LS1201

Introduction to Biology II

Assignment - 03

Mutation

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May 19, 2022

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1 Question 1

This is a typical frameshift mutation. Here, the deletion of a single nucleotide has caused the normal reading frame to disrupt. Since these are read in a group of three, the grouping now will be done incorrectly causing the following entire gene sequence to be read incorrectly.

2 Question 2

2.1 a. Transitions vs. Transversions

Transitions	**Transversions**
When in a point mutation a purine or pyrimidine base is replaced by its own kind, that is, by a purine or pyrimidine respectively.	When in a point mutation a purine or pyrimidine base is replaced by its opposite kind, that is, by a pyrimidine or purine respectively.

2.2 b. Synonymous vs. Neutral

Synonymous	**Neutral**
When in a point mutation even though a base is substituted there is no change in the resultant amino acid and has no effect on the polypeptide chain forming through translation.	The synonymous mutation is actually a subcategory of Neutral mutation. This operates at a population level and has an evolutionary domain. Natural selection cannot remove this as it doesn't affect survival.

2.3 c. Missense vs. Nonsense

Missense	**Nonsense**
When in a point mutation a nucleotide base is indeed substituted by another base such that the resultant polypeptide chain formed is also altered for the amino acid.	When in a point mutation a base is substituted in such a way that when reading and translating it causes the nucleotides around it to form a stop codon and terminate the formation of the polypeptide chain prematurely.

2.4 d. Frameshift vs. Nonsense

Frameshift	**Nonsense**
In a frameshift mutation, a nucleotide is deleted, added, or substituted in such a way that the reading of the DNA sequence is changed and thus changes the whole resulting polypeptide chain.	In nonsense mutation, in the DNA sequence, a nucleotide is substituted in such a way that the codon in the sequence that it was a part of becomes a stop codon causing the formation of the polypeptide chain to stop prematurely.

3 Question 3

3.1 Selfing of AaBb

	AB	**Ab**	**aB**	**ab**
AB	AABB	AABb	AaBB	AaBb
Ab	AABb	AAbb	AaBb	Aabb
aB	AaBB	AaBb	aaBB	aaBb
ab	AaBb	Aabb	aaBb	aabb

Table 1: Selfing of AaBb

Phenotypic ratio : 9:3:3:1
Genotypic ratio : 1:2:1:2:4:2:1:2:1

3.2 Testcrossing AaBb × aabb

	ab	**ab**	**ab**	**ab**
AB	AaBb	AaBb	AaBb	AaBb
Ab	Aabb	Aabb	Aabb	Aabb
aB	aaBb	aaBb	aaBb	aaBb
ab	aabb	aabb	aabb	aabb

Table 2: Testcrossing AaBb × aabb

Phenotypic ratio : 1:1:1:1
Genotypic ratio : 1:1:1:1

4 Question 4

The three laws provided by Gregor Mendel are as follows:-

1. **Law of segregation**: During gamete formation, the alleles of every gene received from the parent split up and give only one each of them to the gamete so that the new gamete has only one of each for each gene.
2. **Law of Dominance**: When the gene is being expressed there are some alleles that are able to repress the property of the other allele present for the same trait and express itself giving the appearance of a dominant trait. Such a trait / allele is called a dominant allele while the other one which failed to express itself is called the recessive one.
3. **Law of Independent Assortment**: It states that different genes assort independently that is genes for different traits do not affect each other.