**Practice problems for epistasis – ANSWERS**

1. A newly discovered, recessively inherited disease is expressed only in individuals with type O blood, although the gene responsible for the disease and the ABO blood group gene assort independently. An unaffected man with type A blood and an unaffected woman with type B blood have one child with the disease. What is the probability that their second child will have the disease? For this problem, assume that both parents are heterozygous for the disease-causing mutation at the disease gene. (Adapted from Campbell, *Biology*)

**Since this couple has an affected child, they must both be carriers of the *i* allele at the ABO blood group gene. Since they are also both heterozygous for the disease-causing gene, their genotypes must be *IAi* *Dd* and *IBi* *Dd.***

**The probability that this couple would have an affected child would be the 1/4 chance of the child being *ii* multiplied by the 1/4 of the child being *dd,* or 1/16.**

1. In corn, a dominant allele *I* inhibits kernel color, while the recessive allele *i* permits color when homozygous. At an independently assorting locus, the dominant allele *P* causes purple kernel color, while the recessive genotype *pp* results in red kernels. If plants heterozygous at both loci are crossed, what phenotypic ratio will be observed among the offspring?

***Ii Pp x Ii Pp***

**offspring: (3/4 *II* or *Ii*) x (1 *PP* or *Pp* or *pp*) = 3/4 or 12/16 colorless**

**(1/4 *ii*) x (3/4 *PP* or *Pp*) = 3/16 purple**

**(1/4 *ii*) x (1/4 *pp*) = 1/16 red**

1. In rats, the *P* gene allele for pigmentation (*P*) is dominant to the allele for albinism (*p*). The *B* gene allele for black pigmentation (*B*) is dominant to the allele for cream pigmentation (*b*). The *pp* homozygous recessive genotype is epistatic to any allele combination at gene *B.* 
   1. Predict the genotype(s) and phenotype(s) of the F1 progeny of a cross between a pure-breeding black rat and an albino that is also homozygous for cream.

**The parental cross is: *PP BB* x *pp bb***

**The F1 offspring will have the genotype: *Pp Bb* black**

* 1. Predict the phenotypic ratio of the F2 progeny of a parental cross between a pure-breeding black rat and an albino that is also homozygous for cream.

**The F2 offspring will be:**

**9/16 *P- B-* black**

**3/16 *P- bb* cream**

**3/16 *pp* *B-* albino**

**1/16 *pp bb* albino… therefore, 9/16 black : 3/16 cream : 4/16 albino**