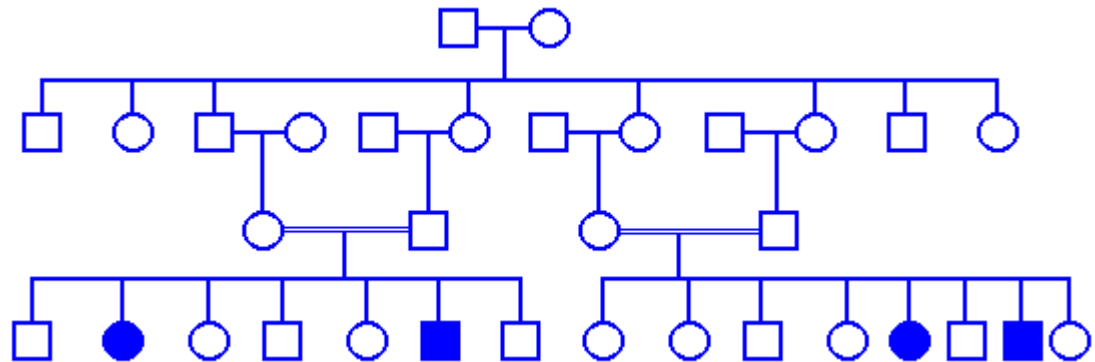


How to Solve Problems Involving Pedigrees

1. Since the pedigrees presented are **simple** pedigrees, the following assumptions can be made:
 - a. No new mutations occur in the families. This means that a dominant trait must occur in a parent if it appears in a child. This also means that if a recessive trait appears in a child but does not occur in either parent, both parents must be heterozygous carriers for the trait.
 - b. All traits are 100% penetrant. This means that if the genotype for the trait occurs in an individual, the trait will appear.
2. If neither parent is affected,
 - a. the trait cannot be dominant.
 - b. the trait could be recessive and either parent or both could be heterozygous carriers.
3. If one parent is affected,
 - a. the trait could be dominant and the affected parent could be heterozygous while the unaffected parent is not a carrier
 - b. the trait could be recessive and the affected parent is homozygous while the unaffected parent could be a heterozygous carrier
4. If both parents are affected
 - a. the trait could be dominant and both parents could be heterozygous carriers which means that some of the children could be unaffected
 - b. the trait could be recessive meaning that both parents would have to be homozygous and all the children would have to be affected
5. Consideration of X-linked or Y-linked traits:
 - a. X-linked recessive
 - i. affected male children must have, at least, an heterozygous mother
 - ii. an affected female will transmit the trait to **all** male children
 - b. X-linked dominant
 - i. affected males transmit the trait to **all** daughters
 - ii. affected sons must have an affected mother
 - c. Y-linkage
 - i. male to male transmission only
 - ii. no affected females
6. Mitochondria associated traits
 - a. affected females transmit the trait to all children
 - b. affected males do not transmit the trait to any children

Mendelian Problem Set

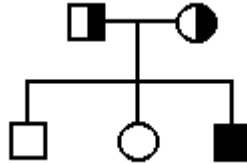
1. Tom and Jane, who have two, healthy children (Liam and Leah) are the parents of a third child, Leander. The front of Leander's diapers show a brown coloration characteristic of alcaptonuria, a trait inherited as an autosomal recessive disorder.
 - a. Draw a pedigree of this family using the standard symbols. Indicate which members of the pedigree must be carriers of alcaptonuria using a half-filled symbol.
 - b. If Tom and Jane have another child, what is the probability it will have alcaptonuria?
2. Given below is a pedigree of some of the "blue" people of Kentucky.



- a. The "blue" trait is inherited as an autosomal recessive trait which means that affected individuals have ____ copies of a mutant gene.
- b. Indicate the individuals who are carriers of the "blue" trait but do not show it as adults (place the letters **Bb** next to each symbol of an obligate carrier).
- c. What is the relationship of the parents of the "blue" children?
- d. What is the probability that the unaffected sibs of the "blue" children are carriers for the "blue" trait?

Answers to Problem Set

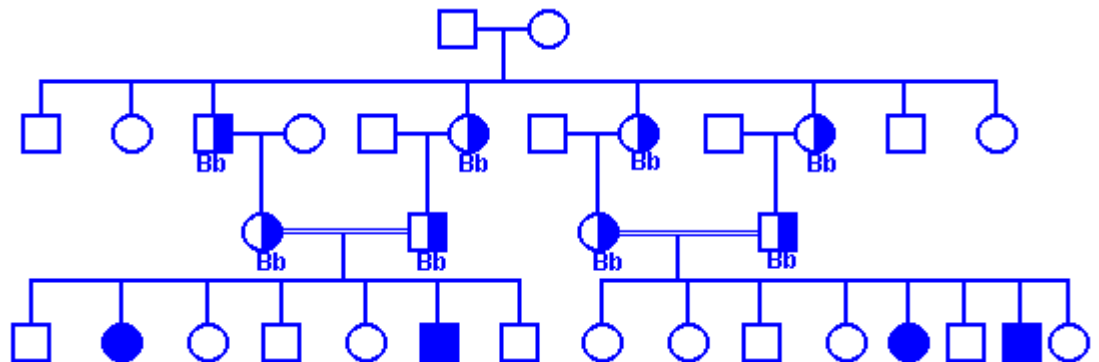
1. Tom and Jane, who have two, healthy children (Liam and Leah) are the parents of a third child, Leander. The front of Leander's diapers show a brown coloration characteristic of alcaptonuria, a trait inherited as an autosomal recessive disorder.
 - a. Draw a pedigree of this family using the standard symbols. Indicate which members of the pedigree must be carriers of alcaptonuria using a half-filled symbol.



- b. If Tom and Jane have another child, what is the probability it will have alcaptonuria?

$Aa \times Aa$ produces $1/4 AA$ $1/2 Aa$ $1/4 aa$. Answer = $1/4$

2. A pedigree of some of the "blue" people of Kentucky (see below).
 - a. The "blue" trait is inherited as an autosomal recessive trait which means that affected individuals have 2 copies of a mutant gene.
 - b. Indicate the individuals who are carriers of the "blue" trait but do not show it as adults (place the letters **Bb** next to each symbol of an obligate carrier).



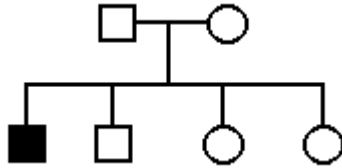
- c. What is the relationship of the parents of the "blue" children? **First Cousins**
 - d. What is the probability that the unaffected sibs of the "blue" children are carriers for the "blue" trait?

An unaffected person is either **BB** or **Bb**. Among the children of a **Bb** x **Bb** mating **who are unaffected**, $1/3$ are **BB** and $2/3$ are **Bb**.

Pedigree Tests

Select one of the several pedigrees to test yourself on your understanding of Mendelian genetic analysis.

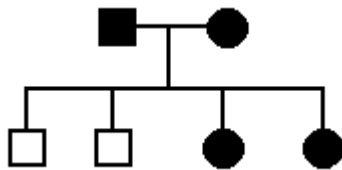
Pedigree A



- Could this trait be inherited as a simple **autosomal recessive**? [YES](#) [NO](#)
Could this trait be inherited as a simple **autosomal dominant**? [YES](#) [NO](#)
Could this trait be inherited as a simple **X-linked recessive**? [YES](#) [NO](#)
Could this trait be inherited as a simple **X-linked dominant**? [YES](#) [NO](#)
Could this trait be inherited as a simple **Y-linked trait**? [YES](#) [NO](#)

Answers: Yes, No, Yes, No, No

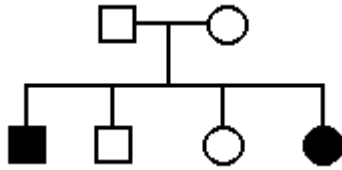
Pedigree B



- Could this trait be inherited as a simple **autosomal recessive**? [YES](#) [NO](#)
Could this trait be inherited as a simple **autosomal dominant**? [YES](#) [NO](#)
Could this trait be inherited as a simple **X-linked recessive**? [YES](#) [NO](#)
Could this trait be inherited as a simple **X-linked dominant**? [YES](#) [NO](#)
Could this trait be inherited as a simple **Y-linked trait**? [YES](#) [NO](#)
Could this trait be inherited as **mitochondria associated**? [YES](#) [NO](#)

Answers: No, Yes, No, Yes, No, No

Pedigree C



Could this trait be inherited as a simple **autosomal recessive**? [YES](#) [NO](#)

Could this trait be inherited as a simple **autosomal dominant**? [YES](#) [NO](#)

Could this trait be inherited as a simple **X-linked recessive**? [YES](#) [NO](#)

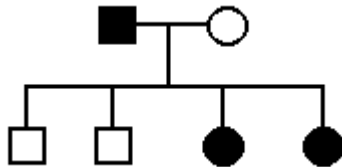
Could this trait be inherited as a simple **X-linked dominant**? [YES](#) [NO](#)

Could this trait be inherited as a simple **Y-linked trait**? [YES](#) [NO](#)

Could this trait be inherited as **mitochondria associated**? [YES](#) [NO](#)

Answers: Yes, No, No, No, No, No

Pedigree D



Could this trait be inherited as a simple **autosomal recessive**? [YES](#) [NO](#)

Could this trait be inherited as a simple **autosomal dominant**? [YES](#) [NO](#)

Could this trait be inherited as a simple **X-linked recessive**? [YES](#) [NO](#)

Could this trait be inherited as a simple **X-linked dominant**? [YES](#) [NO](#)

Could this trait be inherited as a simple **Y-linked trait**? [YES](#) [NO](#)

Could this trait be inherited as **mitochondria associated**? [YES](#) [NO](#)

Answers: Yes, Yes, Yes, Yes, No, No

*For more questions go to the website below and then under the genetics section select Pedigree Interpretation: <http://www.med.uiuc.edu/question/>