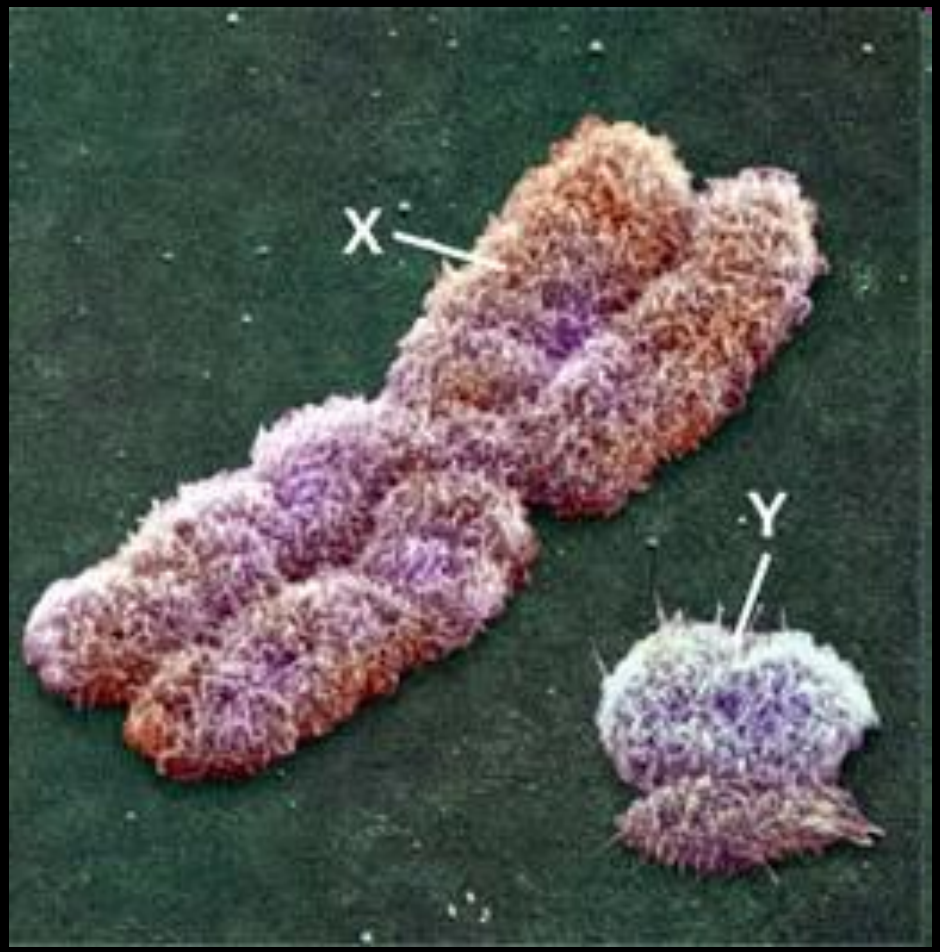
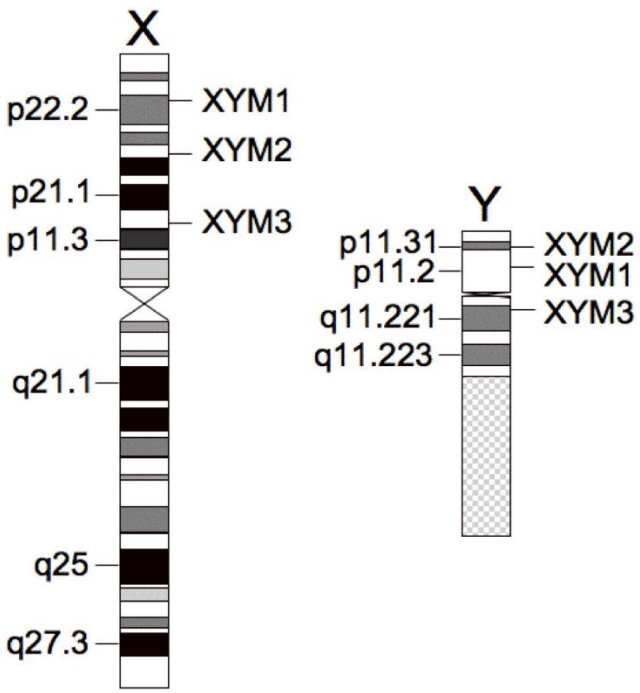


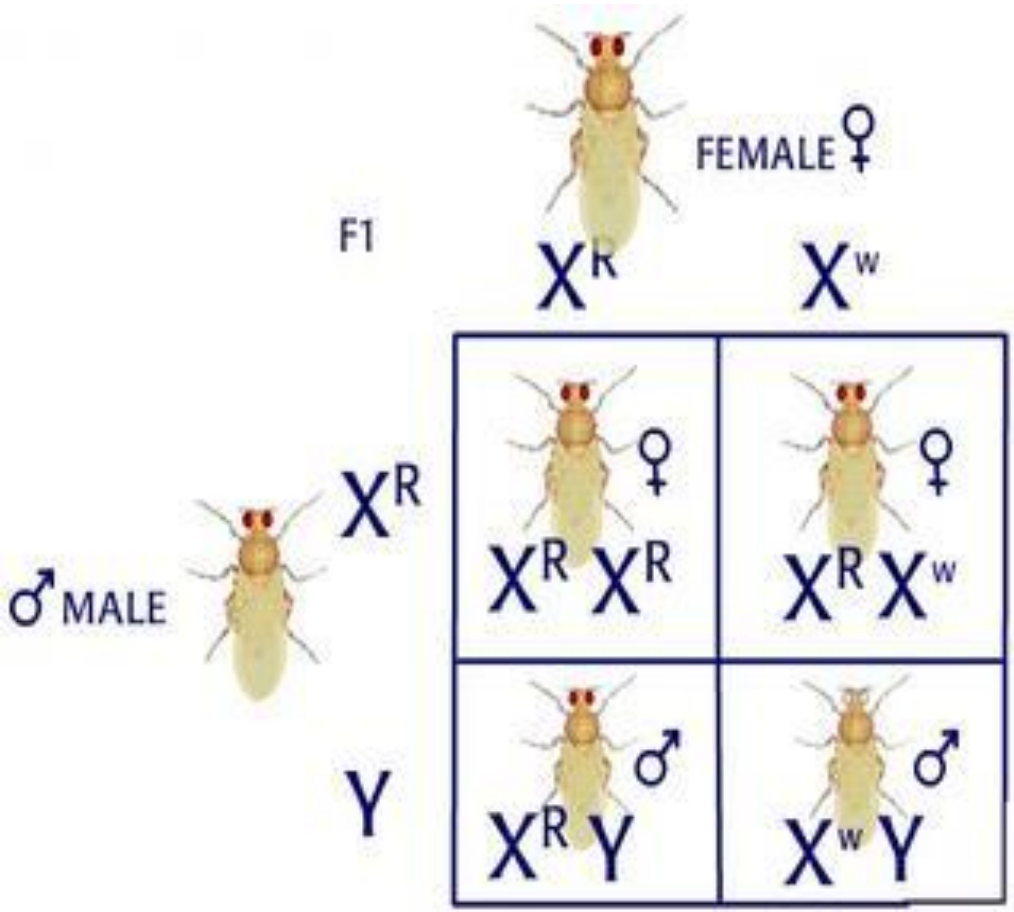
Sex-Linkage & Pedigrees

Sex Linkage

- A person's sex is determined by the presence of sex chromosomes
- Humans have 44 "autosomes" and 2 "sex" chromosomes
- Males are heterozygous XY
- Females are homozygous XX
- Presence of Y indicates maleness rather than the absence of X
- A gene on the X of a male has no matching allele on the Y

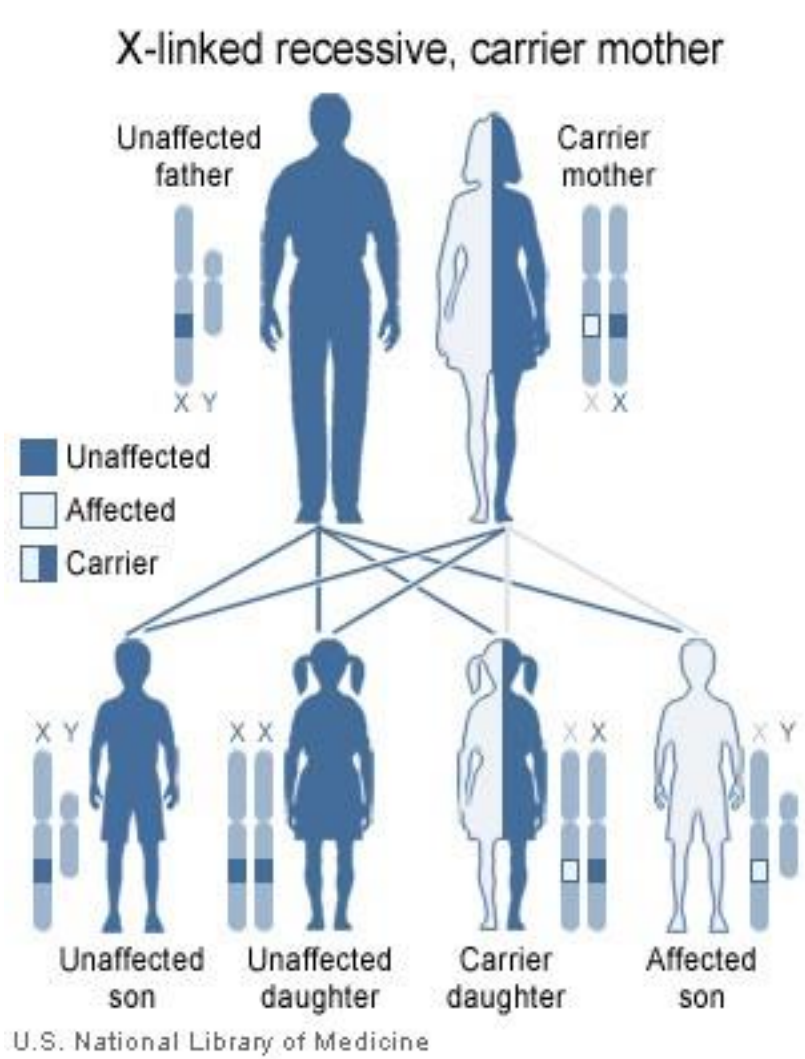


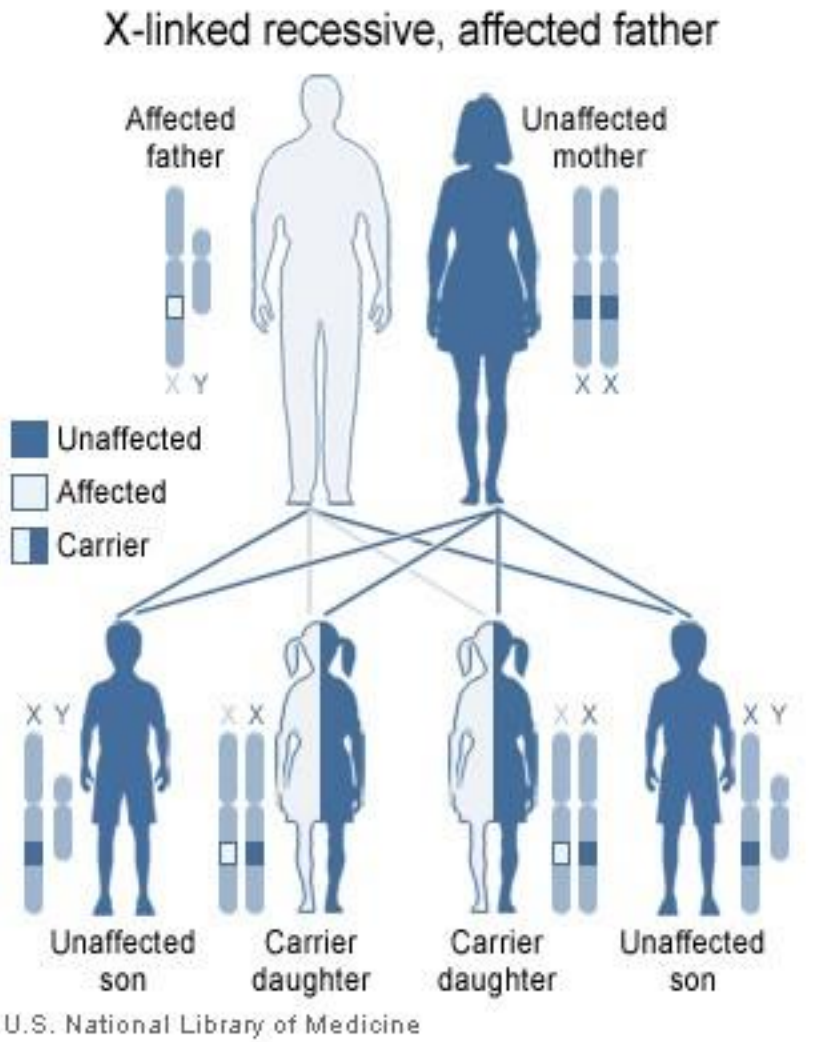
Sex Linkage Explained Further



- Traits found on the X chromosome are commonly referred to as X-linked or Sex-Linked
Each allele of each sex chromosome is written as a superscript
Examples of X-Linked Genes:
  - Hemophilia
  - Muscular dystrophy
  - Red/green colourblindness
  - Early patterned baldness

Take a Look…


X-linked recessive, carrier mother
Unaffected father
Carrier mother
X Y
X X
Unaffected
Affected
Carrier
X Y
X X
X X
X Y
Unaffected son
Unaffected daughter
Carrier daughter
Affected son
U.S. National Library of Medicine

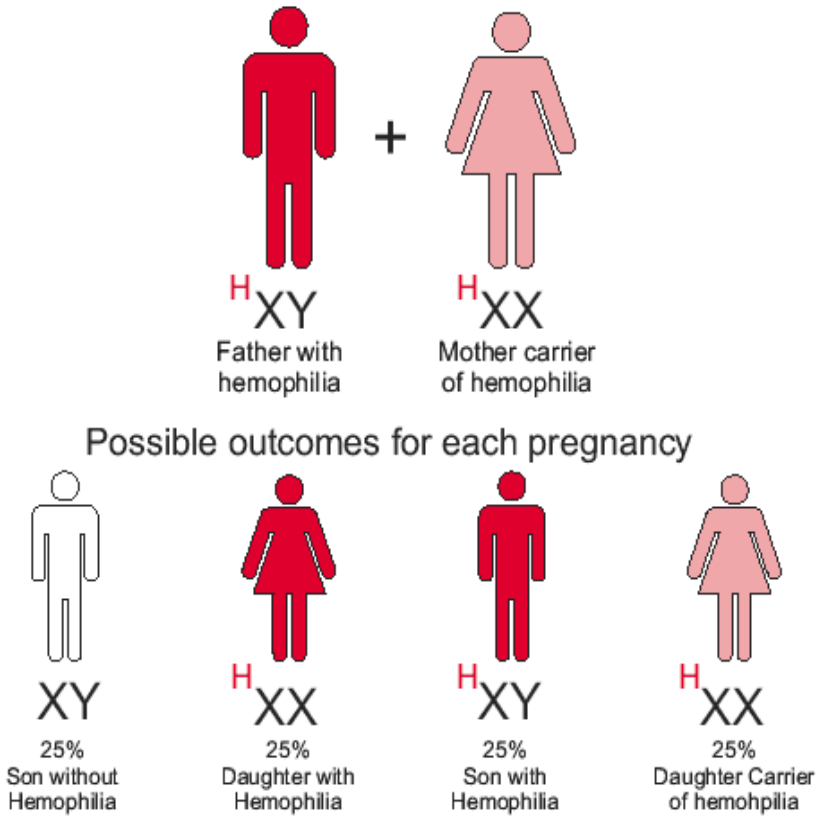

X-linked recessive, affected father
Affected father
Unaffected mother
X Y
X X
Unaffected
Affected
Carrier
X Y
X X
X X
X Y
Unaffected son
Carrier daughter
Carrier daughter
Unaffected son
U.S. National Library of Medicine

Hemophilia: A Royal Curse

- Blood clotting
  - Normal blood clotting is dominant to hemophilia
  - The gene for blood clotting in on the X chromosome

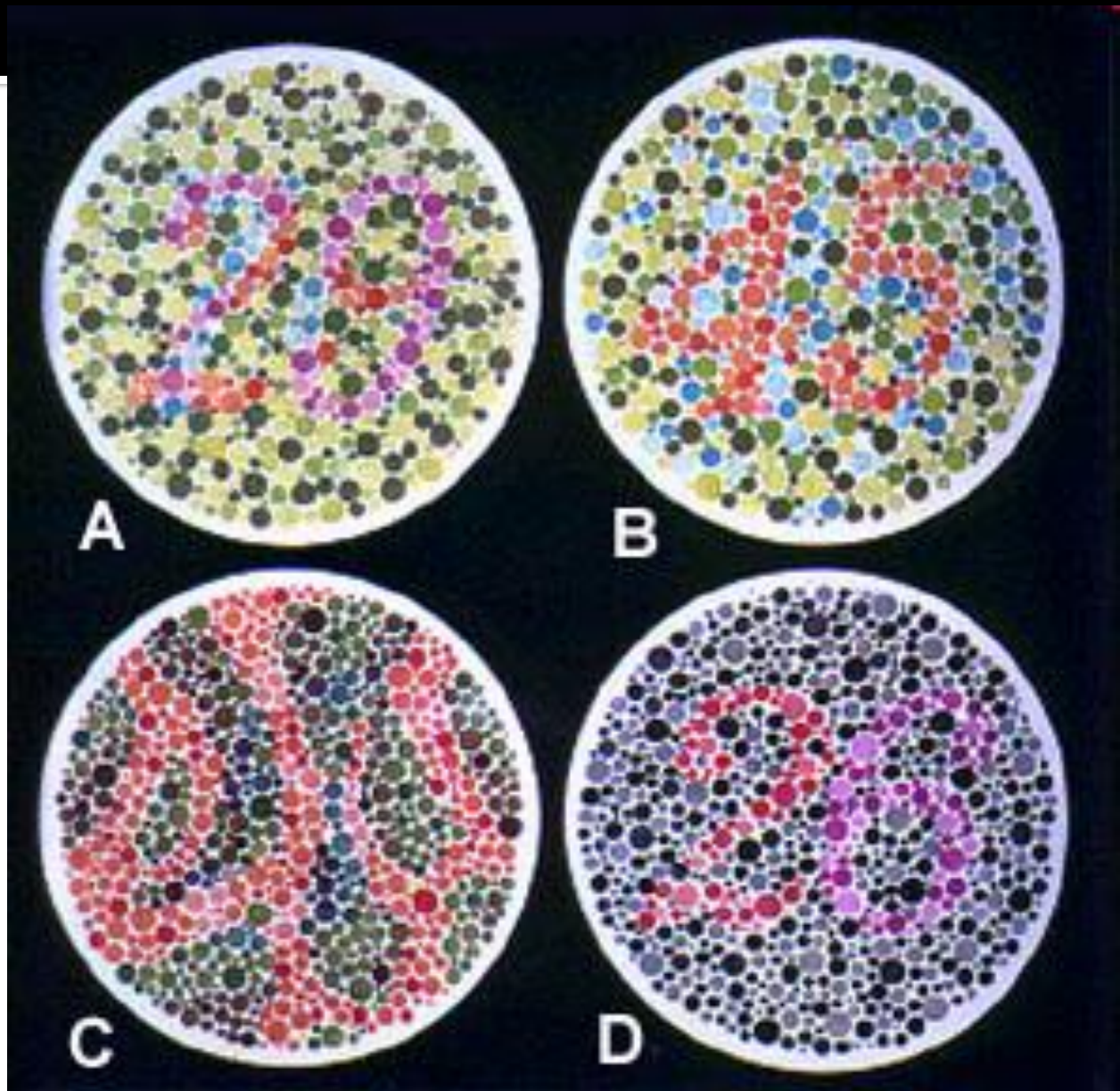
Hemophilia Discovered

- Let ^{H}X = the hemophilia on the X chromosome
- Let Y represent the Y chromosome
- Cross a heterozygous female with a normal blood clotting male
- ^{H}XX cross ^{H}XY
- The Y factor
- Males CANNOT pass on an X-linked trait to a son because he MUST pass on the Y to him



Vision Test

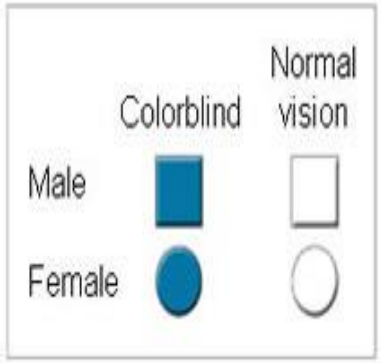
- 8% of men, 0.04% of women
- Three genes give us our colour vision
  Blue, Red, and Green
- Blue is found on an autosome
- Red and green are found on the X chromosome

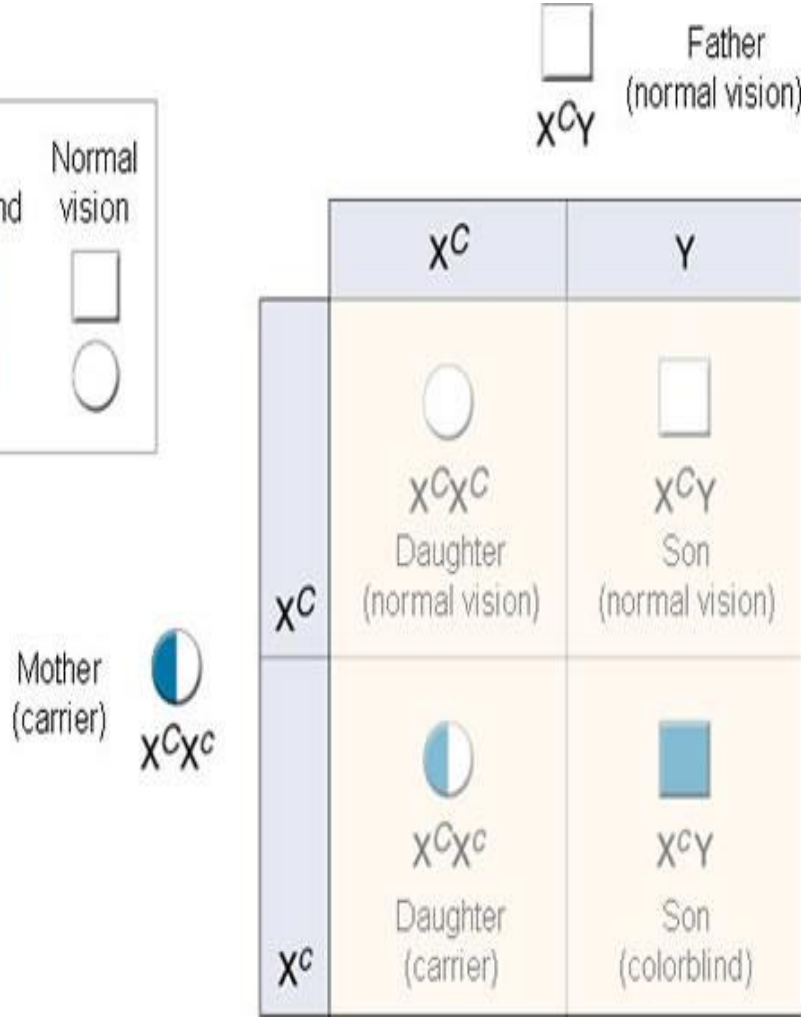


- **1. Normal Color Vision:**
  A: 29, B: 45, C: --, D: 26
- **2. Red-Green Color-Blind:**
  A: 70, B: --, C: 5, D: --
- **3. Red Color-blind:**
  A: 70, B: --, C: 5, D: 6
- **4. Green Color-Blind:**
  A: 70, B: --, C: 5, D: 2

Red/Green Colour Blindness

- Defective red allele
  - If the red defective allele is passed but green allele is normal
  - the person can't tell the difference between red and green
- Defective green allele
  - Same effect if the green defective allele is passed on and the red is normal

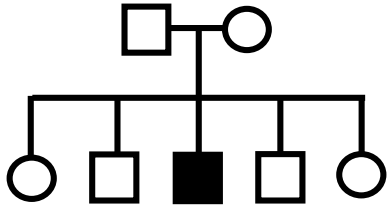




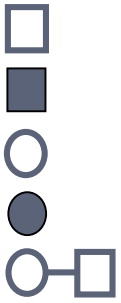
Pedigree Charts

- Pedigree charts show a record of the family of an individual
- They can be used to study the transmission of a hereditary condition
- They are particularly useful when there are large families and a good family record over several generations.

A mating with five children, two daughters and three sons. The middle son is affected by the condition.



Eldest child → Youngest child



Normal male
Affected male
Normal female
Affected female
Mating

Organizing Pedigree Charts

- A pedigree chart of a family showing 20 individuals
- Individuals in each generation are identified by Roman numerals numbered from the left
- Therefore the affected individuals are **II3**, **IV2** and **IV3**