13.9.2012

Mathematical theory of population genetics

Exercises 1.

1. (6 points) Explain:

   (a) locus, allele

   (b) gamete, zygote

   (b) haploid, diploid

   (d) heterozygote, homozygote, genotype

2. Consider a diploid individual with three loci $\mathcal{A}, \mathcal{B}, \mathcal{C}$ on the same chromosome (loci are arranged on the chromosome in an alphabetical order), such that the individual is heterozygous in each locus (e.g. in locus $\mathcal{A}$ it has alleles a and A).

   (a) (3 points) If no recombination (by crossover) occurs, what are the allele combinations in gametes ?

   (b) (3 points) If one crossover happens between locus $\mathcal{A}$ and loci $\mathcal{B}, \mathcal{C}$, what are the allele combinations in gametes?

   (c) (3 points) If two crossovers happen, one between locus $\mathcal{A}$ and locus $\mathcal{B}$ and one between $\mathcal{B}$ and $\mathcal{C}$, what are the allele combinations in gametes?

3. (3 points) Consider a diploid individual with three loci $\mathcal{A}, \mathcal{B}, \mathcal{C}$, such that locus $\mathcal{A}$ lies on a different chromosome than loci $\mathcal{B}, \mathcal{C}$. As in exercise 2, all the loci are heterozygous. If no crossover happens between loci $\mathcal{B}$ and $\mathcal{C}$, what are the allele combinations in gametes?

4. (4 points) Which Mendel's laws apply to exercises 2 and 3?