

Extensions of Mendel

9/12/12

recessive \rightarrow WT allele is haplo sufficient
mut. allele

Dominant \Rightarrow WT allele is haplo insufficient
mut. allele

Loss-of-function mutation (null mutation) or hypomorph
Gain-of-function mutation (neomorph) or hypermorph

1 Gene

Snap-Drum \Rightarrow (P) RR (Red) x rr (white) \rightarrow Incomplete dominance
(F₁) 100% pink Rr

(F₂) Rr x Rr \rightarrow 1RR : 2Rr : 1rr \rightarrow genotypic and phenotypic ratios equal

Multiple alleles
Blood groups:

3 alleles
A I^A
B I^B
AB i
O

Genotypes

$I^A I^A$ } A
 $I^B I^B$ } B
 $I^A I^B$ = AB
 $i i$ = O

Parents

AB x B

A x O

O x O

Progeny

O = $i i$

A = $I^A i$

B = $I^B i$

mutant strain

9/17/12

mutant strain	1	2	3	4	5	6	7	8	9	10	11	12	
1	+	+	+	+	+	+	+	+	+	+	+	+	+ = wild type W = wobble mutation Complementation groups 1,5 2,6,8,10 3,4 7,11,12 9 S groups ↓ S genes
2	W	+	+	+	+	+	+	+	+	+	+	+	
3		W	+	+	+	+	+	+	+	+	+	+	
4			W	+	+	+	+	+	+	+	+	+	
5				W	+	+	+	+	+	+	+	+	
6					W	+	+	+	+	+	+	+	
7						W	+	+	+	+	+	+	
8							W	+	+	+	+	+	
9								W	+	+	+	+	
10									W	+	+	+	
11										W	W		
12												W	

* Recessive lethal alleles \Rightarrow Homozygous recessive is lethal

\hookrightarrow ex. mouse coat color yellow x yellow
 $A^Y A^Y$ or $A^Y A$ $A^Y A^Y$ $A^Y A$
 most dominant
 $\frac{2}{3}$ yellow : $\frac{1}{3}$ WT

Allele that is lethal is dominant for coat color but is recessive for fatality. (needs 2 copies to be fatal)

* Multiple Alleles

\hookrightarrow gene $\rightarrow C > C^{ch} > C^h > c$

normal
 chinchilla
 Himalayan
 albino
 temperature sensitive mutation

(P) WT x chinchilla
 Cc $C^{ch}c$

(F) 2WT : 1ch : 1albino

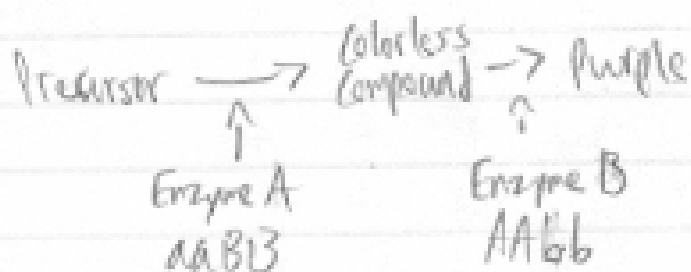
Extensions of Mendel for 2 genes - will deviate from 9:3:3:1

ex. (P) White flowering pea plant \times white flowering
 $PP (AABB)$ \times $PP (AAbb)$

(F₁) 100% purple \times purple
 $(Pp) AaBb$ \times $(Pp) AaBb$

(F₂) 9:7
 purple:white $A_B_ = \frac{9}{16}$

$aAB_ = \frac{2}{16}$
 A_bb
 $aaBb$



need a functional Enzymes A + B in order to produce color. (Complementation)
 9:7 ratio

Epistasis: One gene alters the phenotypic expression of a second gene.

9:3:4 - Recessive epistasis - ex. Labrador coats
 black = B } pigment producing gene
 brown = b }
 Yellow = deposit } pigment depositing gene
 epistatic gene

(P) Black \times Yellow
 $BBYY$ $bbyy$

(F₁) 100% black \rightarrow black \times black
 $BbYy$ $BbYy$

(F₂) $\frac{9}{16}$ black : $\frac{3}{16}$ brown : $\frac{4}{16}$ yellow
 $B_Y_$ $\frac{3}{16} bbY_$ $\frac{3}{16} B_yy$ $\frac{4}{16} bbyy$