

Part 3: BIO 201 End Semester Examination

Answer all the questions.

Note that the question numbers start from 19, in continuation of part 2.

19. Choose all the correct statements. (2 Marks)

2 points

- ☐ Evolution is always a population level process
- ☐ Evolution always increases the adaptedness of the population to its environment
- ☐ Evolution always leads to a change in the mean value of a trait under selection
- ☐ Evolution always depends on heritable variation
- ☐ Evolution always leads to the extinction (elimination) of the low fitness genotypes

20. In *Drosophila*, curly (Cy) is a dominant autosomal mutation which causes the wings to curl upwards. Homozygous curly individuals die at the embryonic stage and do not become adults. At an independently segregating autosomal locus, ebony (e) is a recessive mutation that causes black body colour. The wild type body colour is gray. Consider a cross between two flies that have curly wings and are heterozygous for body colour. In the surviving progeny from this cross, what phenotypes can be observed and in what proportions? (4 marks)

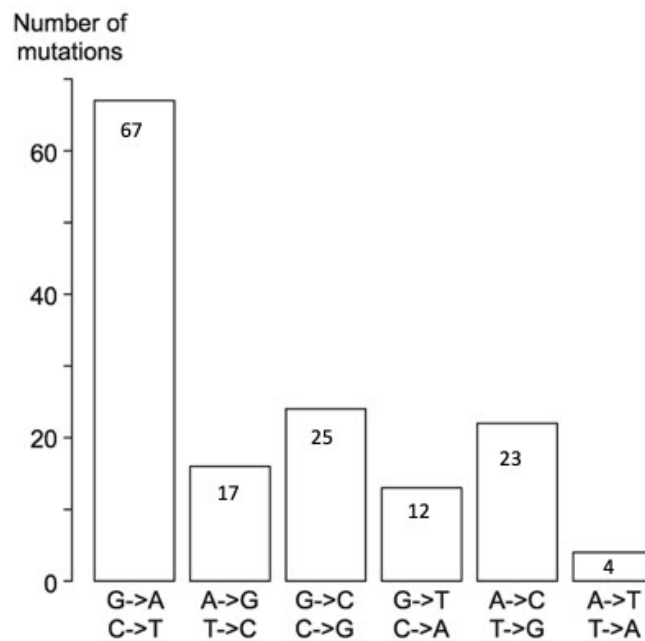
4 points

Please just write the phenotypes and the corresponding proportions/frequencies. You do not have to describe anything.

Your answer



Krasovec et al (2019) estimated mutation rates in the diatom *Phaeodactylum tricornutum* which is haploid and has a genome size of 10,000 bases. They created 36 mutation accumulation lines and maintained them for 181 generations. At the end of 181 generations, they sequenced the DNA from all the 36 mutation accumulation lines. They found 148 single nucleotide mutations in total. The figure shows the distribution of these mutations. The x axis shows what base has mutated to what other base (For example, G->A shows G mutating to A). The numbers within the bars show the number of such mutations. Based on this information, answer questions 21 and 22.



21. Calculate the total mutation rate per nucleotide per generation. (2 marks)

2 points

Please just write the numerical value.

Your answer



22. Of the 148 mutations, how many are transitions, and how many are transversions? (1 mark)

1 point

Please just write in the following way: Transition = ____; Transversion = _____. You do not have to describe anything.

Your answer

In *Drosophila*, purple eye phenotype is due to an autosomal recessive allele. A recessive allele at a different locus on the same chromosome leads to vestigial wing phenotype. A cross was conducted using two pure breeding lines of *Drosophila*. The F1 progeny from this cross was in turn crossed to a fly with purple eyes and vestigial wings (this would be a test cross). The results from the cross involving F1 fly are tabulated below. Based on this information, answer questions 23 and 24.

Phenotype	Number
Purple eye	1668
Vestigial wing	1700
Purple eye, Vestigial wing	157
Wild type	163
Total	3688

23. What are the genotypes and phenotypes of the two pure-breeding parental flies? (2 marks)

2 points

Please just write the genotype and phenotype. No other description is required.

Your answer



24. What is the genetic distance between these two loci? (2 marks)

2 points

Please just write the numerical value with the correct units. No other description is required.

Your answer

25. In a certain human population, with respect to the A, B, AB, O blood groups, the A allele is at a frequency of 0.2 and the B allele is at a frequency of 0.3. The locus is at Hardy-Weinberg equilibrium. Consider a child with blood group A. It is claimed that a certain man is the father of this child. What is the probability that the man will be found to be NOT the father of the child by a testing lab which tests for the man's A, B, AB, O blood group? Assume that the man has been randomly picked from the population and is not actually the father- while you know this, the lab does not. (2 Marks)

2 points

Just write the numerical value. You do not have to describe anything.

Your answer

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