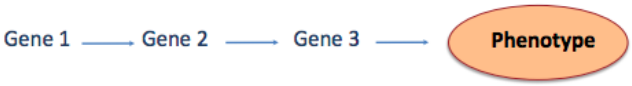
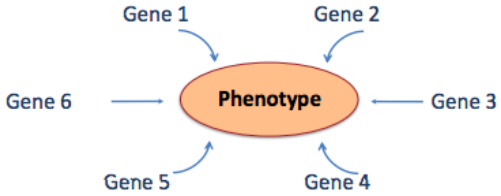
Lecture 5: gene interaction and complementation

How different genes contribute to a phenotype

- Linear or dependent functions=genetic interaction



- Parallel or independent functions=synthetic interaction

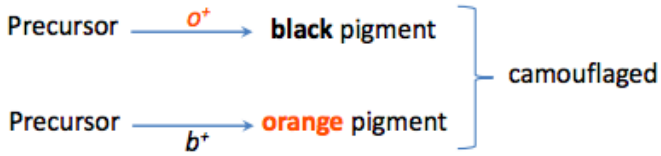


Variations in dihybrid cross

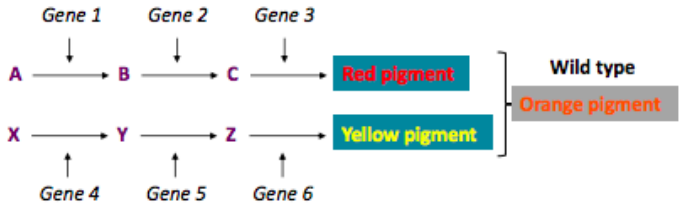
Example:

- a snake have 4 phenotype (WT camouflage, black mutant, orange mutant & albino mutant)
- Pure breeding black and orange snakes are crossed and all F1 progeny are WT(complement)
- F1 self crossed and in F2 all phenotype are found (9 WT : 3 black : 3 orange : 1 white)
- Camouflage is a dihybrid trait, there is no genetic interaction

    -> synthetic phenotype =created by allele of different genes in combination



- There can be many precursors that leads to one phenotype
- Genes in the biochemical pathway affect the same phenotype

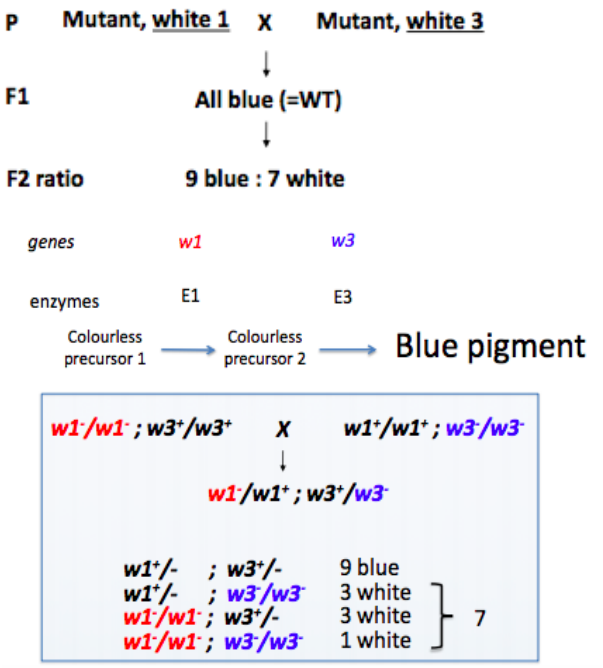


- Mutation in any of these genes alter pigmentation
- If at least 2 different genes from each pathway is not working, mutation will be colourless

    -> double mutant = colourless >> novel phenotype (new unique appearance)

Gene Interactions

- 9:7 ratio = genes in the same pathway
    - **Example: harebell flowers colour**



- A number of genes contribute to the phenotype
- Any gene changes in the pathway will result in the loss of pigment (pathway block)

- **Example 2: Interaction between regulatory protein and its target**
- Regulatory protein regulates expression of another gene
- Both WT= WT phenotype
- Mutation in the regulatory gene= mutant
- Mutation in the structural protein=mutant
- Mutation in both genes=mutant

- 9:3:4 ratio = recessive epistasis
  - 2 mutants have the same phenotype
  - Double mutant shows phenotype of one but not the ther
  - Epistatic = the overriding mutation
  - Hypostatic = the overridden mutation
  - Epistatic mutation is carried by gene that is farther upstream than the gene of the overridden mutation (gene in the same pathway)

  - **Example: Labrador coat colour**

- ***B*** **= Black,** ***b*** **= brown**
- ***E*** **= normal color deposition,** ***e*** **= no color deposition (gold)**

P	*B/B e/e* (gold)	**X** *b/b E/E* (brown)	Cross btw 2 mutants
F1	*B/b E/e*		Black (WT)
F2	*B/- E/-* *B/- e/e* *b/b E/-* *b/b e/e*		9 black (WT) 3 gold 3 brown 1 gold

  - Recessive phenotype (no colour deposition) overrides the colour phenotype

- 12:3:1 ratio = dominant epistasis
  - Example: flower colour

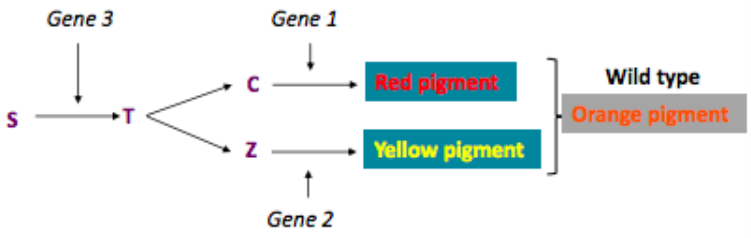
Foxgloves

- **Phenotype = petal colouration**
- ***D*** **= dark red,** ***d*** **= light red**
- ***W*** **= restricts colour to throat spots**

	Dark red		White with spots	
P	*D/D ; w/w*	**X**	*d/d ; W/W*	
F1	*D/d W/w*			White with spots
F2	*D/- ; W/-* *d/d ; W/-* *D/- ; w/w* *d/d ; w/w*			9 White with spots 3 White with spots 3 dark red 1 light red

  - Dominant phenotype overrides the other phenotype

Alternative pathway: Epistasis due to divergent pathway



- 13:3 ratio
  - If recessive suppressor itself have no detectable phenotype
  - a=mutant a+=WT su+= WT su= supressor mutation