**Topic 3.4: Inheritance**

**Essential Idea: The inheritance of genes follows patterns.**

**Statements & Objectives:**

**3.4.U1 Mendel discovered the principles of inheritance with experiments in which large numbers of pea plants were crossed.**

Describe Mendel’s pea plant experiments.

**Describe**: Give a detailed account)

**3.4.U2 Gametes are haploid so contain only one allele of each gene.**

Define gamete and zygote.

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

State two similarities and two differences between male and female gametes

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

**3.4.U3 The alleles of each gene separate into different haploid daughter nuclei during meiosis.**

State the outcome of allele segregation during meiosis.

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

**3.4.U4 Fusion of gametes results in diploid zygotes with two alleles of each gene that may be the same allele or different alleles.**

Outline the possible combination of alleles in a diploid zygote for a gene with two alleles.

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

Outline the possible combination of alleles in a diploid zygote for a gene with three alleles.

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

**3.4.U5 Dominant alleles mask the effect of recessive alleles but co-dominant alleles have joint effects.**

Define dominant allele and recessive allele.

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

State an example of a dominant and recessive allele found in pea plants.

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

State the usual cause of one allele being dominant over another.

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

Define codominant alleles.

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

Using the correct notation, outline an example of codominant alleles.

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

**3.4.U6 Many genetic diseases in human are due to recessive alleles of autosomal genes.**

Define “carrier” as related to genetic diseases.

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

Explain why genetic diseases usually appear unexpectedly in a population

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

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**3.4.U7 Some genetic diseases are sex-linked and some are due to dominant or co-dominant alleles.**

Describe why it is not possible to be a carrier of a disease caused by a dominant allele.

**Describe**: Give a detailed account)

Outline inheritance patterns of genetic diseases caused by dominant alleles.

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

Explain sickle cell anemia as an example of a genetic disease caused by codominant alleles.

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

Define sex linkage.

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

**3.4.U8 The pattern of inheritance is different with sex-linked genes due to their location on sex chromosomes.**

Outline Thomas Morgan’s elucidation of sex-linked genes with Drosophila.

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

Use correct notation for sex-linked genes.

(**Use** Apply knowledge or rules to put theory into practice.)

Describe the pattern of inheritance for sex-linked genes.

**Describe**: Give a detailed account)

Construct Punnett grids for sex-linked crosses to predict the offspring genotype and phenotype ratios.

(**Construct** Display information in a diagrammatic or logical form.)

**3.4.U9 Many genetic diseases have been identified in humans but most are very rare in Drosophila.**

List five example genetic diseases.

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

Explain why most genetic diseases are rare in a population.

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

**3.4.U10 Radiation and mutagenic chemicals increase the mutation rate and can cause genetic diseases and cancer.**

State two factors that can increase the mutation rate.

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

Outline the effects of gene mutations in body cells and gamete cells.

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

**3.4.A1 Inheritance of ABO blood groups.**

Describe ABO blood groups as an example of complete dominance and codominance.

**Describe**: Give a detailed account)

Outline the differences in glycoproteins present in people with different blood types.​

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

**3.4.A2 Red-green color blindness and hemophilia as examples of sex-linked inheritance.**

Describe the cause and effect of red-green color blindness.

**Describe**: Give a detailed account)

Explain inheritance patterns of red-green color blindness.

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

Describe the cause and effect of hemophilia.

**Describe**: Give a detailed account)

Explain inheritance patterns of hemophilia.

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

**3.4.A3 Inheritance of cystic fibrosis and Huntington’s disease.**

Describe the relationship between the genetic cause of cystic fibrosis and the symptoms of the disease.

**Describe**: Give a detailed account)

Outline the inheritance pattern of cystic fibrosis.

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

Outline the inheritance pattern of Huntington’s disease.

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

List effects of Huntington’s disease on an affected individual.

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

**3.4.A4 Consequences of radiation after nuclear bombing of Hiroshima and accident at Chernobyl.**

Outline the effects of radiation exposure after nuclear exposure at Hiroshima and Chernobyl.

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

**3.4.S1 Construction of Punnett grids for predicting the outcomes of monohybrid genetic crosses.**

Define monohybrid, true breeding, hybrid, F1 and F2.

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

Determine possible alleles present in gametes given parent genotypes.

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

Construct Punnett grids for single gene crosses to predict the offspring genotype and phenotype ratios.

(Construct Display information in a diagrammatic or logical form.)

**3.4.S2 Comparison of predicted and actual outcomes of genetic crosses using real data.**

Explain the reason why the outcomes of genetic crosses do not usually correspond exactly with the predicted outcomes.

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

Describe the role of statistical tests in deciding whether an actual result is a close fit to a predicted result.

**Describe**: Give a detailed account)

**3.4.S3 Analysis of pedigree charts to deduce the pattern of inheritance of genetic diseases.**

Outline the conventions for constructing pedigree charts

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

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Deduce inheritance patterns given a pedigree chart.​

(**Deduce** Reach a conclusion from the information given.)

**3.4.NOS Making quantitative measurements with replicates to ensure reliability, Mendel’s genetic crosses with peas plants generated numerical data.**

Outline why Mendel’s success is attributed to his use of pea plants.

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

List three biological research methods pioneered by Mendel.

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

**Key Terms**

Genotype

Locus

Punnett square

Inheritance

Monohybrid

X

​Allele

gametes

Drosophila

Phenotype

Homozygous

multiple alleles

color blindness

pedigree chart

Y

​allele masking

​haploid

radiation

dominant allele

heterozygous

blood group

hemophilia

Greg Mendel

Huntington's disease

​Diploid

mutagen

recessive allele

carrier

gender

X-linked

Albinism

​Autosomes

cystic fibrosis

hemophilia

​ABO Blood Group

codominant allele

test cross

sex linkage

ratios

sex chromosome

​zygote

segregation

Thomas Morgan

glycoproteins