Exceptions to Mendel's Laws

Intermediate Phenotypes

So far....

- TALL or SHORT
- WHITE or PURPLE
- CURLY or STRAIGHT

So far...

- Complete dominance
  - one allele completely COVERS up the other
  - a true relationship of dominance and recessiveness
  - only two phenotypic outcomes
  - Ex.
    - R= red
    - r= white

    →
    - RR= red
    - Rr= red
    - rr= white

But, what if . . .

- RED, PURPLE, or BLUE
- SHORT, MEDIUM, or TALL
- CURLY, WAVY, or STRAIGHT

Intermediate Inheritance

- **Incomplete dominance**
  - when neither allele covers up the other
  - In the heterozygous, you fail to see EITHER TRAIT PURELY!
  - three phenotypic outcomes
- Ex.
  - R= red
  - R'= white

  →
  - RR= red
  - RR'= pink
  - R'R'= white

Incomplete Dominance

Practice

- In snapdragons, flower color is controlled by incomplete dominance. The two alleles are red (R) and white (R'). The heterozygous genotype is expressed as pink.

a) What is the phenotype of a plant with the genotype RR?
b) What is the phenotype of a plant with the genotype R'R'?
c) What is the phenotype of a plant with the genotype RR'?

Intermediate Inheritance

- **Codominance**
  - when BOTH alleles show up PURELY in the heterozygous.
  - three phenotypic possibilities
- Ex:
  - R= white
  - R'= red

→

  - RR= white
  - RR'= white with red spots
  - R'R'= red

Codominance

Codominance

Practice

- In some chickens, the gene for feather color is controlled by codominance. The allele for black is B and the allele for white is B'. The heterozygous phenotype is known as erminette.
- If two erminette chickens were crossed, what is the probability that:

a) They would have a black chick?
b) They would have a white chick?

Multiple Alleles

- there are more than two alleles for one characteristic.
  - you still only inherit one from each parent
  - There are more than three possible combinations.

Multiple Alleles

- **Example**
  - Human blood types
  - Three possible alleles:
    - I^A = Type A
    - I^B = Type B
    - i = Type O

Blood Groups

Genotypes	Phenotypes
I^AI^A	Type A
I^Ai	Type A
I^BI^B	Type B
I^Bi	Type B
ii	Type O
I^AI^B	Type AB

Blood Groups Practice

- Sara has Type O blood. What is her genotype?
- Mark has Type B blood. What is his genotype?
- Gert has Type AB blood. What is her genotype?

Blood Groups Practice

- Bob has Type A blood and Debbie has Type B blood. Is it possible for them to have a child with Type O blood?

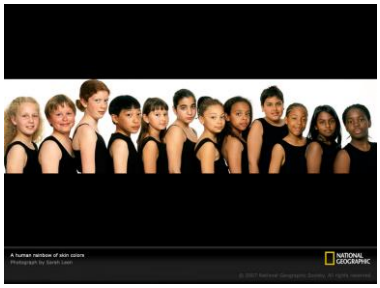
Blood Groups Practice

- If Roger is heterozygous for Type A blood and Lisa is heterozygous for Type B blood..
  - A. What are the chances they could have a child with Type O blood?
  - B. What are the chances they could have a child with Type AB blood?

Polygenic traits

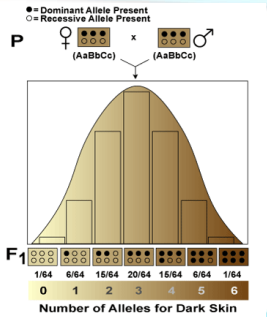
- When more than ONE pair of genes affects a trait
  - many, many phenotypic outcomes
  - Ex. Human height, weight, skin color, hair color

Polygenetic Inheritance



Polygenetic Inheritance

Polygenetic Inheritance



Epistasis

- One gene alters the phenotypic expression of a second gene
- Examples:
  - Wheat kernel color
  - Squash fruit shape
  - Sweet pea flower color

Coat color in Labrador retrievers

- One gene determines the pigment color
  - B=black
  - b=brown
- The other gene determines whether the pigment will be deposited
  - E=pigment
  - e=no pigment