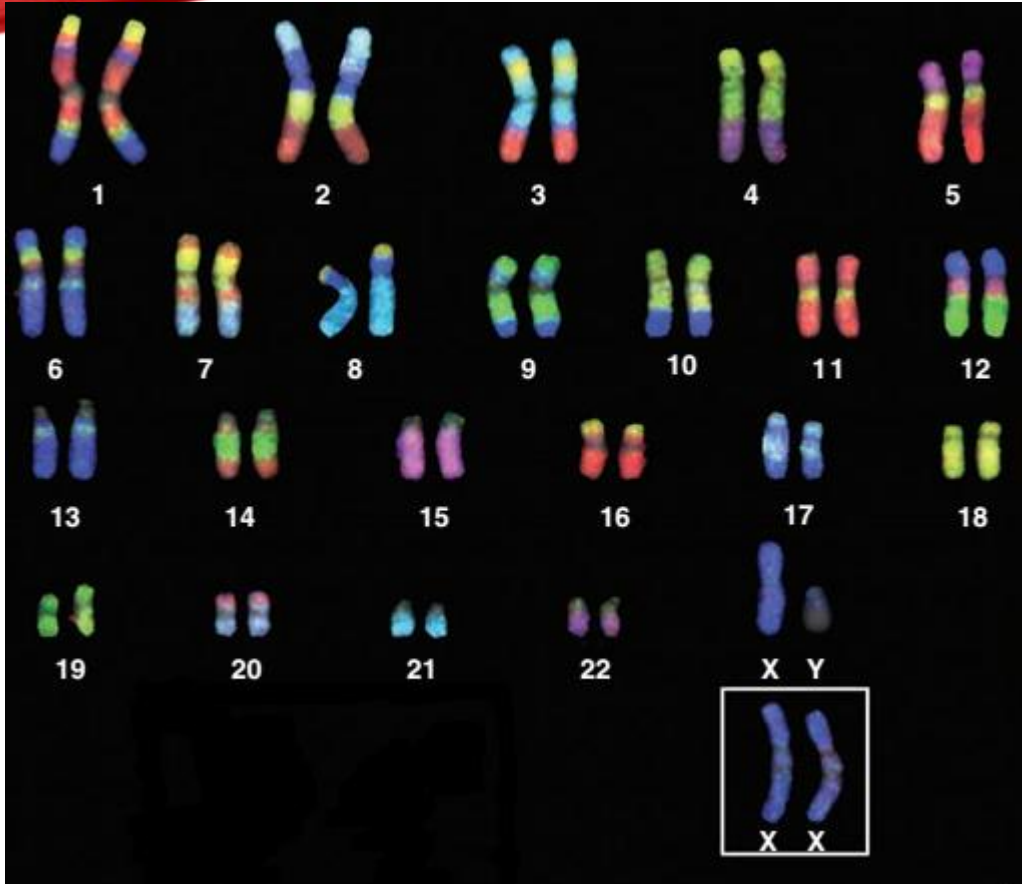


# Gene Mapping

A microscopic view of red blood cells. The background is a gradient of red and orange. Several red blood cells are visible, some appearing as normal biconcave discs and others as distorted, sickle-shaped cells. The sickle cells are more prominent and have a curved, crescent-like shape. The overall image has a soft, glowing quality.

How do scientists track diseases like sickle cell anemia down through family lines?

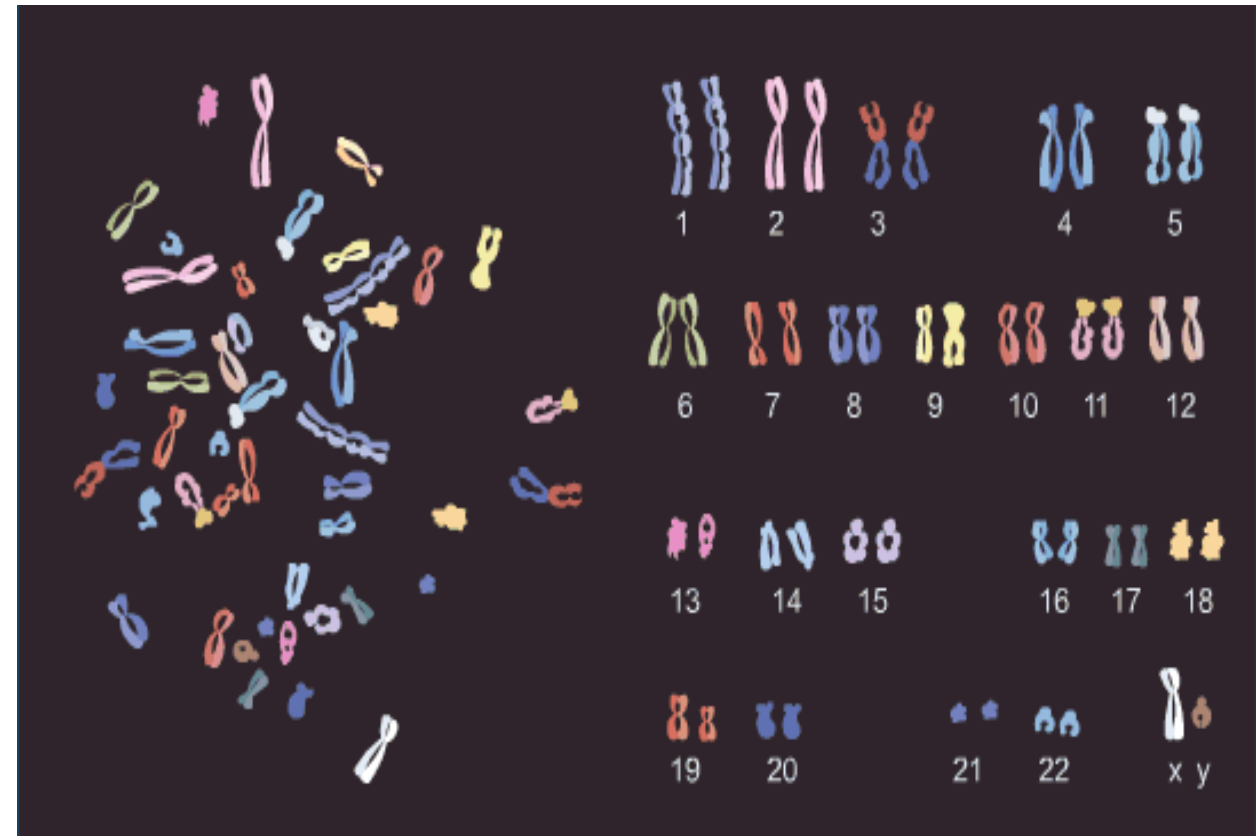
# KARYOTYPE



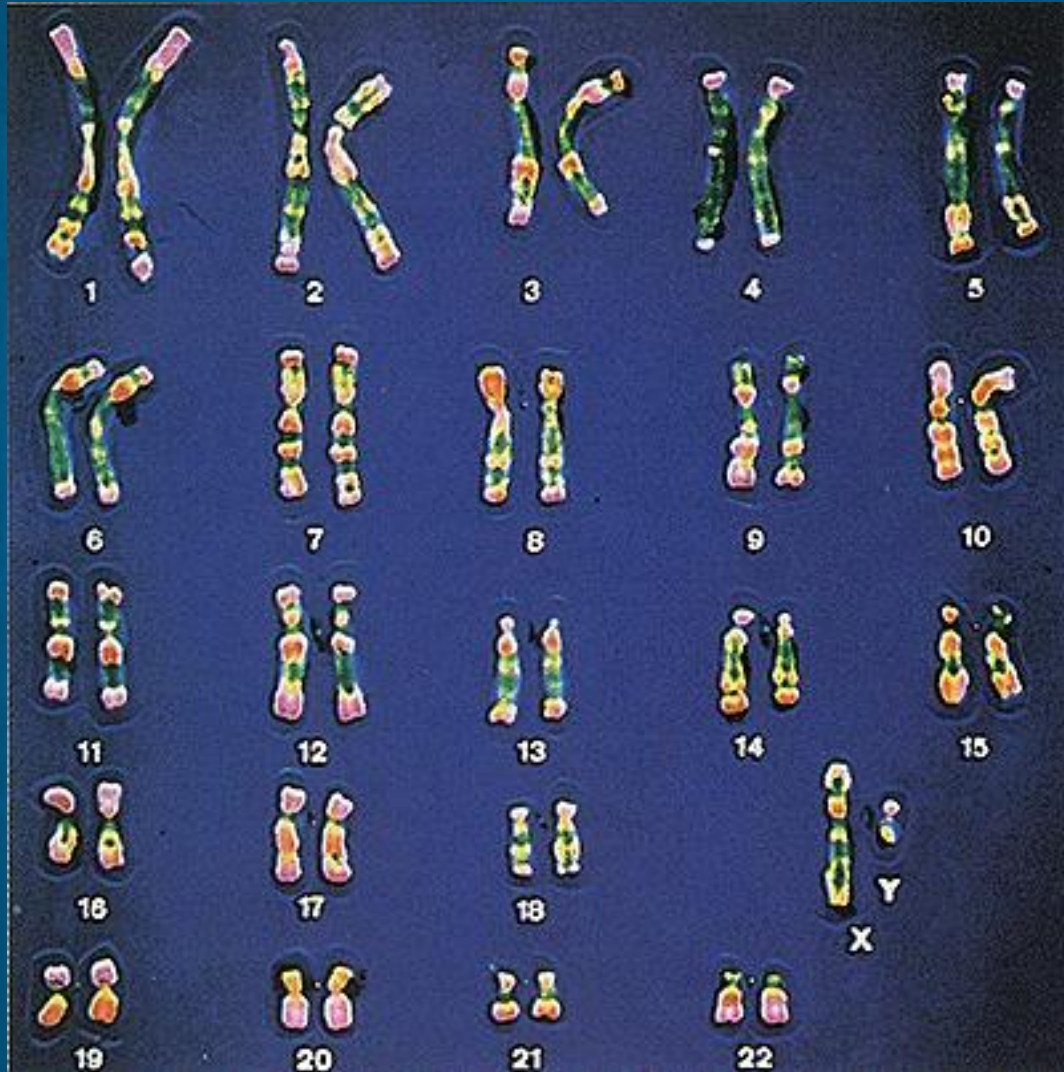
- The number and **visual appearance** of the **chromosomes** of a specific organism.
- This map only shows the chromosomes not the individual genes

# HOW TO MAKE ONE

- Arranged by **homologous** chromosomes and numbered based on size and banding patterns.
- **Autosomes** are pairs # **1-22**
- **Sex chromosomes** are pair # **23**
- **XX** = female human
- **XY** = male human



# THINK PAIR SHARE



• Is this organism human?

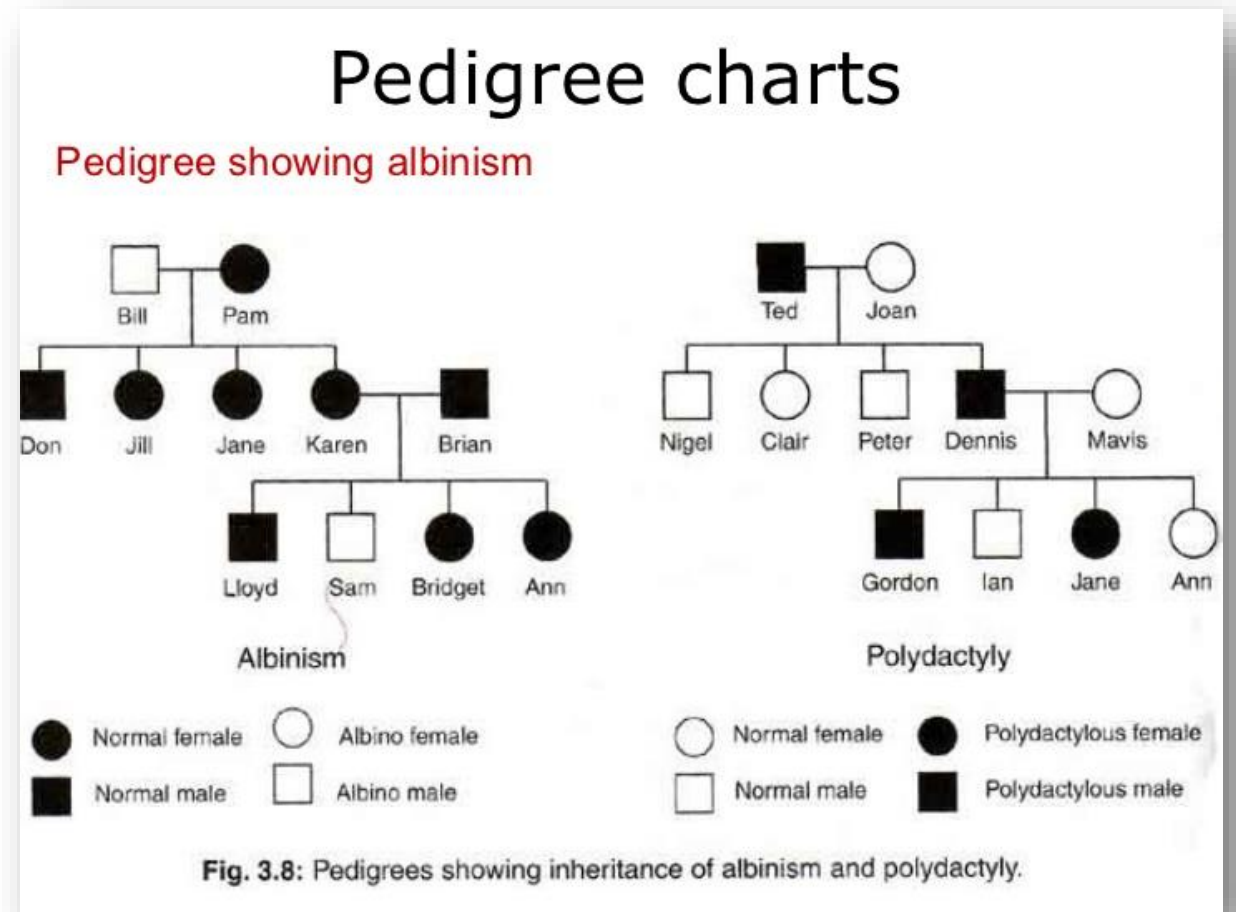
Yes, it has 46 chromosomes.

• Is it male or female and why?

Male, has XY

# PEDIGREE

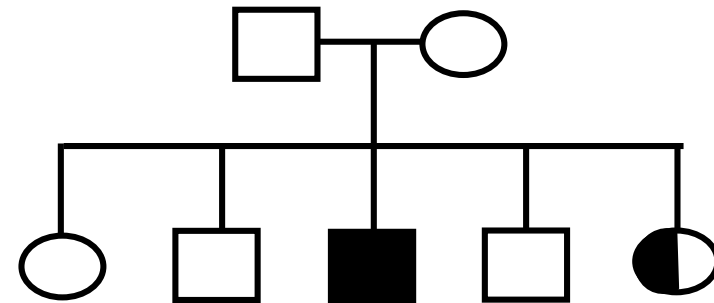
- Shows a record of the family of an **individual**.
- Used to track genetic disorders within a family over several generations.
- Used today to track purebred animals



# SYMBOLS USED IN PEDIGREE CHARTS

- □ Normal male
- ■ Affected male
- ○ Normal female
- ● Affected female
- ○—□ Marriage
- ○⊥ Carrier female
- □⊥ Carrier male

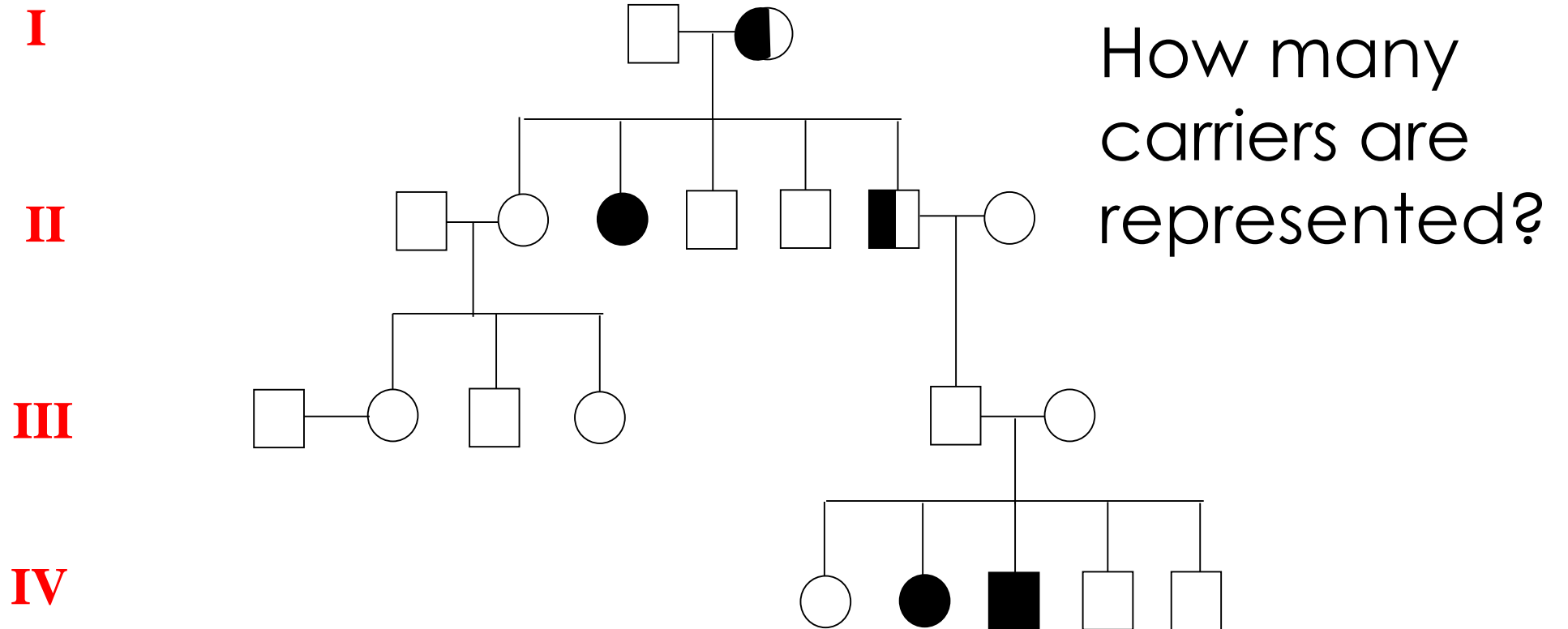
A marriage with five children, two daughters and three sons. The middle son is affected by the condition. The youngest daughter is a carrier of the condition.



Eldest Child ↔ Youngest Child

# ORGANISING THE PEDIGREE CHART

- Generations are identified by Roman numerals



# INTERPRETING A PEDIGREE CHART

1. Determine if the pedigree chart shows an autosomal or X-linked disease.
  - If **many** more of the males in the pedigree are affected the disorder is **X-linked**.
  - If it is about a **50/50** ratio between men and women the disorder is probably **autosomal**.

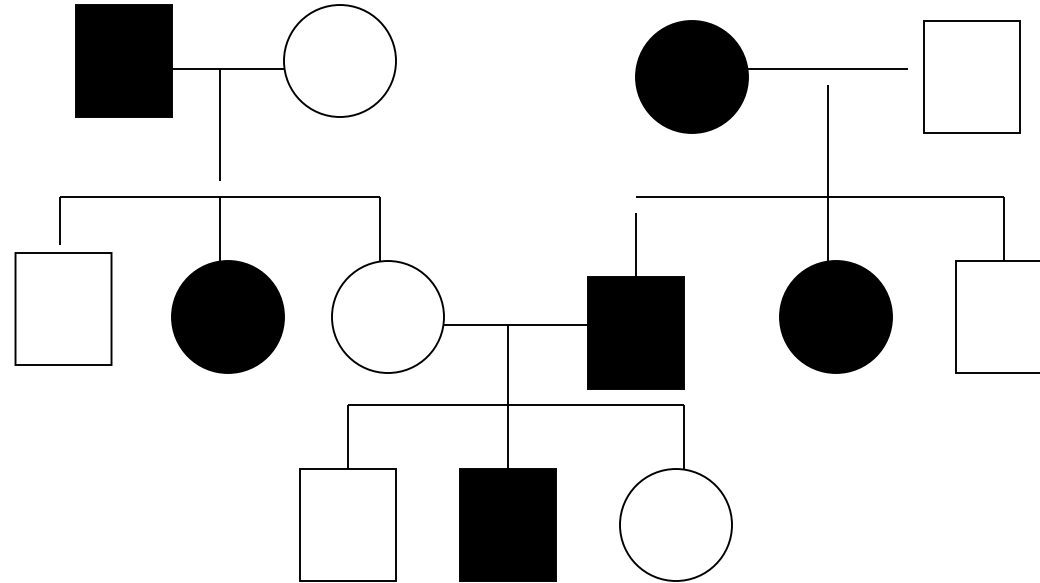


# 1<sup>st</sup>

# EXAMPLE OF PEDIGREE CHARTS

Is it Autosomal or X-linked?

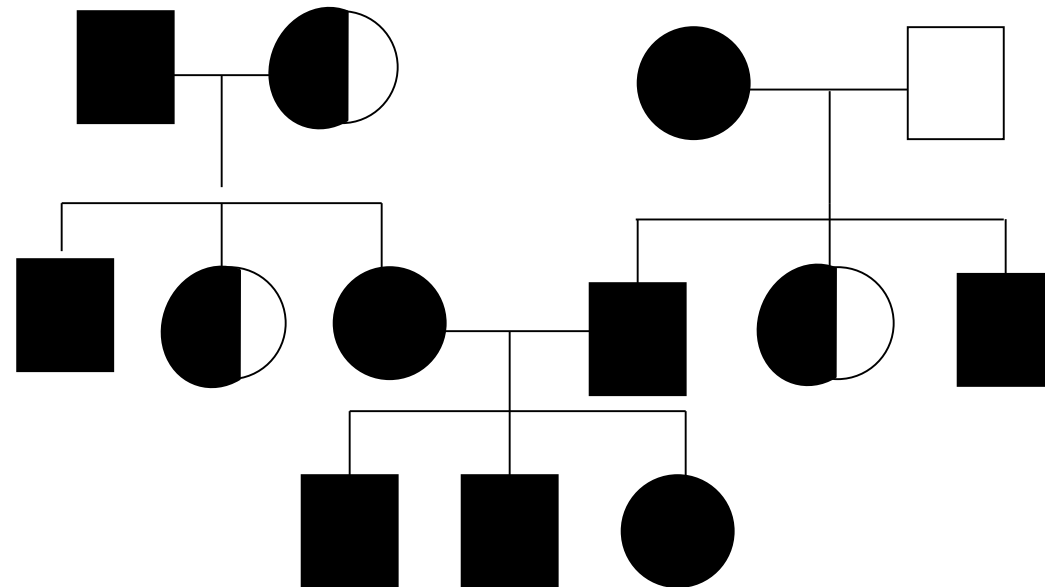
50/50 ratio  
between men and  
women have  
disorder.



# 2<sup>nd</sup> EXAMPLE OF PEDIGREE CHARTS

- Is it Autosomal or X-linked?

6 affected males  
vs  
3 affected females  
(the rest are only carriers)



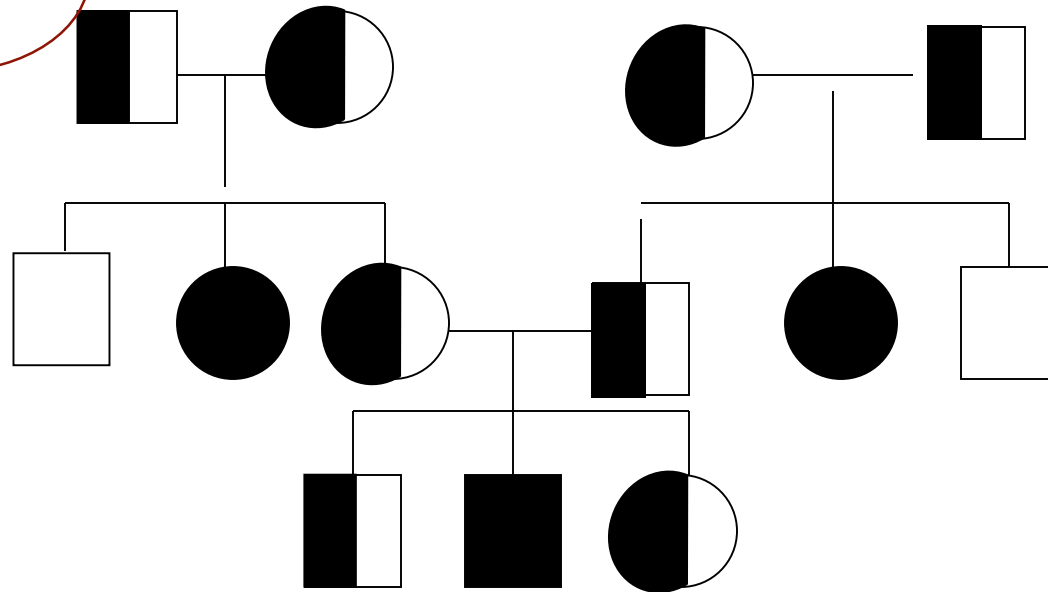
# INTERPRETING A PEDIGREE CHART

2. Determine whether the disorder is dominant or recessive.
  - If the disorder is dominant, **one** of the parents must have the disorder.
  - If the disorder is recessive, **neither** parent has to have the disorder because they can be heterozygous. (Unless X-linked, then fathers will have the recessive disorder.)

# 3<sup>rd</sup>

# EXAMPLE OF PEDIGREE CHARTS

- Dominant or Recessive?



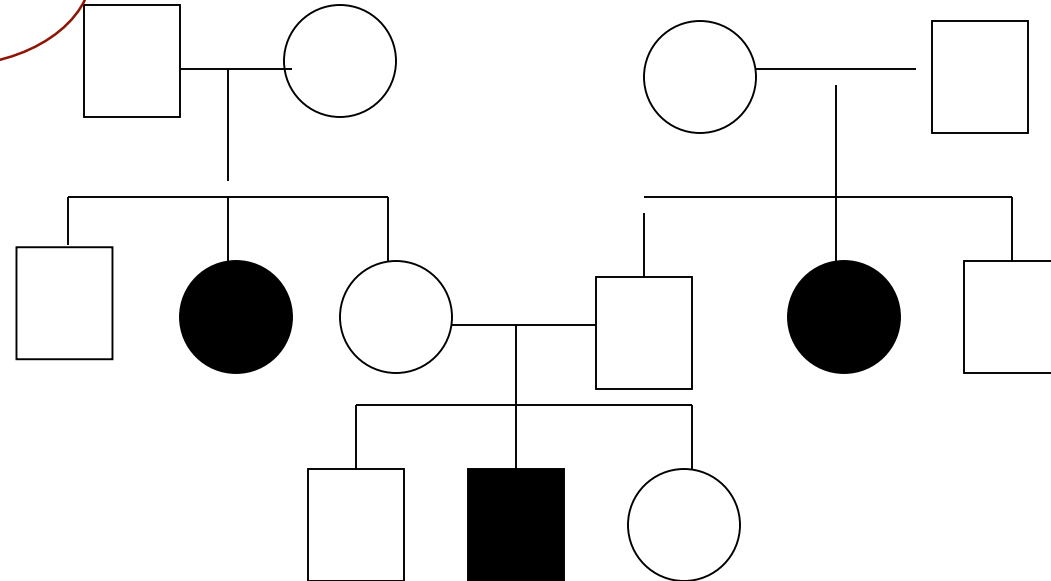
Neither parents in the 1<sup>st</sup> and 2<sup>nd</sup> generations are affected by condition (they are only carriers of it) but some of their children are.

# 3<sup>rd</sup>

# EXAMPLE OF PEDIGREE CHARTS

- Dominant or Recessive?

Neither parents in the 1<sup>st</sup> and 2<sup>nd</sup> generations are affected by condition (they are only carriers of it) but some of their children are.



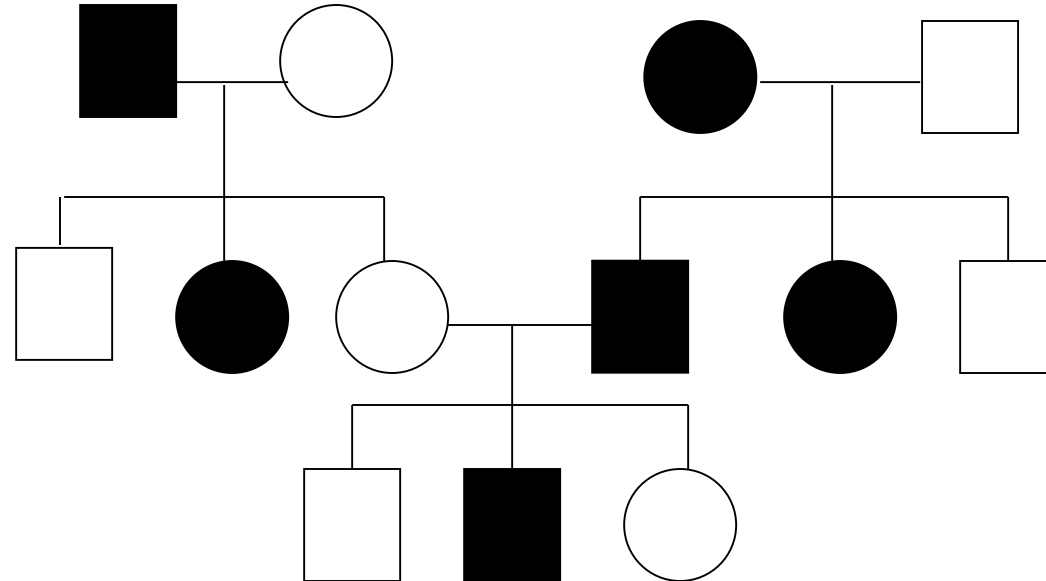
Carriers often won't be represented in pedigree problems.

It will be up to YOU to understand how to recognize them.

# 4<sup>th</sup>

# EXAMPLE OF PEDIGREE CHARTS

- Dominant or Recessive?



At least 1 parent from both the 1<sup>st</sup> and 2<sup>nd</sup> generations are affected by condition.

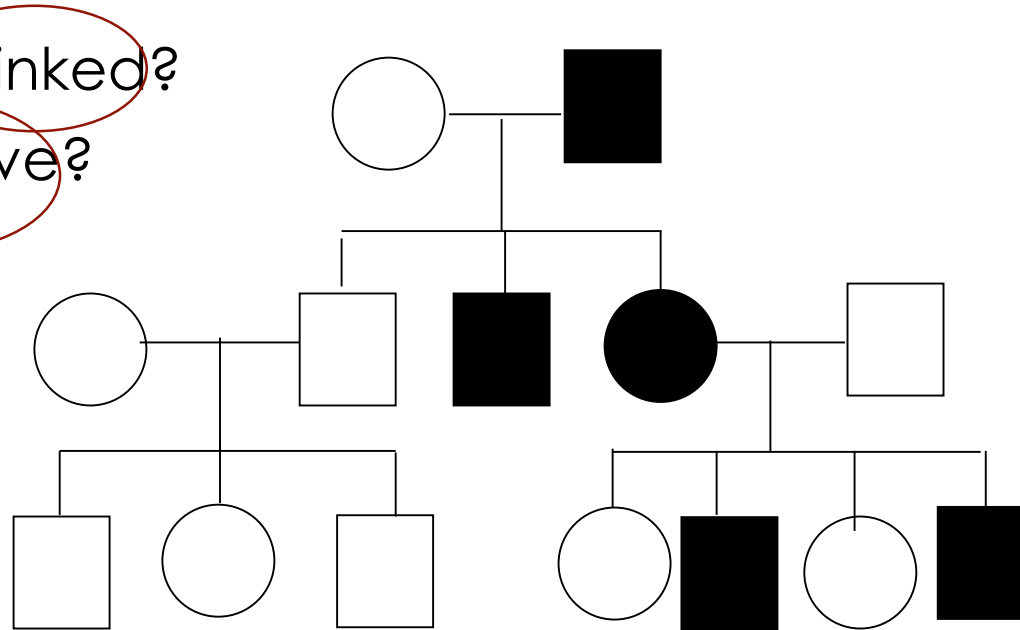
# 5<sup>th</sup>

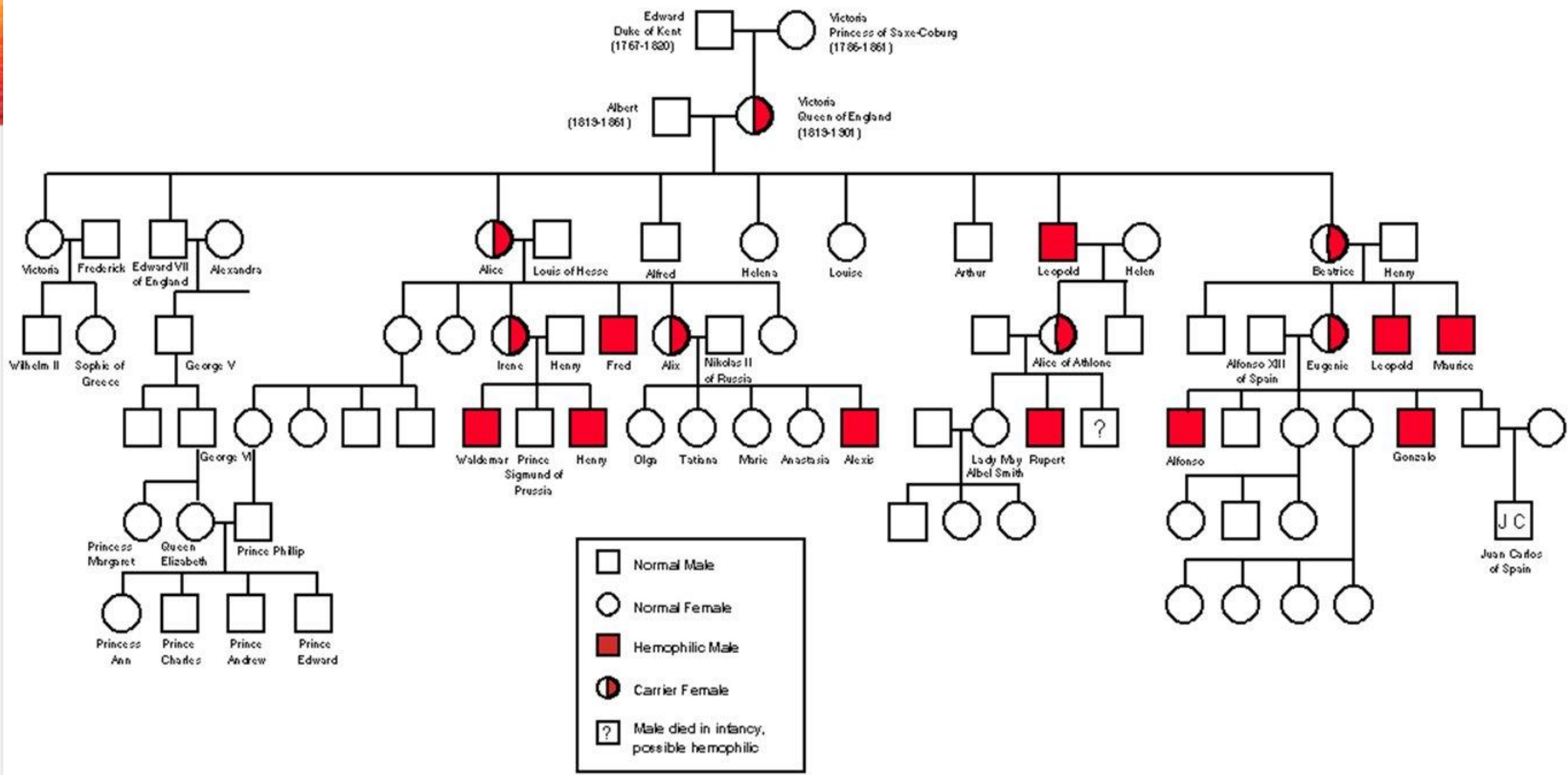
# EXAMPLE OF PEDIGREE CHARTS

- Is it Autosomal or X-linked?
- Dominant or recessive?

4 males affected  
vs  
1 female affected

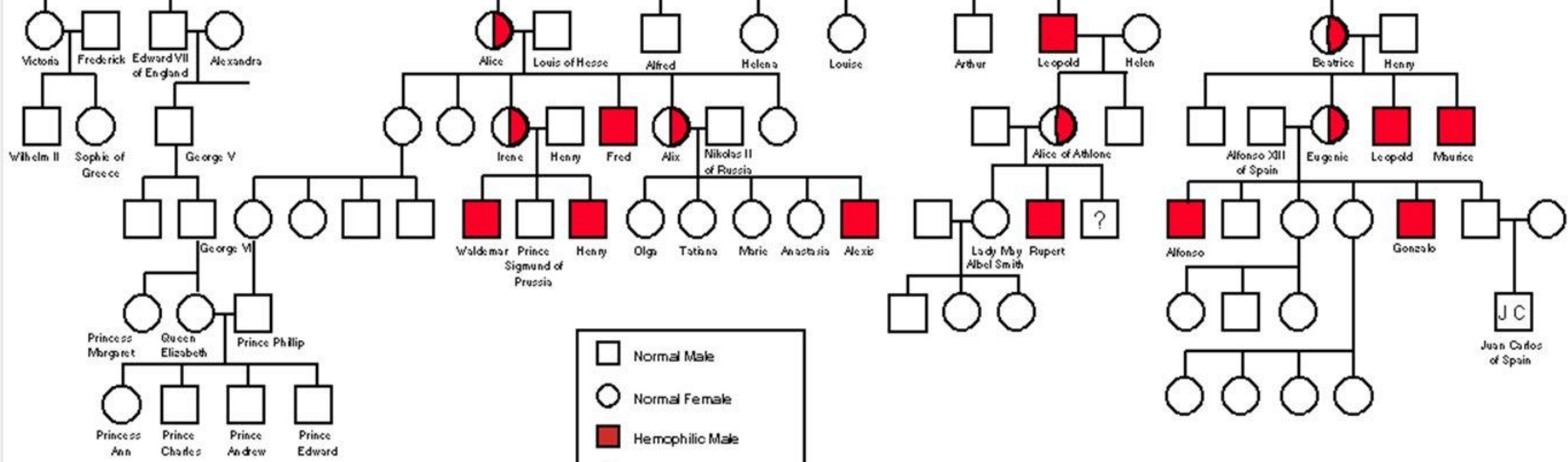
Recessive, because the affected female in 2<sup>nd</sup> generation **only** gave the disorder to her sons. Daughters are only carriers.





Edward Duke of Kent (1767-1820) and Victoria Princess of Saxe-Coburg (1786-1861)

Albert (1819-1861) and Victoria Queen of England (1819-1901)



- Normal Male
- Normal Female
- Hemophiliac Male
- Carrier Female
- Male died in infancy, possible hemophiliac



# THE MOST TECHNICAL MAP IS THE CYTOLOGICAL MAP

- This shows the sequence (order of) genes along the chromosome.
- We can see the actual A,T,G and C order of each gene on the chromosome.
- Requires very high tech equipment to construct.
- Notice the traits of the fly are mapped (#) to tell their location and order along the leg of the chromosome

