Introductory Biology Genetics Problems – Complete Dominance through Multi-hybrid Crosses

1. Suppose that two true breeding lines of lobsters have the following phenotypes: green and white body color. Hybrids of these two lines are all green.
(a) name the two alleles and state which is dominant and which is recessive

G= green and g = white -- it is common to name genes for dominant alleles and to use upper case for the dominant and lower case same letter for recessive.

(b) what is the genotype of the F1 (hybrids) just described?

Gg

(c) If the F1 is test-crossed what are the expected (i) phenotypic and (ii) genotypic ratios of the F2?

A test cross is a cross with a homozygous recessive. Thus:

Gg (the F1) * gg

phenotypic ratio of 1 green to 1 white (1G to 1 g)
genotypic ratio of 1 Gg to 1 gg

2. Suppose that genes A, B, C and D assort independently of each other. Moreover, assume that:

(i) there are only two types of alleles for each gene and
(ii) one allele at each locus shows complete dominance

Suppose that:
Parent #1 -- an individual with the phenotype **ABcD** who had true breeding parents with phenotypes ABcD and abcd
is crossed with parent #2 -- an individual with the phenotype **ABCD**.
Some of their offspring are phenotype **abcd**

(a) What are the genotypes of parent #1 (ABcD) and #2 and (ABCD)?

ABcD must be heterozygous at the loci A.B.and D since it shows the dominant phenotype at each of these loci but had one parent that showed the recessive. Since it shows the recessive phenotype at c, it must be homozygous – i.e., it is AaBbccDd

And, since one of the offspring was homozygous recessive at all genes, then parent #2 (dominant phenotype with all four traits) must be heterozygous for all genes (AaBbCcDd)

(c) What is the chance of these parents producing offspring with the following phenotypes or genotypes?

(a) ABCD

¾ * ¾ * ½ * ¾

(b) AABBCcDd

¼ * ¼ * ½ * ½

(c) abcd

¼ * ¼ * ½ * ¼

(d) AbcD

¾ * ¼ * ½ * ¾

Do NOT use a Punnett square to solve any of these problems (except to work out the results of monohybrid crosses if you have forgotten the probabilities of various results)

(c) Could an individual with the phenotype ABcD possibly ever be true breeding? (explain)

sure – all it has to be is homozygous at each locus – AABBccDD – any cross with an individual of the same genotype will continue to give this genotype.