Answer on Question #52816-Biology-Other

1. Population with a given locus is occupied by two alleles, A and a, the frequency of A is 0.6. If we consider that the population is in Hardy-Weinberg, calculate the frequency of heterozygotes.

Solution

The frequency of A is 0.6. So, the frequency of A is $1 - 0.6 = 0.4$.

The frequency of heterozygotes is

$$Freq(Aa) = 2 \cdot 0.6 \cdot 0.4 = 0.48.$$

Answer: **0.48.**

2. In a balanced population of Hardy-Weinberg, 15% of individuals show the recessive trait. Calculate the frequency of the dominant allele in the population.

Solution

15% of individuals show the recessive trait:

$$Freq(aa) = 0.15 = q^2.$$

The frequency of the recessive allele in the population is

$$q = \sqrt{0.15} = 0.39.$$

The frequency of the dominant allele in the population is

$$p = 1 - q = 1 - 0.39 = 0.61.$$

Answer: **0.61.**

3. 50 fishes of AA genotype and 50 fishes of genotype aa were placed in an aquarium. What should be, according to the Hardy-Weinberg proportions of genotypes (AA, Aa and aa) in this population in the next generation? And the next generations? Is that what we will see? Explain.

Solution

We see that

$$p = 0.5 \ and \ q = 0.5.$$

Thus, the Hardy-Weinberg proportions of genotypes (AA, Aa and aa) in this population in the next generation are

$$p^2 = 0.5^2 = 0.25, 2pq = 2 \cdot 0.5 \cdot 0.5 = 0.5, \ q^2 = 0.5^2 = 0.25.$$

Because the frequencies of alleles are equal we will have in every next generation the same proportions.

4. If the conditions of the Hardy-Weinberg are met, the probability that an individual is AA is p2, that it is aa q2 and that it is 2pq Aa. How are Hardy and Weinberg arrived at these values? Why p2 for AA? Why 2pq Aa? Imagine that you place in a bag 100 white balls and 100 red balls. You freelancing a ball and put it back in the bag. Then you freelancing one second ball...

Solution

Let the probability of white ball is p (in our case $p = \frac{100}{100+100} = 0.5$). Then the probability of red ball is q (in our case $q = 1 - 0.5 = 0.5$).

We have 4 choices for combination of two balls:

$$WW, RR, WR, RW.$$

Their probabilities are

$$pp = p^2, qq = q^2, pq, qp.$$

Because in our problem the order is insignificant:

$$WR = RW, pq = qp.$$

The sum of probabilities of all possible outcomes is 1:

$$p^2 + q^2 + 2pq = 1.$$

Thus we have 3 possible outcomes WW, RR, WR with probabilities $p^2, q^2, 2pq$.