Chromosomes, Genes, Alleles and Mutations (4.1)

Define the following terms (4.1.2 / 4.1.3 / 4.2.2 / 4.3.1 / 4.4.11)

Gene: A heritable factor that controls a specific characteristic

Allele: One specific form of a gene, occupying the same gene locus as other alleles of the gene

Genome: The whole of the genetic information of an organism

Gene Mutation: A change in the nucleotide sequence of a section of DNA coding for a polypeptide

Homologous Chromosomes: Chromosomes that have the same structural features and the same genes

Genotype: The alleles of an organism

Phenotype: The characteristics of an organism (combination of genotype and environmental factors)

Dominant Allele: An allele that is expressed in the phenotype in a homozygous or heterozygous state

Recessive Allele: An allele that is only expressed in the phenotype in a homozygous state

Codominant Alleles: A pair of alleles which both affect the phenotype in a heterozygote

Locus: The particular position on homologous chromosomes of a gene

Homozygous: Having two identical alleles of a gene

Heterozygous: Having two different alleles of a gene

Carrier: A heterozygote who has one copy of a recessive allele that causes a genetic disease

Test Cross: Testing a suspected heterozygote by crossing with a known homozygous recessive

Clone: A group of genetically identical organisms or a group of cells derived from a single parent cell

Organisation of chromosomes (4.1.1)

- Eukaryotic chromosomes consist of DNA wrapped around histone proteins
- This forms the basic structure of the nucleosome, which are packaged into chromatin
- Chromatin containing active genes remains in an expanded form (euchromatin)
- Chromatin with genes not expressed by the cell becomes condensed (heterochromatin)
- Chromatin only supercoils into chromosomes during cell division (mitosis / meiosis)



Consquences of a base substitution mutation in sickle cell anaemia (4.1.4)

Causer

- Base substitution: GAG → GTG
- Amino acid change: Glu → Val
- Location of change: Haemoglobin beta chain (chromosome 11)
- Mode of inheritance: Autosomal recessive

Consequence:

- Structural effect: Haemoglobin forms strands; red blood cells to become sickle-shaped
- Functional effect: Causes anaemia (low RBC count) as sickle-cells destroyed faster

Blood is less effective at transporting oxygen, causing fatigue

Complications: Altered shape causes clotting, leading to organ failure (e.g. kidneys)

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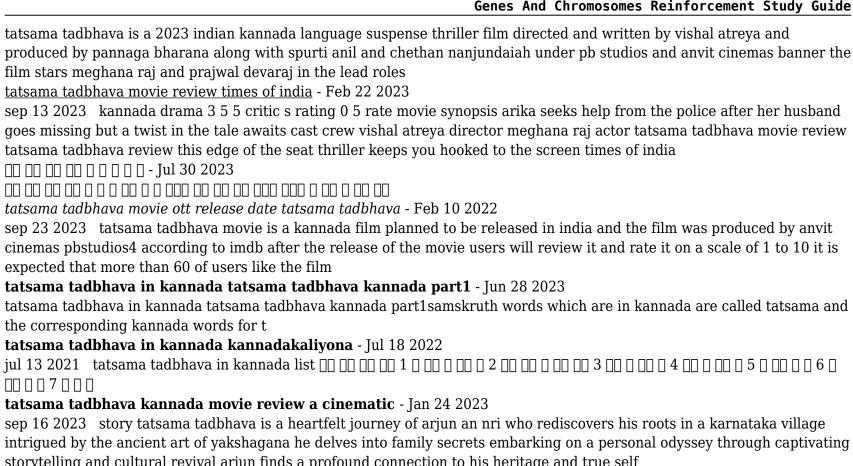
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