

Pedigree Analysis in Genetic Inheritance Patterns



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Outline



- What is Pedigree Analysis.
- Why do Pedigrees
- Symbols Used in Pedigrees Analysis
- Patterns of Inheritance
- Steps in Pedigree Analysis
- Applications of Pedigree Analysis

■ Objectives

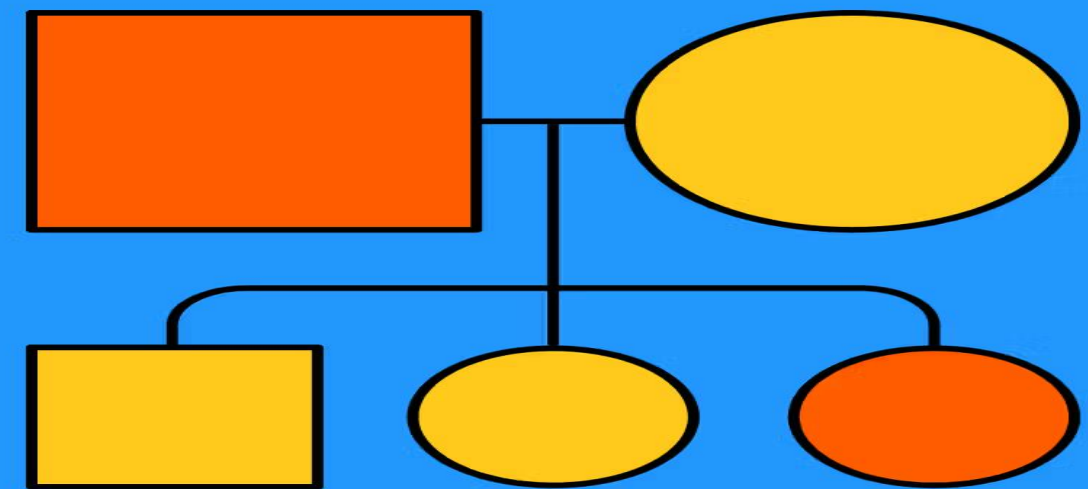


To acquaint students with the concepts of Pedigree Analysis in Genetic Inheritance Patterns.

❖ What is Pedigree Analysis?



- Is a diagram used to represent the **inheritance of a particular trait, disease, or genetic condition** within a family across multiple generations.
- Pedigree analysis helps in understanding how **genetic disorders** are passed down, and can **identify carriers, affected individuals, and predict future occurrences** in offspring.



❖ Why do Pedigrees?

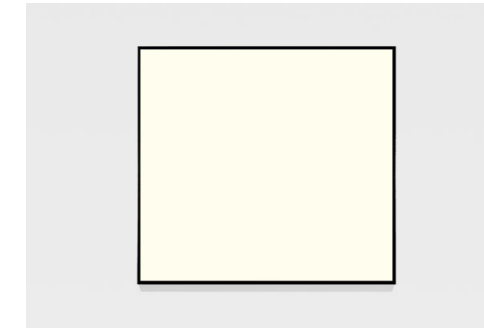


- Individuals may wish to be tested if:
 - A.) There is a family history of one specific disease.
 - B.) They show symptoms of a genetic disorder.
 - C.) They are concerned about passing on a genetic problem to their children.

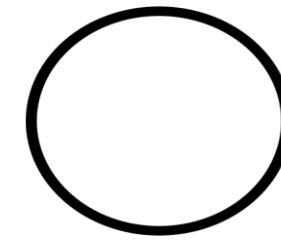
❖ Major Symbols Used in Pedigrees Analysis



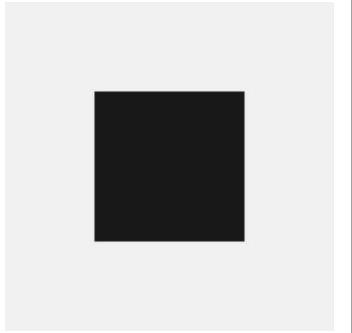
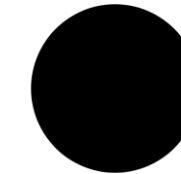
i. **Square:** – Represents a male.



ii. **Circle:** – Represents a female.

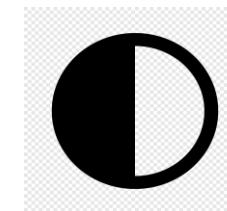


iii. **Shaded Symbol:** – Indicates an affected individual.



iv. **Unshaded Symbol** – Represents an unaffected individual.

v. **Half-Shaded Symbol** – Denotes a carrier



vi. **Horizontal Line Between Male & Female** – Represents mating



❖ More Symbols in Pedigrees Analysis



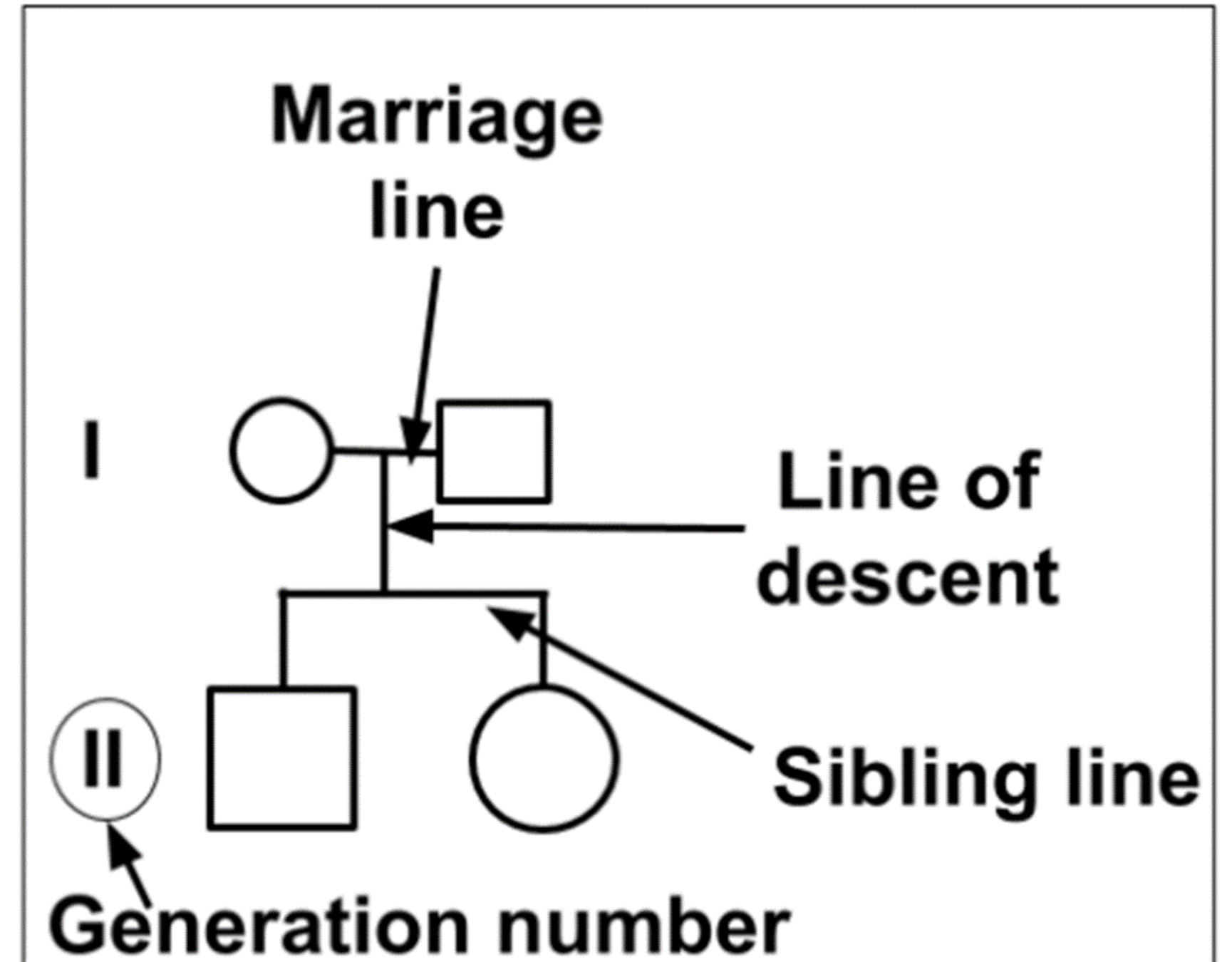
Twins



Adopted



Miscarriage



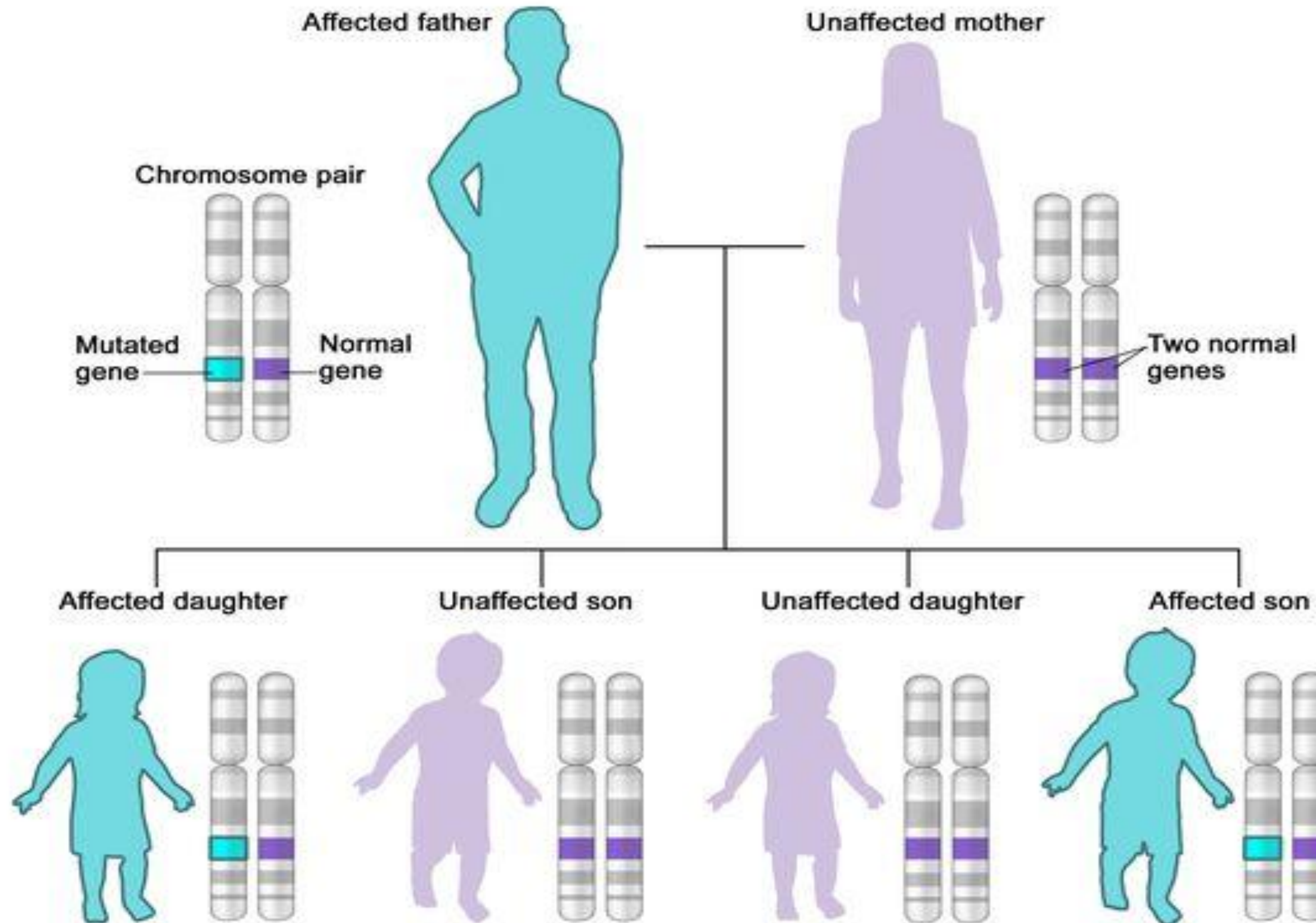
❖ Patterns of Inheritance:



1. Autosomal Dominant Inheritance Disorder:

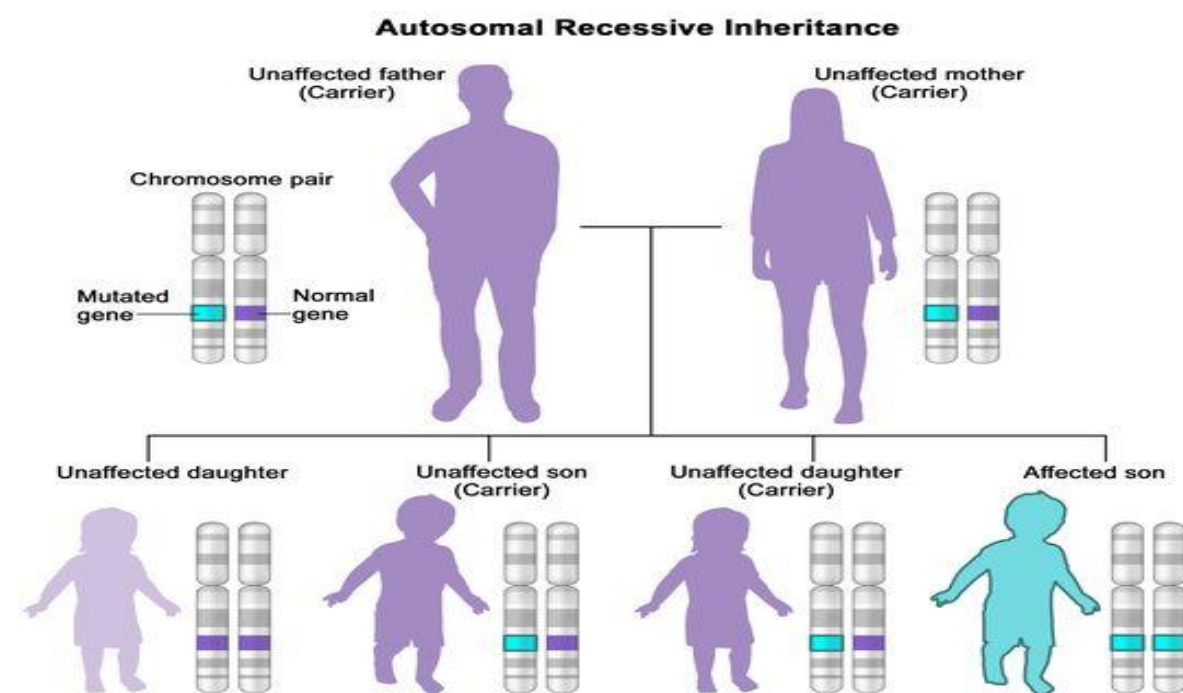
- ✓ Disorder typically appears in every generation.
- ✓ Affected individuals have at least one affected parent.
- ✓ Equal occurrence in males and females.
- ✓ Example: **Huntington's disease**, **Marfan syndrome**

Autosomal Dominant Inheritance



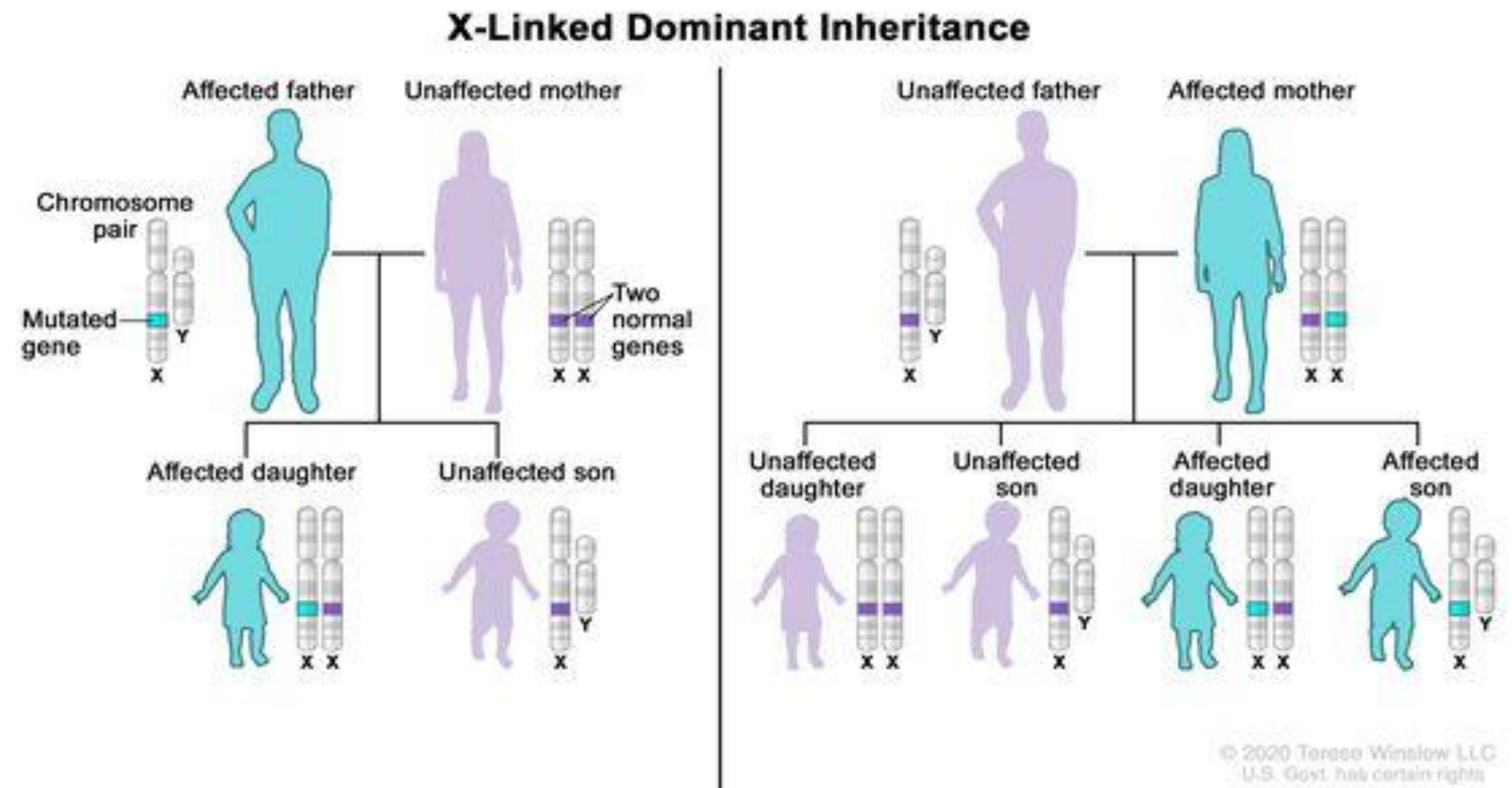
2. Autosomal Recessive Inheritance Disorder:

- ✓ Disorder may skip generations.
- ✓ Affected individuals may have unaffected parents (carriers).
- ✓ Equal occurrence in males and females
- ✓ Example: Cystic fibrosis, Sickle cell anemia, Phenylketonuria (PKU).



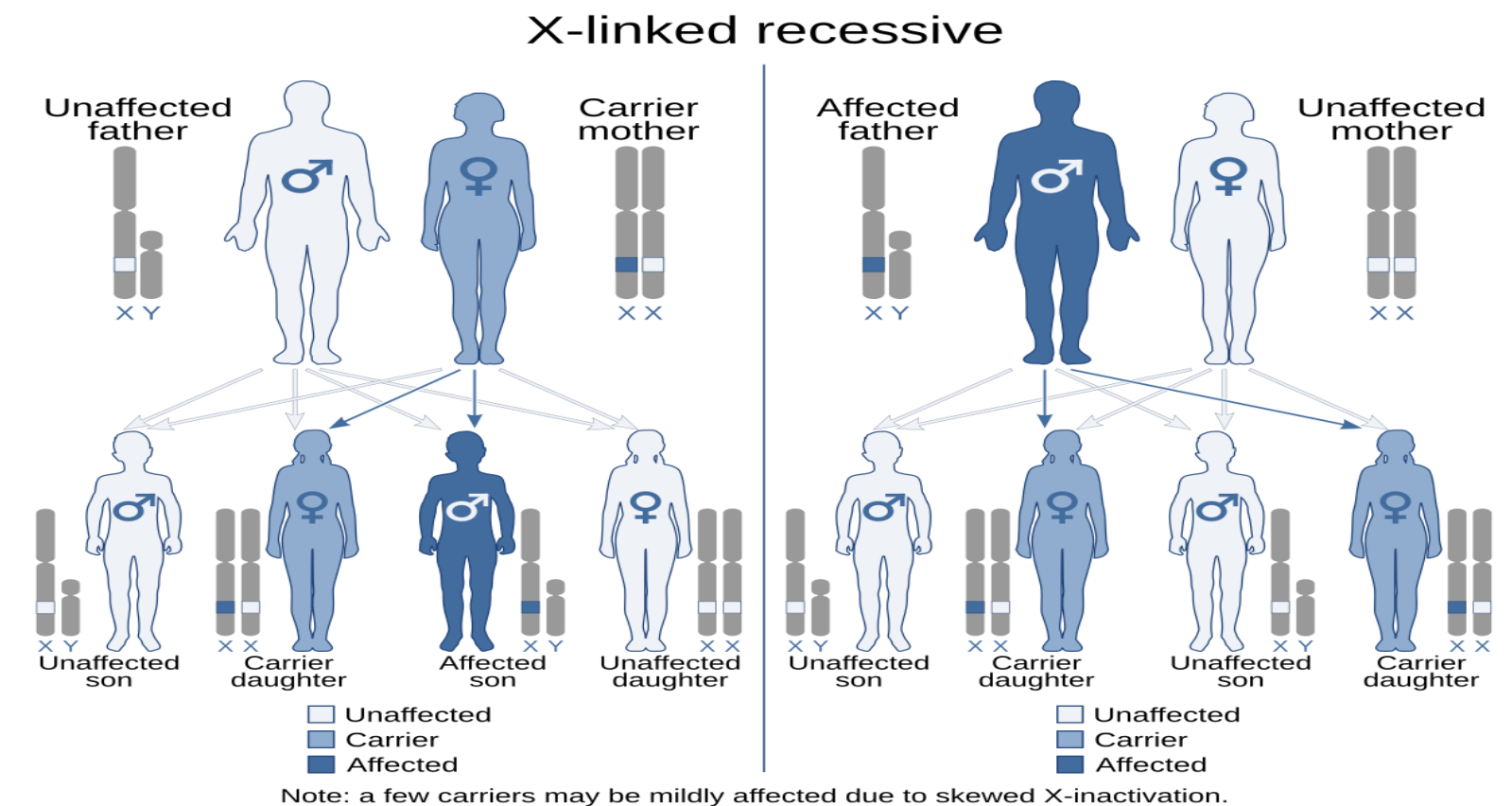
3. X-linked Dominant Inheritance Disorder:

- ✓ No male-to-male transmission.
- ✓ Affected males pass the disorder to all daughters, but not sons.
- ✓ Affected females can pass the disorder to both sons and daughters.
- ✓ Example: Rett syndrome.



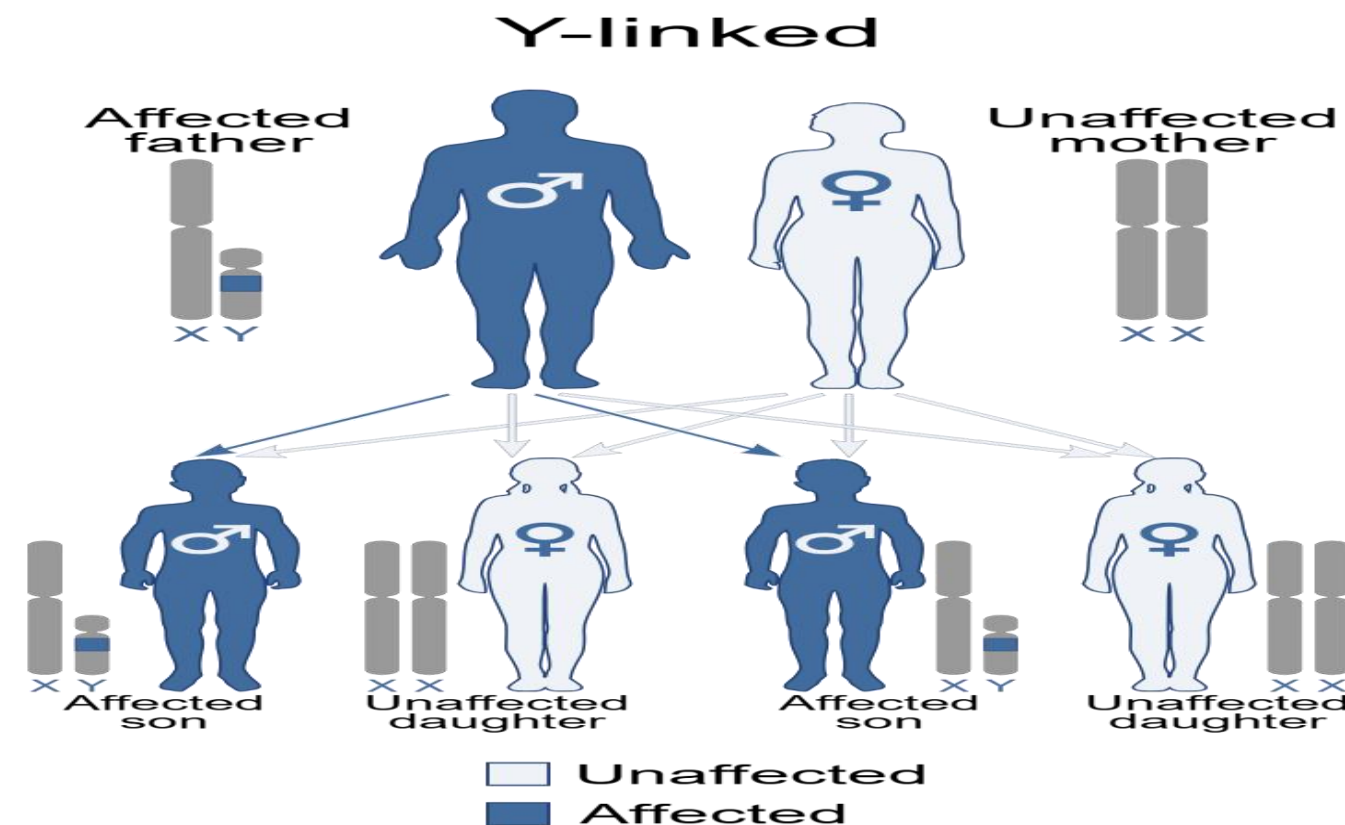
4. X-linked Recessive Inheritance Disorder:

- ✓ More common in males (as they inherit only one X chromosome).
- ✓ Affected males typically inherit from carrier mothers.
- ✓ No male-to-male transmission.
- ✓ Example: Hemophilia, Duchenne muscular dystrophy



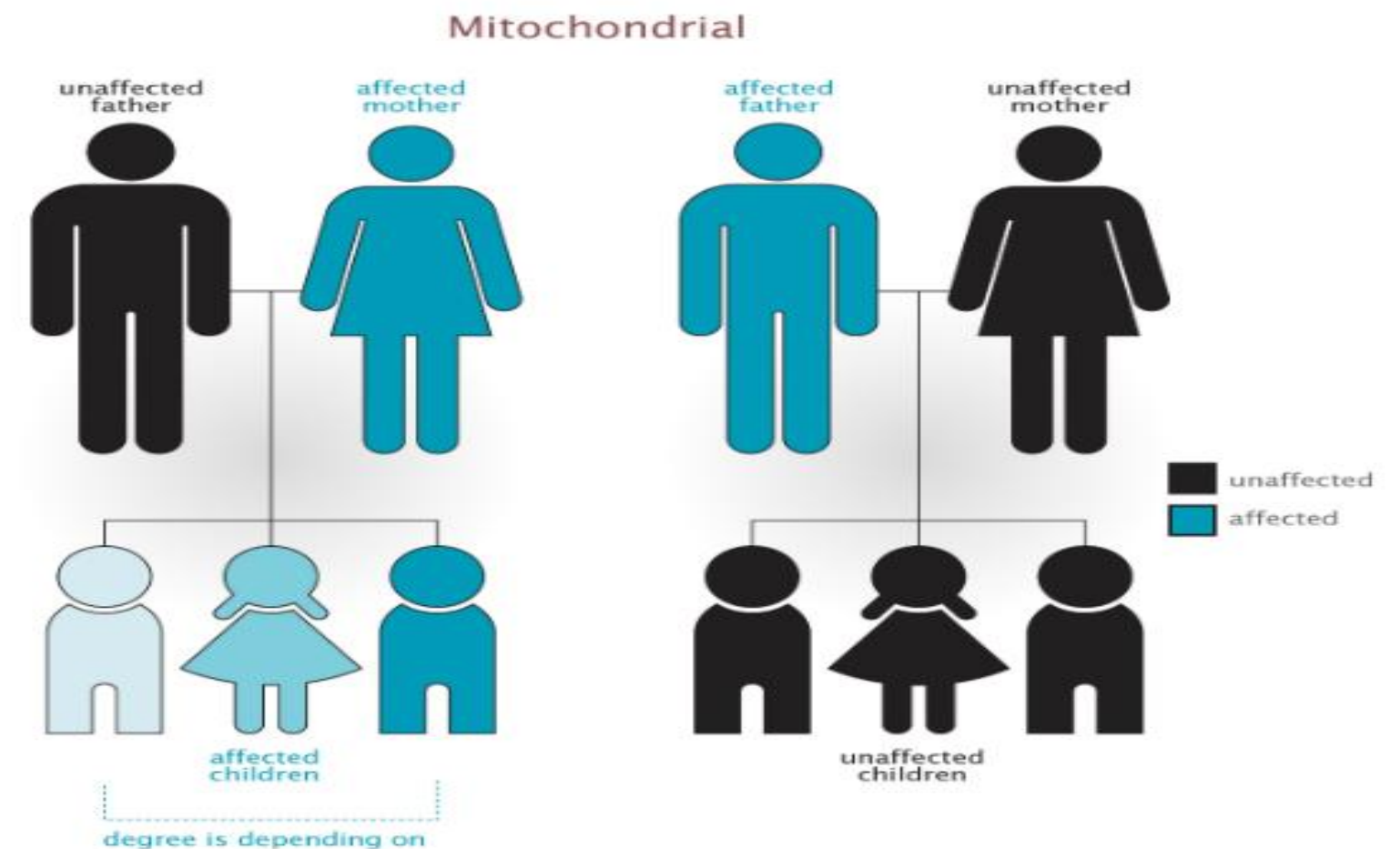
5. Y-linked Inheritance Disorder:

- ✓ Only males are affected.
- ✓ Affected males pass the disorder to all of their sons.
- ✓ No female carriers or affected females
- ✓ No skipping of generations



6. Mitochondrial Inheritance Disorder:

- ✓ Passed only through the mother.
- ✓ All offspring of an affected mother inherit the disorder.
- ✓ Example: Leber's hereditary optic neuropathy



❖ Steps in Pedigree Analysis:



1. **Step 1: Collect Family History Data**
2. **Step 2: Construct the Pedigree Chart.**
3. **Step 3: Identify the Mode of Inheritance.**
4. **Step 4: Confirm with Additional Data.**
5. **Step 5: Calculate Risk Probabilities**
6. **Step 6: Interpret Findings and Provide Recommendations**

❖ Applications of Pedigree Analysis:



1. Medical Genetics.
2. Evolutionary Biology
3. Forensic Science
4. Animal Breeding & Agriculture

❖ Classwork: Pedigree Analysis Activity:



Question: A family has a history of hemophilia (an X-linked recessive disorder). The mother is a carrier, and the father is unaffected. Draw the pedigree using standard symbols for three generations and determine the probability of their son having hemophilia.

References



- Babcock, E. B., & Collins, J. L. (1918). Genetics laboratory manual. McGraw-Hill Book Company Incorporated.
- Blair, C. (2018). BIO2450L Genetics Laboratory Manual.
- VENNISON, S. (2009). Laboratory manual for genetic engineering. PHI Learning Pvt. Ltd..



Thanks