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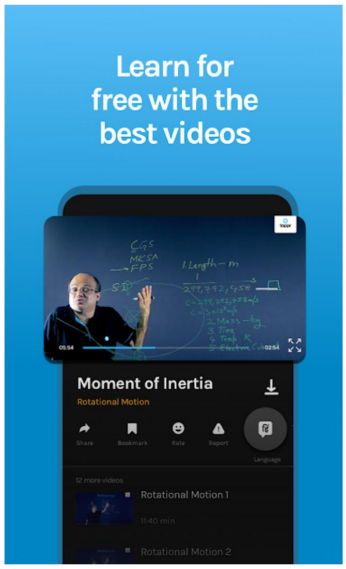

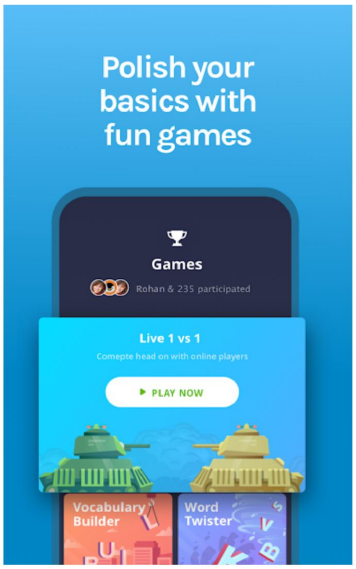

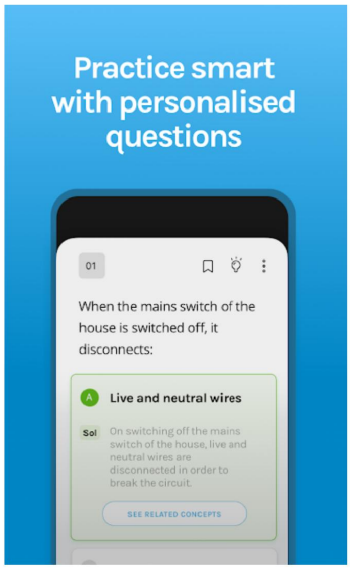

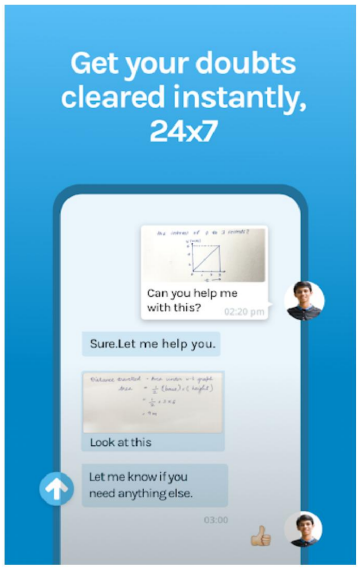

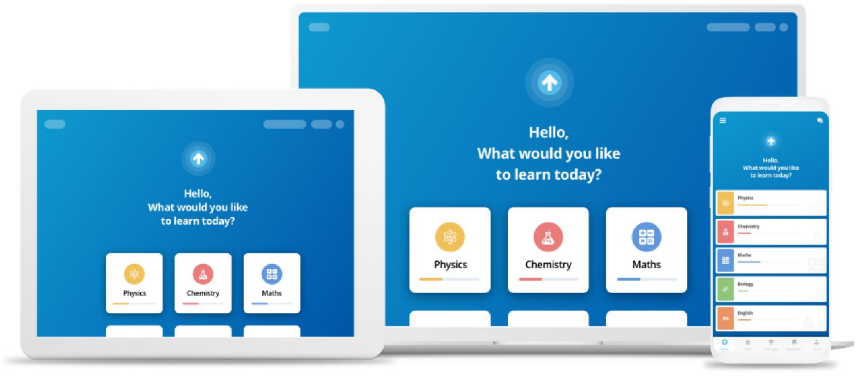

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#465001
Topic: Mendelism

Outline a project which aims to find the dominant coat colour in dogs.

Solution

Coat colour in dogs is governed by a variety of genes. At least 11 genes have been identified that influence the colour of coat in a dog. A dominant gene is a gene that is expressed in both homozygous as well as heterozygous conditions, whereas recessive gene is only expressed in homozygous condition.
Let us consider, one parent is homozygous black (BB) and another parent is homozygous brown (bb). Cross between the two parent produces the offspring with the genetic make-up: Bb. Now we don't know whether Black is dominant or brown is dominant. By observing the off-springs produced are we can say which one is a dominant trait. If the 1 generation comprisess of black we can say black is dominant and if it is brown then we can say brown is dominant.

#526074
Topic: Sex determination

In our society the women are often blamed for giving birth to daughters. Can you explain why this is not correct?

Solution

In our society women are always falsely accused for giving birth to daughters.
First of all, it is incorrect in itself as both Boys and Girls are equal. Also, women do not have any role in deciding the sex of their child. It is actually the male whose sperm chromosome decides the fate of the sex of the child.
Females have 23 pairs of chromosomes, 22 + XX (sex chromosome) and males have 23 pairs of chromosomes as well 22 + XY (sex Chromosome). While fertilization ova will b carrying one X chromosome while sperm would either be carrying X or Y chromosome. So if ova having X chromosome fertilizes with sperm having X chromosome, the child w be Girl (XX) and if ova having X chromosome fertilizes with sperm having a Y chromosome, the child will be a boy (XY). Thus mothers are wrongly blamed.
In humans, this XX, XY type of determination occurs to determine the sex of children.

#526111
Topic: Mendelism

Mention the advantages of selecting pea plant for experiment by Mendel.

Solution

Mendel studied the common garden pea plant, *Pisum sativum* because it was easy to cultivate and had a relatively short life cycle of 3 months. The plant exhibited discontinuous characteristics such as flower color and pea texture. Owing to its anatomy, it was easy to control the self-pollination of the plant and cross-fertilization between desired parents could be accomplished artificially. The presence of pure breeding varieties and easily visible contrasting characters and presence of F_1 fertile hybrids were th additional advantageous characters for which Mendel chose garden pea as experimental material.

#526115
Topic: Mendelism

Differentiate between the following
(a) Dominance and Recessive
(b) Homozygous and Hetrozygous
(c) Monohybrid and Dihybrid.

Solution

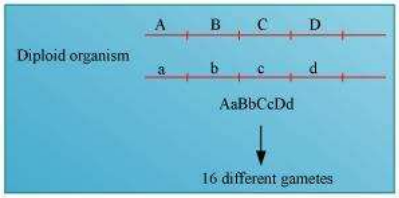
(a) Expression of trait in heterozygous as well as homozygous genotype is called as dominance while the trait which is expressed in homozygous genotypes only is called as recessive one.
(b) Presence of two copies of either dominant or recessive allele of same gene is called as homozygous (TT) while heterozygous refers to presence of dominant and recessive allele of a gene in same genotype (Tt).
(c) Monohybrid refers genotype heterozygous for singe trait (Tt) while dihybrid refers to the genotype heterozygous for two pairs of contrasting characters (YyRr).

#526116
Topic: Mendelism

A diploid organism is heterozygous for 4 loci, how many types of gametes can be produced?

Solution

Types of gametes produced by organism= 2^n wherein n= number of loci for which the organism is heterozygous. The given diploid organism is heterozygous for 4 loci, types o gametes produced = $2^4 = 16$.



#526118

Topic: Mendelism

Explain the Law of Dominance using a monohybrid cross.

Solution

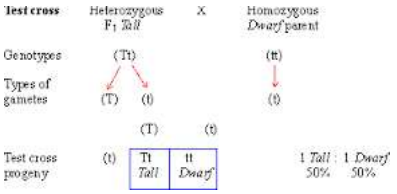
According to the law of dominance, a trait is represented by two contrasting factors of a gene in a heterozygous individual; the allele/factor that can express itself in a heterozygous individual is called as a dominant trait. The other factor whose effect is masked by the presence of dominant factor is called recessive factor. A cross between tw pure breeding tall (TT) and dwarf (tt) varieties gives all heterozygous tall (Tt) F_1 progeny. Selfing of F_1 hybrid gives tall and dwarf progeny in 3:1 ratio. The recessive factor is present in F_1 hybrid but is masked by a factor for the dominant trait and that's why it produced both parental types in F_2 progeny.

#526119

Topic: Mendelism

Define and design a test-cross.

Solution



A test cross is performed to determine the genotype of a dominant parent if it is a heterozygous- or homozygous-dominant. For the purpose, a dominant parent is crossed with homozygous recessive parent. A test cross between a heterozygous dominant (carrying one copy of dominant and recessive allele each) and recessive parent obtains domina and recessive offspring in 1:1 ratio while that between homozygous dominant and recessive parent gives all dominant progeny. A cross between two pure breeding tall (TT) and dwarf (tt) varieties gives all tall F_1 progeny. To test genotype of F_1 progeny, it is crossed with pure breeding dwarf plant and obtains tall and dwarf progeny in 1: 1 ratio suggesting the tested dominant variety is heterozygous.

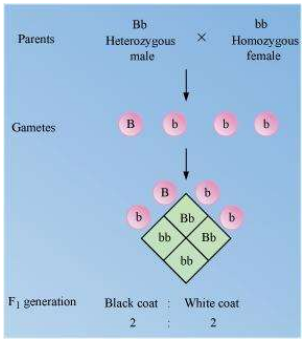
#526122

Topic: Mendelism

Using a Punnett Square, workout the distribution of phenotypic features in the first filial generation after a cross between a homozygous female and a heterozygous male for a single locus.

Solution

If B is dominant over b, a cross between a homozygous female (bb) and a heterozygous male (Bb). The male will produce two types of gametes, B and b, while the female will produce only one kind of gamete, b. The genotypic and phenotypic ratio in the progenies of F1 generation will be same i.e., 1:1.



#526124

Topic: Mendelism

When a cross is made between tall plant with yellow seeds (TtYy) and tall plant with green seed (Ttyy), what proportions of phenotype in the offspring could be expected to be

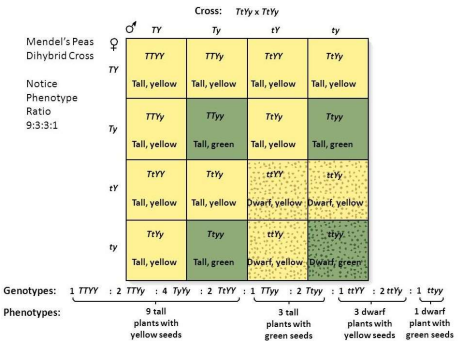
(a) tall and green.

(b) dwarf and green.

Solution

As given phenotype of TtYy parent, tallness is dominant over dwarfism and yellow seed is dominant over green seeds. Genotype of tall and green progeny will be Ttyy and TTy and that of dwarf and green progeny will be ttyy. Proportion of tall and green progeny= 3

Proportion of dwarf and green progeny= 1



#526125

Topic: Mendelism

Two heterozygous parents are crossed. If the two loci are linked what would be the distribution of phenotypic features in F_1 generation for a dibybrid cross?

Solution

Linked loci do not exhibit cross over and therefore; no recombinant gametes will be formed. The cross between two heterozygous parents with linked loci will form gametes with parental genetic combinations only. Fusion of these parental gametes will give progeny having the parental phenotype. For example, a cross between TtRr and TtRr where loci for two genes are linked, both parents will form gametes with parental genetic combinations (TR and tr). Fusion of these gametes will give TtRr progeny (parental type).

#526127

Topic: Linkage and crossing over

Briefly mention the contribution of T.H. Morgan in genetics.

Solution

T.H. Morgan proved the phenomenon of linked genes. These are the genes that are linked and hence not inherited together. These genes do not follow the law of independent assortment. To prove this he conducted an experiment on Drosophila from which he drew the following conclusions-

1) The gene responsible for eye color is located on X chromosome.

2) The alleles responsible for eye color are present on X chromosome.

3) There are two X chromosomes in females. Both X chromosomes carry an allele of the trait.

4) Females can be homozygous or heterozygous for the alleles.

#526128

Topic: Human genetic disorders

What is pedigree analysis? Suggest how such an analysis can be useful.

Solution

Pedigree analysis refers to a record of the occurrence of a trait generation over a generation in a family based on inheritance pattern of the trait under study. It predicts negative effects of inbreeding, occurrence and origin of a trait in a family, the probability of occurrence and expression of a genetic disorder and helps in the alleviation of these disorders in the progeny.

#526129

Topic: Sex determination

How is sex determined in human beings?

Solution

Human follows XX- XY mechanism of sex determination in which females have forty-six chromosomes arranged in twenty-three homologous, homomorphic pairs. Males have twenty-two homomorphic pairs and one heteromorphic pair, the XY pair. During meiosis, all the gametes produced by females contain only the X chromosome (22 A + X), whereas males produce two kinds of gametes, 1/2 gametes with X- and 1/2 with Y-chromosome (22 A + X and 22 A + Y). Fertilization of egg (22 + X) with sperm carrying 22+X chromosomes results in female child (44A + XX). Fertilization of egg (22 + X) with a sperm carrying 22+Y chromosomes results in a male child (44A + XY).

#526130
Topic: Mendelism

A child has blood group O. If the father has blood group A and mother blood group B, work out the genotypes of the parents and the possible genotypes of the other offspring

Solution

I^Ai I^Bi	I^A	i
I^B	I^AI^B (AB blood group)	I^Bi (B blood group)
i	I^Ai (A blood group)	ii (O blood group)

To have a child with O blood group, both paretns should have atleast one copy of i allele. This means parents with A and B blood group are heterozygous and have genotype I^Ai and I^Bi respectively. Parental genotypes I^Ai and I^Bi give progeny with 1 I^AI^B: 1I^Bi: 1 I^Ai : 1 ii genotypic ratio.

#526131
Topic: Mendelism

Explain the following terms with example

(a) Co-dominance

(b) Incomplete dominance

Solution

Co-dominance: When both recessive and dominant traits are expressed in a heterozygous genotype. This means that none of the factors is recessive but both can express themselves irrespective of their presence in homozygous or heterozygous condition. For example, I^A and I^B alleles of I gene of ABO blood group.

Incomplete dominance: When none of the factors of a gene is dominant, the phenotype of a heterozygous dominant individual is a blend of dominant and recessive traits. For example, flower colour in *Mirabilis jalapa.*

#526132
Topic: Genes, mutation, genetic expression

What is point mutation? Give one example.

Solution

Mutation in single nucleotide base of a DNA segment is called as a point mutation. It can introduce a premature stop codon, or a nonsense codon, by addition or deletion of th base, in the transcribed mRNA (nonsense mutation) or changes a codon specifying a different amino acid by substitution of one base (missense mutation). For example, replacement of A by T at the 17^{th} nucleotide of the Hbb gene changes the codon GAG (glutamic acid) to GTG (which encodes valine) and causes sickle cell anemia.

#526134
Topic: Linkage and crossing over

Who had proposed the chromosomal theory of the inheritance?

Solution

The chromosomal theory of inheritance was proposed by Sutton and Boveri in 1903 which states that genes are present on chromosomes and homologous chromosomes separate during anaphase-I of meiosis resulting in segregation of alleles of a gene controlling the contrasting traits.

#526135
Topic: Human genetic disorders

Mention any two autosomal genetic disorders with their symptoms.

Solution

Down syndrome is trisomy-21 i.e. presence of chromosome 21 in three copies. The affected individuals are mentally challenged (mildly to moderately) and suffer from congenit heart defects with a very high (1/100) risk of acute leukemia. They are short in stature and have a broad, short skull; low-set ears, small mouth, the hyper-flexibility of joints; and excess skin on the back of the neck, epicanthus skin fold above the eyes and transverse palmar crease.

Cri-du-chat Syndrome characterized by mewing like cry of the newborn which is caused by loss of half of the short arm of chromosome 5 causes a severe developmental dela in newborn.