Variations on Mendel's Themes

Incomplete Dominance

- Appearance of a 3rd Phenotype
- The phenotype of the heterozygote is intermediate between the 2 homozygotes
- Use uppercase letter and uppercase prime
  - RR= Red
  - R^1R^1= White
  - RR^1 = Pink

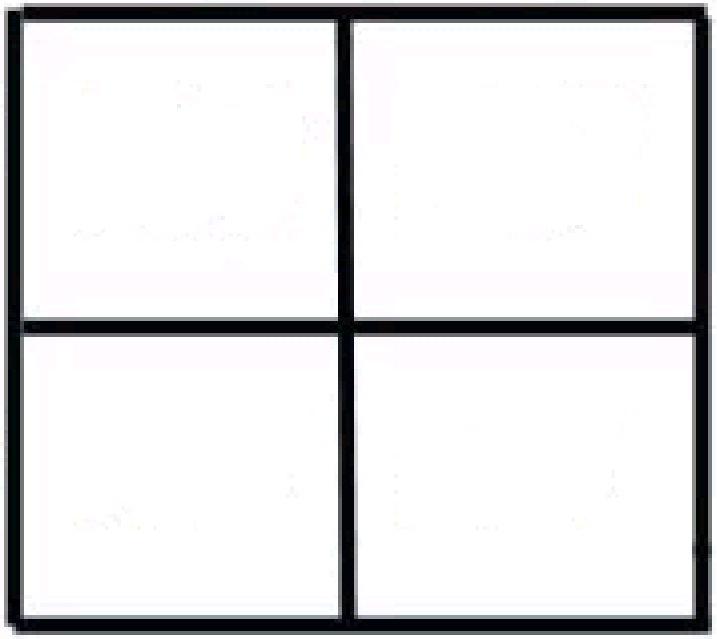
Incomplete Dominance

RR  X  R^1R^1

RR^1

Incomplete Dominance

- Cross 2 pink snapdragons



•Phenotypic results

•Genotypic results

Codominance

- Expression of both alleles
- The phenotype of the heterozygote shows both phenotypes of the 2 homozygotes
- Use 2 different uppercase letters
  - B for black feather chicken
  - W for white feather chicken

Codominance

BB

X

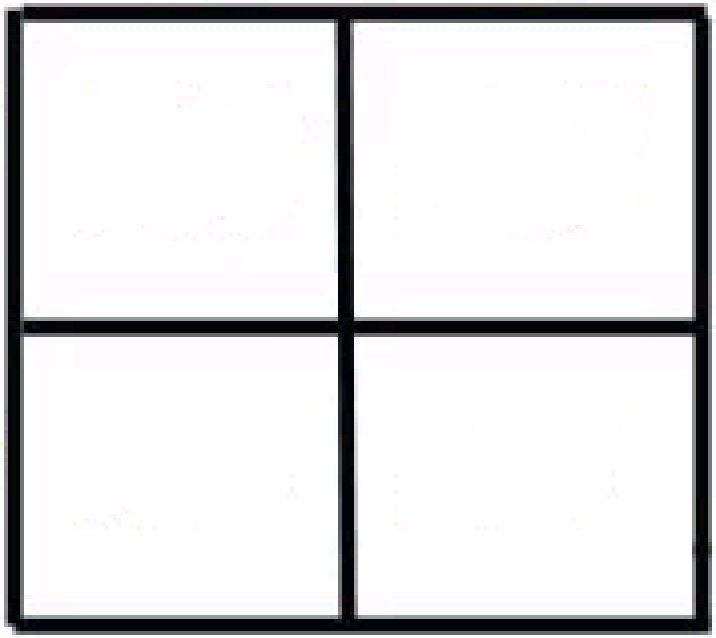
WW

BW

Black and white Checkered Chicken

Codominance

- Cross 2 checkered chickens



Phenotypic results

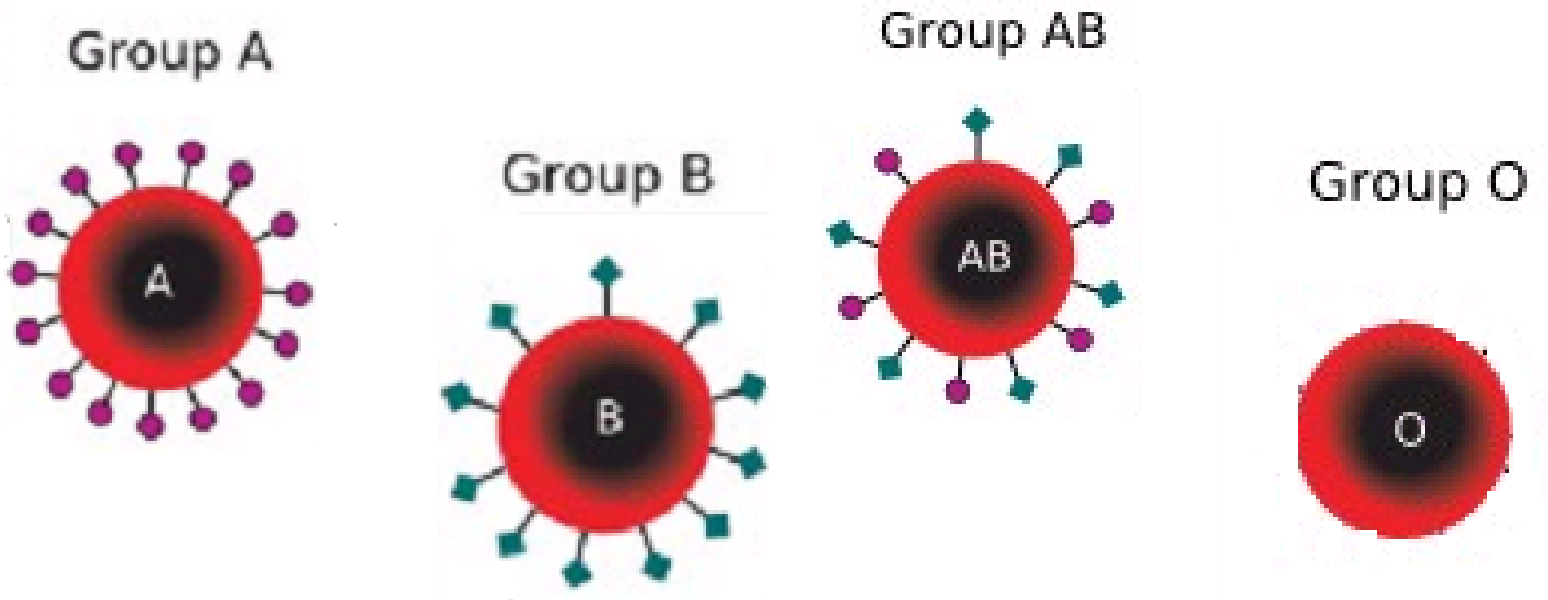
Genotypic results

Multiple Alleles

- More than 2 alleles for a trait exist in a population
- Complicated inheritance rules
- Human blood type
  - 3 Alleles
    - I^A and I^B : codominant
    - i : recessive

Human Blood Type

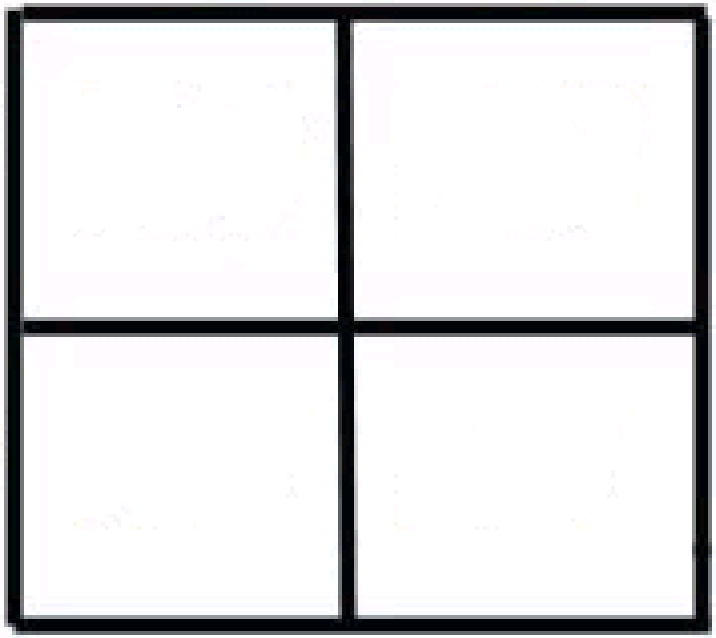
Blood type is determined by protein on the outside of red blood cells



Phenotype	Genotype
• Type A blood	• I^AI^A or I^Ai
• Type B Blood	• I^BI^B or I^Bi
• Type AB Blood	• I^AI^B
• Type O Blood	• ii

Blood Type

Cross heterozygous Type A with heterozygous Type B



- Phenotypic results
- Genotypic results

Polygenic Inheritance

- Trait shows a wide range of varieties
- 2 or more genes control 1 trait
- Use upper and lowercase letters for more than 1 letter
- Human eye color, skin color and height

Polygenic Inheritance

Mother
Aa Bb

Father
Aa Bb

	AB	*Ab*	*aB*	*ab*
AB	*AA BB*	*AA Bb*	*Aa BB*	*Aa Bb*
Ab	*AA Bb*	*AA bb*	*Aa Bb*	*Aa bb*
aB	*Aa BB*	*Aa Bb*	*aa BB*	*aa Bb*
ab	*Aa Bb*	*Aa bb*	*aa Bb*	*aa bb*

AA BB

AA Bb

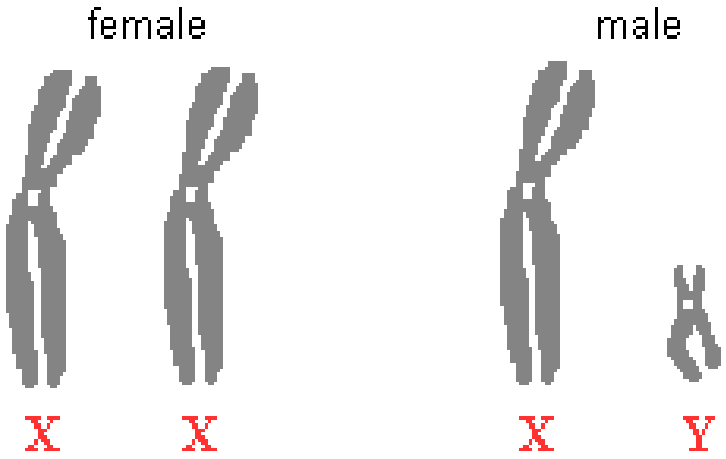
Aa Bb

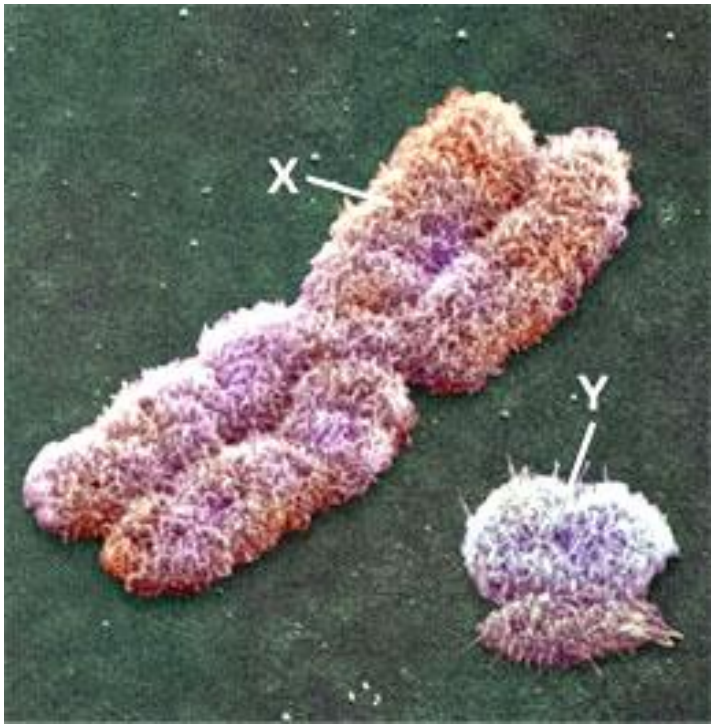
Aa bb

aa bb

Sex Determination

- Sex chromosomes, X and Y, determine the sex of an individual
  - XX = female
  - XY = male



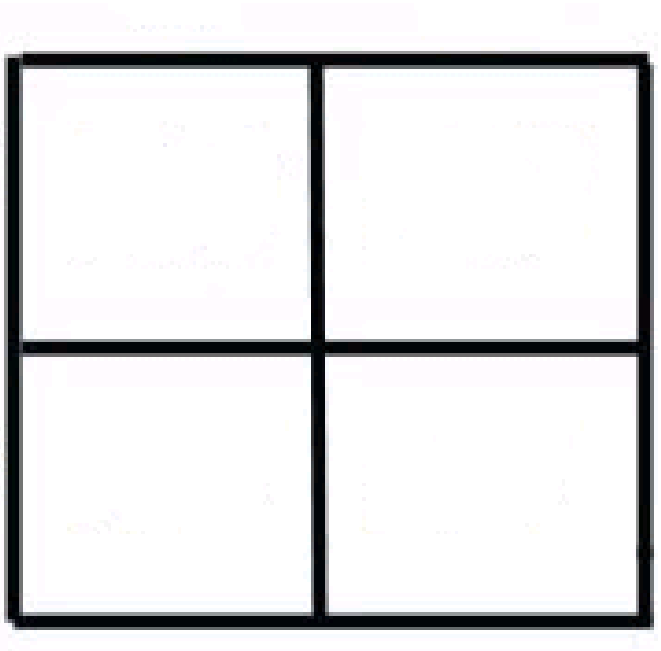


Sex Determination of Offspring

- Cross a

  Male and Female

  XY x XX



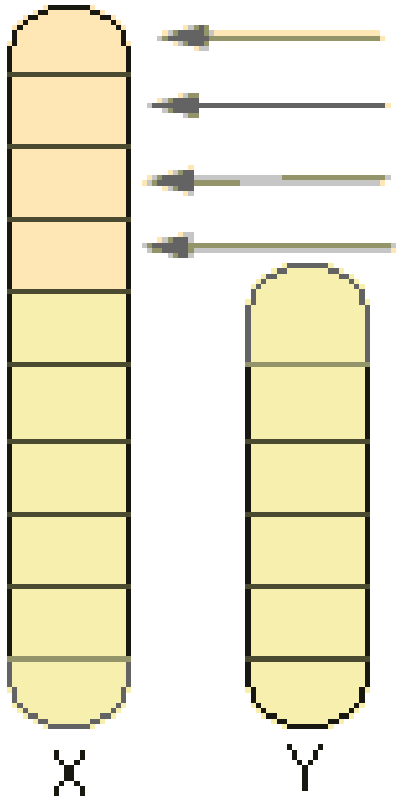
- For each pregnancy there is a 50/50 chance the child is a girl or a boy

Sex Linked Inheritance

- aka: X Linked Inheritance
- Inheritance pattern is different for males and females
- Gene for the trait is carried on the X chromosome

Sex Linked Inheritance

- There is no corresponding gene on the Y chromosome
- Use upper and lowercase letters for dominant and recessive trait, as superscript on X
- No letter on the Y

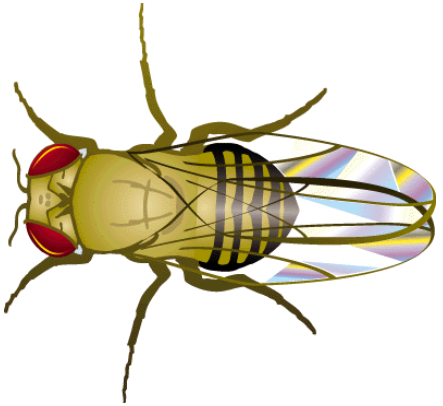


Sex Linked Inheritance

- Human color blindness, hemophilia, and male pattern baldness

Sex Linked Inheritance

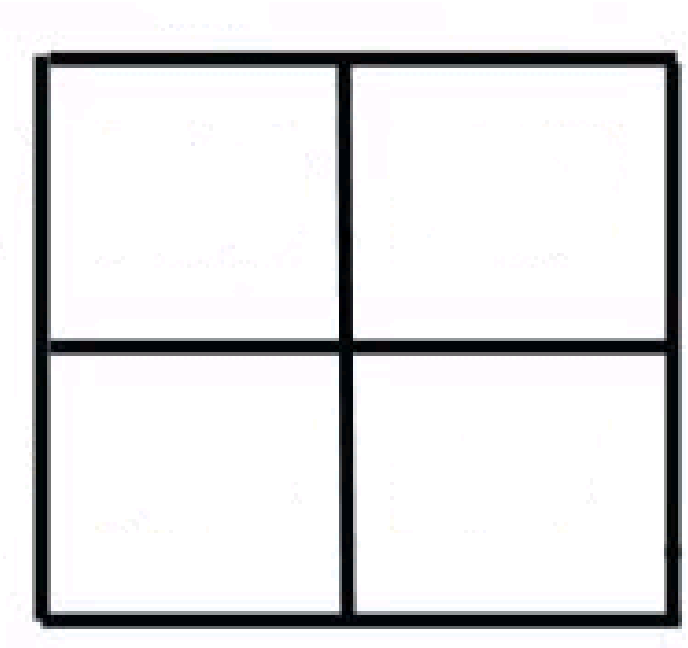
- Fruit fly eye color
  - X^R: red eye
  - X^r: white eye
  - Y: no gene for eye color



Sex Linked Inheritance

- Cross red eyed male with heterozygous red eyed female

$X^R Y \quad X \quad X^R X^r$



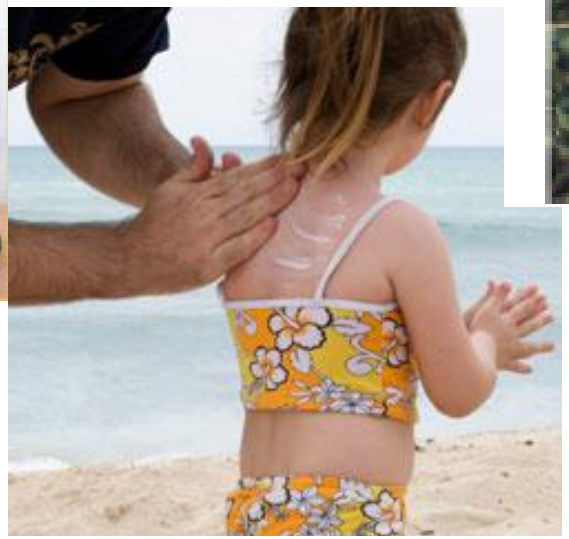
•Phenotypic results

•Genotypic results

Environmental Influences

- Genes may be expressed differently depending on
  - External environment:
    - Temperature, nutrition, light, chemicals
  - Internal environment
    - Hormones, age

Environmental Influences



Test Cross

- Used to determine unknown genotype of a known phenotype
- Cross homozygous recessive with unknown dominant and observe offspring
  - Dominant phenotype: Purple flower
  - Is it heterozygous Pp or homozygous PP if all offspring are purple?

Test Cross