give a brief account or summary.)

**3.1.A1 The causes of sickle cell anemia, including a base substitution mutation, a change to the base sequence of mRNA transcribed from it and a change to the sequence of a polypeptide in hemoglobin.**

State the cause of sickle cell anemia, including the name of differences in the Hb alleles.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

State the difference in amino acid sequences in transcription of normal and mutated Hb mRNA.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Outline the consequences of the Hb mutation on the impacted individual.

(**Outline** Give a brief account or summary.)

**3.1.A2 Comparison of the number of genes in humans with other species.**

State the number of genes in the human genome.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Describe the relationship between the number of genes in a species and the species complexity in structure, physiology and behavior.​

**(Describe**: Give a detailed account)

**3.1.S1 Use of a database to determine differences in the base sequence of a gene in two species.**

Explain why cytochrome oxidase 1 is often used to assess the differences in the base sequences of a gene between two species.

(**Explain**: Give a detailed account including reasons or causes)

Use NCBI to search for COX1 sequences for different species.

Use a computer software tool to create an alignment of the gene sequences between different species.

Outline information that can be determined given gene sequence alignment data.

(**Outline** Give a brief account or summary.)

**3.1.NOS Developments in scientific research follow improvements in technology-gene sequencers are used for the sequencing of genes.**

Outline the technological improvements that have sped the DNA sequencing process.

(**Outline** Give a brief account or summary.)

Determine a DNA sequence from an electropherogram.

(**Determine** Obtain the only possible answer)

**Key Terms**

Chromosomes

Allele

E.coli

Sickle cell anemia

Chromatid

​base pair

​glutamic acid

​sequence

​COX1

gene

genome

mutation

base deletion

centromere

​primer

plasmid

​mRNA

species

eukaryote

prokaryote

sequence

hemoglobin

locus

Human Genome Project

Polypeptide

​Hb

​​DNA sequencing

locus

DNA

blood type

transcription

malaria

​Genbank database

transcription

​electropherogram.

Mutation

​Protein

clotting

base substitution

anemic

​gene mapping

valine

​cytochrome oxidase