Human Genetics - What will your children be like?

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This is a laboratory exercise designed to help students visualize the separation and randomization of alleles during gametogenesis by physically manipulating "chromosomes". The chromosomes are represented by laminated paper strips each with an allele printed on it. After determining the potential gametes that a given genotype could produce, these are combined with those produced by their "spouse" to illustrate potential offspring. The exercise illustrates simple Mendelian inheritance, multiple alleles, and sex-linked transmission.

The exercise begins with each student drawing two alleles for each of the traits being studied. Beakers for each trait are set out containing the strips of paper with the alleles printed on them. We use the following traits each illustrating a certain type of inheritance:

Autosomal trait controlled by two alleles: Ability to taste PTC paper - T = taster, t = non-taster
Autosomal trait controlled by multiple alleles: Blood type - I^A, I^B, i
Sex chromosomes and sex-linked traits: X = normal, X^o = colorblind, Y = male

For the sex linked traits, females draw two X chromosomes (which may have either the normal or colorblind allele), and the males draw one X and one Y (with no allele). In order to make the lab more challenging and to see how quickly the possibilities for variability in offspring mount, you might include additional traits such as hair color (B / b) or Rh factor (Rh^+ / Rh^-).

Students also draw a first and last name (note: there should be two beakers with identical last names and the total number should equal the number of people in the class). Those with the same last name are "married" for the exercise. After locating their spouse (same last name), they determine their own genotypes and phenotypes for each trait. Then they are asked to determine all of the variations possible in the gametes they could produce (2^n - where n = the number of heterozygous loci).

The last step is to determine the number of different offspring possible from the union. At this point questions and word problems can be posed.

The exercise has been a favorite with students. It requires interaction with others in the class by randomly pairing students. Once paired the students must work together to determine the genetic outcome of such a pairing. In addition, the chromosomes and alleles are made concrete so that they can be used by students to represent gametogenesis and fertilization.

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