AP Bio Math Mondays

Hardy-Weinberg: Counting Alleles Method

Identification of Variables

p = frequency of allele 1 (dominant)

q = frequency of allele 2 (recessive)

AA = number of individuals homozygous allele 1 (homozygous dominant)

p^2 = frequency of homozygous allele 1 (homozygous dominant)

aa = number of individuals homozygous allele 2 (homozygous recessive)

q^2 = frequency of homozygous allele 2 (homozygous recessive)

Hardy Weinberg

$$p^2 = \frac{AA}{total} \qquad 2pq = \frac{Aa}{total} \qquad q^2 = \frac{aa}{total}$$

$$p = \frac{2(AA) + 1(Aa)}{totalx2}$$

$$q = \frac{2(aa) + 1(Aa)}{totalx2}$$

Aa = number of individuals with allele 1/allele 2 (heterozygous)

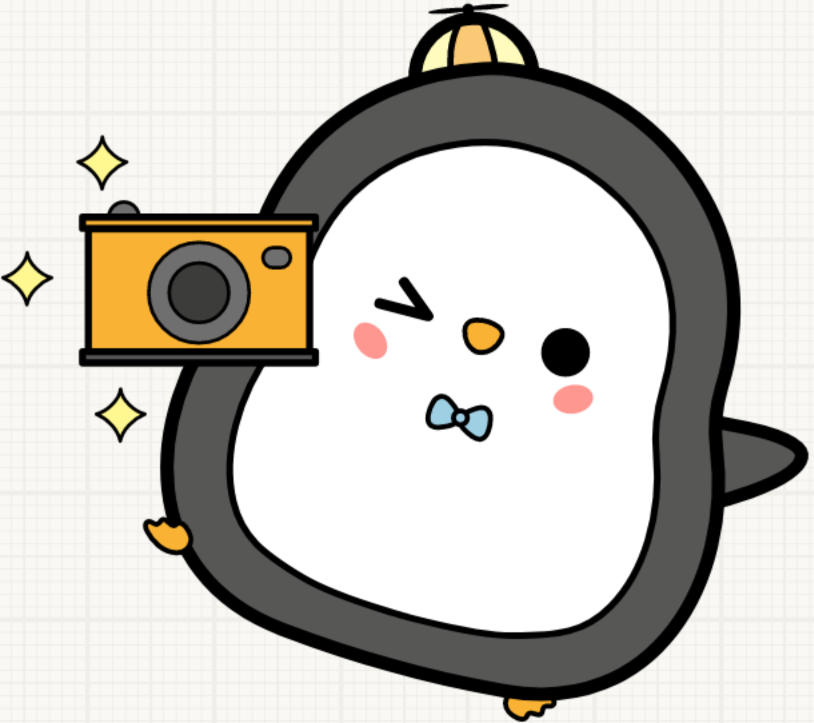
2pq = frequency of allele 1/allele 2 (heterozygous)

Hardy Weinberg

$$p^2 = \frac{AA}{total}$$

$$2pq = \frac{Aa}{total}$$

$$q^2 = \frac{aa}{total}$$



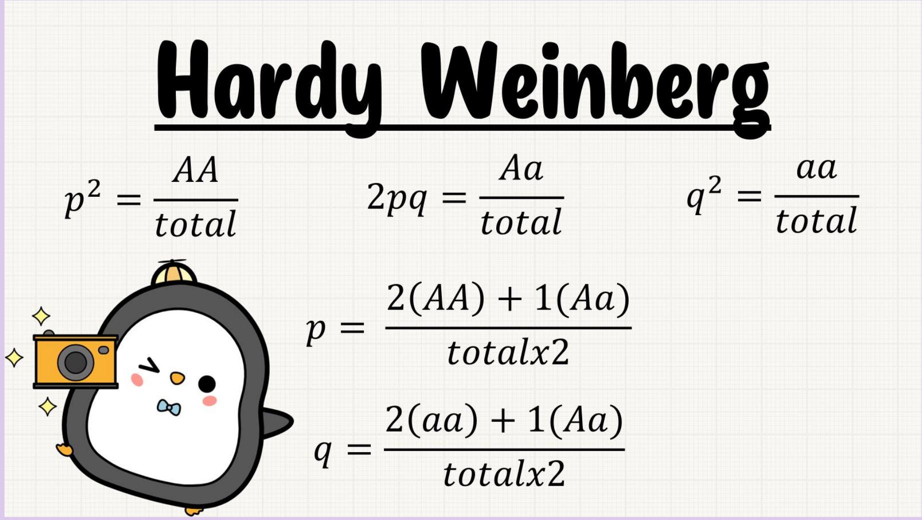
$$p = \frac{2(AA) + 1(Aa)}{total x2}$$

$$q = \frac{2(aa) + 1(Aa)}{total x2}$$

Math Monday #3 Hardy-Weinberg

A cruise ship is stranded on a desert island. There are 400 individuals aboard. There are 200 individuals with sickle cell trait (carriers), 150 unaffected individuals, and 50 individuals with sickle cell disease (homozygous recessive).

$$p^2 = \frac{150}{400} = 0.375$$



$$q^2 = \frac{50}{400} = 0.125$$

$$2pq = \frac{200}{400} = 0.5$$

Math Monday #3 Hardy-Weinberg

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Hardy Weinberg

$$p^2 = \frac{AA}{total} \qquad 2pq = \frac{Aa}{total} \qquad q^2 = \frac{aa}{total}$$

$$p = \frac{2(AA) + 1(Aa)}{totalx2}$$

$$q = \frac{2(aa) + 1(Aa)}{totalx2}$$

$$p = \frac{2(150) + 1(200)}{400\ x\ 2}$$

$$p = \frac{300 + 200}{800}$$

$$p = \frac{500}{800} = 0.625$$

$$q = \frac{2(50) + 1(200)}{400\ x\ 2}$$

$$q = \frac{100 + 200}{800}$$

$$q = \frac{300}{800} = 0.375$$

Example Problem Hardy-Weinberg

In a given population, only the "A" and "B" alleles are present in the ABO system; there are no individuals with type "O" blood or with O alleles in this particular population. If 200 people have type A blood, 75 have type AB blood, and 25 have type B blood, what are the allelic frequencies of this population (i.e., what are p and q)?

Hardy Weinberg

$$p^2 = \frac{AA}{total} \qquad 2pq = \frac{Aa}{total} \qquad q^2 = \frac{aa}{total}$$

$$p = \frac{2(AA) + 1(Aa)}{totalx2}$$

$$q = \frac{2(aa) + 1(Aa)}{totalx2}$$

Example Problem Hardy-Weinberg

In a given population, only the "A" and "B" alleles are present in the ABO system; there are no individuals with type "O" blood or with O alleles in this particular population. If 200 people have type A blood, 75 have type AB blood, and 25 have type B blood, what are the allelic frequencies of this population (i.e., what are p and q)?

$$p^2 = \frac{200}{300} = 0.667$$

$$2pq = \frac{75}{300} = 0.25$$

$$q^2 = \frac{25}{300} = 0.083$$

$$p = \frac{2(200) + 1(75)}{300\ x\ 2}$$

$$p = \frac{400 + 75}{600}$$

$$p = \frac{475}{600} = 0.792$$

$$q = \frac{2(25) + 1(75)}{300\ x\ 2}$$

$$q = \frac{50 + 75}{600}$$

$$q = \frac{125}{600} = 0.208$$