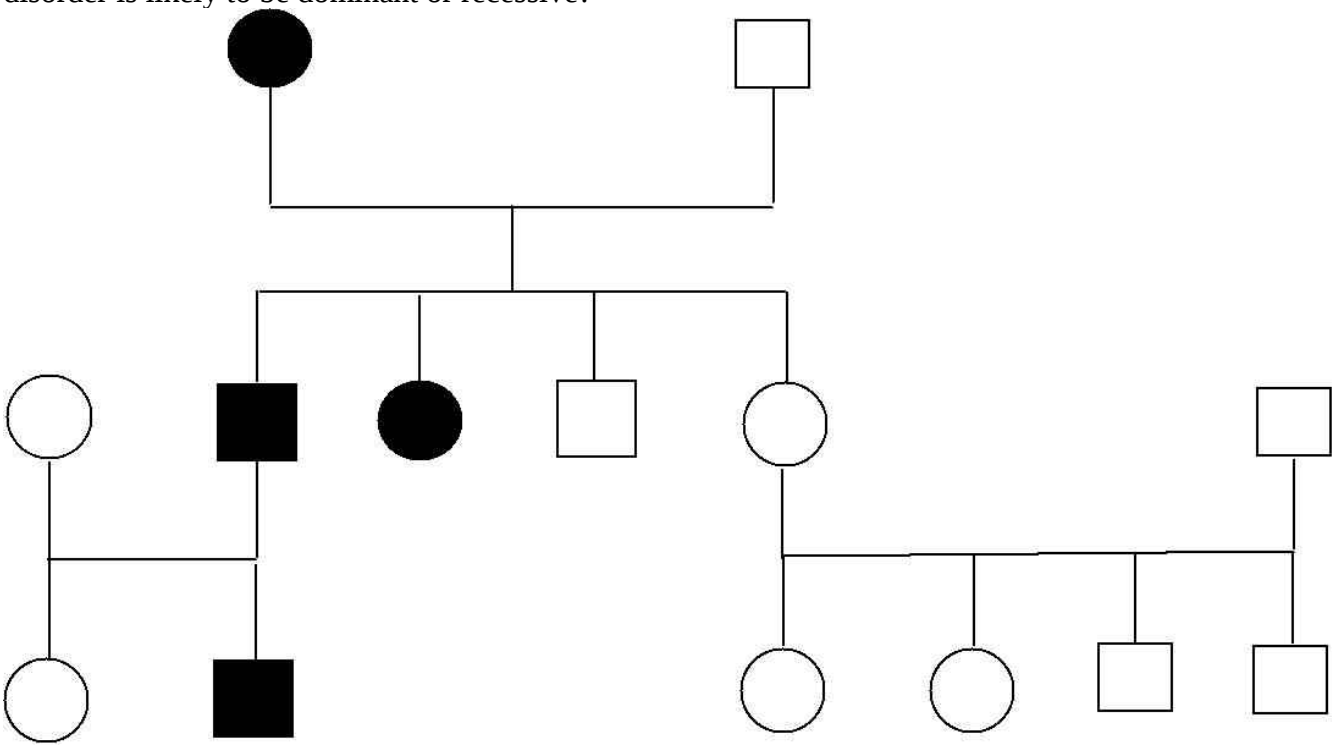
Intro to Biology homework 6 March 2014, Winslow

This homework is due on Tuesday, 25 March 2014.

1. (6 points) Consider the genes for seed color and shape in maize (corn) that we investigated in lab. If you were to cross an individual plant of genotype *PpSs* with an individual of genotype *ppss*, what genotypes and phenotypes would be expected in the offspring? Recall that *P* (purple) is dominant to *p* (yellow) and *S* (starchy) is dominant to *s* (sweet). Use a Punnett square to calculate expected genotypic and phenotypic ratios for the offspring. How might these ratios be different if the two genes were linked; i.e., close together on the same chromosome?

2. (4 points) Red-green color blindness in humans is a recessive X-linked trait. If a woman with red-green color blindness marries a man with normal vision, what phenotypes would you expect in the offspring? Consider both sex and color blindness as aspects of phenotype. Use a Punnett square to calculate genotypic and phenotypic ratios.

3. (2 points) Examine the pedigree chart below. The dark-filled symbols indicate the presence of a genetic disorder. Do you think the disorder is autosomal, X-linked, or Y-linked? Do you think the disorder is likely to be dominant or recessive?



4. (3 points) Two black guinea pigs were mated and over several years produced 29 black and 9 white offspring. Explain these results, giving the genotypes of parents and progeny.

5. (2 points) From a large-scale screen of many plants of *Collinsia grandiflora*, a plant with three cotyledons was discovered (normally, there are two cotyledons). This plant was crossed with a normal pure-breeding wild-type plant, and 600 seeds from this cross were planted. There were 298 plants with two cotyledons and 302 with three cotyledons. What can be deduced about the inheritance of three cotyledons? Invent gene symbols as part of your explanation.

6. (4 points) Recall that the ability to taste phenylthiocarbamide (PTC) is an autosomal dominant trait. If a "taster" (one who can taste it) woman with a nontaster father marries a taster man who in a previous marriage had a nontaster daughter, what is the probability that their first child will be:
(1) A nontaster girl

(2) A taster girl

(3) A taster boy

What is the probability that their first two children will be tasters (of either sex)?

7. (1 point) Suppose that a husband and wife are both heterozygous for a recessive allele for albinism. If they have two children, what is the probability that both will be albino?

8. (1 point) The allele *c* causes albinism in mice (*C* causes mice to be black). The cross *C*/*c* X *c*/*c* produces 10 progeny. What is the probability of all of them being black?

9. (1 point) An X-linked dominant allele causes hypophosphatemia in humans. A man with hypophosphatemia marries a normal woman. What proportion of their sons will have hypophosphatemia?

10. (2 points) In mice, dwarfism is caused by an X-linked recessive allele, and pink coat is caused by an autosomal dominant allele (coats are normally brownish). If a brown dwarf female from a pure-breeding line is crossed with a pink, normal-sized male from a pure-breeding line, what will be the phenotypic ratios in the F1 and F2 generations for each sex? (Invent and define your own gene symbols.)