LECTURE 3

Types of Dominance

a) Simple dominance: -- phenotype of F_1 same as that of one of the parental types

b) Incomplete dominance or semidominance:

(i) alleles contribute equally (additively) to phenotype; phenotype of heterozygote is intermediate between parental types

c) Codominance: -- both alleles expressed independently; example is MN blood groups

d) Lethal inheritance: three types (note wild-type [wt] vs mutant allele)

i) dominant lethals: organism dies, so difficult to carry out formal genetics; examples include lethals induced with X-rays, Huntington's chorea

ii) dominant genes: homozygous lethal, with phenotypic effects in heterozygote; examples include polydactyly/brachydactly in humans; note the 2:1 phenotypic ratio in simulated F_2

iii) recessive lethals: also difficult to work with, requiring special techniques

(a) very common class, 4-6 (in heterozygous state) in diploid bisexual species

(b) taboos on consanguinity or consanguineous marriages a result

e) Different allele interactions in same cross:

(i) Consider cross involving ABO and rh systems:

$I^A/I^A; rh^-/rh^-$ x $I^B/I^B; rh^+/rh^+$ [P_1]

$I^A/I^B; rh^+/rh^-$ [F_1]

	I^A, rh^+	I^A, rh^-	I^B, rh^+	I^B, rh^-
I^A, rh^+	A positive	A positive	AB positive	AB positive
I^A, rh^-	A positive	A negative	AB positive	AB negative
I^B, rh^+	AB positive	AB positive	B positive	B positive
I^B, rh^-	AB positive	AB negative	B positive	B negative

$A^+ = 3/16$ $AB^+ = 6/16$ $B^+ = 3/16$

$A^- = 1/16$ $AB^- = 2/16$ $B^- = 1/16$

(ii) probability of different genotypes and phenotypes

(iii) work backward to demonstrate power of the Mendelian cross and and why it's still used today

f) Other note: erythroblastosis fetalis, universal donor (O^-), and universal acceptor (AB^+)

Probability

Multiplicative rule: if two or more events are independent, the probability (chance) they will co-occur is the *product* of their separate probability of occurrence

applicable to both segregation and independent assortment, e.g.,

Aa x Aa p(A) = ½, p(a) = ½

Aa;Bb x Aa;Bb p(A-) = ¾ p(aa) = ¼
p(B-) = ¾ p(bb) = ¼

So.....p(A-;B-) = 9/16, etc. and p(AA;BB) = 1/16, p(Aa;bb) = 1/8, etc.

Useful for any situation where inheritance is (assumed) independent: examples...

1) Consider pentahyhrid cross: Aa; Bb; Cc; Dd; Ee x Aa; Bb; Cc; Dd; Ee

a) probability of any genotype or phenotype (assume simple dominance)

b) estimate number of (total) genotypes and phenotypes

c) mix types of dominance: examples include...

Legend:

CC = lethal	Ald^1/Ald^1 = aldolase 1	BB = black feathers
Cc+ = creeper	Ald^1/Ald^2 = aldolase1-2	BB^1 = "blue" feathers
c+c+= wild-type	Ald^2/Ald^2 = aldolase 2	B^1B^1 = white feathers

R- = rose comb F- = feathered legs
rr = single comb ff = "clean" legs

(i) estimate number of genotypes, number of phenotypes, expected (specific) genotype and phenotypes in different crosses

(ii) note situations where genes are interacting, sex-linkage, etcetera, will be considered later