Solving Genetics Problems Using Probability Introduction: One of the main purposes of solving genetics problems is to determine the combinations of offspring a particular set of parents could produce. So far we have used Punnett Squares to solve these problems. Punnett Squares are nice in that they provide a visual of all possible offspring one could expect from a given cross. However, there are many times in which Punnett Squares are not necessary. For instance, there is no reason to complete a Punnett Square and determine complete genotypic and phenotypic ratios if you simply wanted to know what the chances of having *one particular type* of offspring are. Solving genetics problems using probability solves both of these problems, and is the problem solving method most often used by those studying genetics.

There are a variety of problem types that we can (and should) use probability to solve. We will look at several of these in class, although there are many more types we will not get into due to the complexity of the problems.

Problem Type #1: Determining the chance of a particular order of events occurring.

1. A couple has two children. What are the chances of both children being girls?
2. What are the chances of having four children in the following order – boy, girl, boy, girl?

Problem Type #2: Determining the chance of having children with particular genotypes/phenotypes.

3. In monsters, having blue fur is dominant to having red fur. If a heterozygous monster and a monster with red fur decide to have baby monsters, what is the probability of having a monster with blue fur?
4. Using the information from the previous question, what is the probability of having a boy monster with blue fur?
5. Using the information from above, what is the probability of having a monster with blue fur, followed by a monster with red fur?
6. In monsters, having yellow teeth is dominant to having white teeth. If two heterozygous monsters decide to have baby monsters, what is the probability of having a baby monster that is homozygous for yellow teeth?
7. Using the information from the previous question, what is the probability of having three baby monsters with the following genotypes, in this order: homozygous dominant, heterozygous, homozygous recessive?

Problem Type #3: Determining the chance of having children with particular genotypes/phenotypes when working with two traits.

8. In turtles, being slow is dominant to being fast, and being green is dominant to being brown. If a turtle heterozygous for each trait and a fast turtle that is heterozygous for being green have baby turtles, what is the probability that their first baby turtle will be fast and green or slow and brown?
9. Using the information from above, what is the probability that their second baby turtle is heterozygous for being slow, and homozygous recessive for being brown?

Additional Practice

10. What fraction of the offspring of parents each with genotype *RrSsTt* will be *rrsstt*? (Note: use the rules of probability rather than making a gigantic Punnett square) Show or explain your work.
11. Suppose two *DdEeFfGgHh* individuals are mated. What would be the predicted frequency of *ddEEFfggHh* offspring from such a mating, if the genes are all on different chromosomes? Show or explain your work.