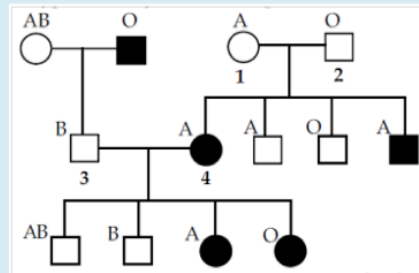


Part A: Pedigree Analysis 1

Alkaptonuria is an extremely rare disease. The gene for Alkaptonuria (ALK) has recently been shown to lie on human chromosome 9 and to be linked to the gene encoding the ABO blood group, with a recombination frequency of 11% between the loci. A pedigree of a family with the disease is shown below, with affected individuals indicated in black. In addition, the blood type of family members is given.



The two alleles at the ALK locus will be denoted + (wild type, no ALK) and - (the ALK allele). The three alleles at the ABO blood group locus will be denoted A, B (which are co-dominant) and O (which is recessive to A and B).

For the following questions, you **MUST** enter your answers using the format indicated; otherwise, they will not be recognized as correct.

What is the genotype of individual 1 at the ALK and ABO loci?

Write the ABO alleles first (e.g., AO+-); write dominant alleles first; in an instance of codominance, write A before B.

Answer:

What is the genotype of individual 2 at the ALK and ABO loci? Follow the same writing conventions as above.

Answer:

What is the genotype of individual 3 at the ALK and ABO loci? Follow the same writing conventions as above.

Answer:

For individual 3, which alleles of each gene are carried on the chromosome he inherited from his father and which alleles are carried on the chromosome he inherited from his mother?

In the answer box below, answer for the father; in the following answer box, answer for the mother.

For these two answers, write the ABO allele first, followed by a comma and a space, and then the ALK allele (e.g., A, +).

Answer:

Answer for the mother:

Answer:

The following question is a bonus question that will be worth an extra 2% on the next unit test if you get it right.

You must review your answer with me before the end of the activity to get the bonus.

Individuals 3 and 4 are expecting their fifth child. A physician draws a prenatal blood sample and determines that the child has blood type B.

B. What is the probability that the child will have alkaptonuria? Explain your answer.

A

▼

B

I

A

▼

☰

☷

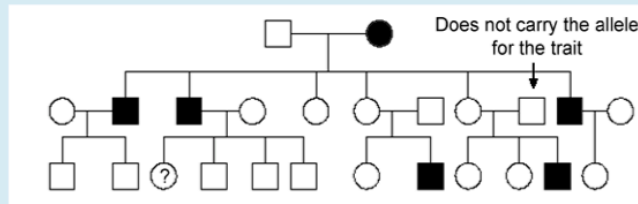
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Part B: Pedigree Analysis 2

What type of inheritance does this pedigree represent, and what is the probability that the child in question (?) will be affected? Assume a $\frac{1}{2}$ probability for each of ?'s mother's possible genotypes.



Select one:

- ☐ a. X-linked recessive, $\frac{1}{2}$
- ☐ b. X-linked recessive, $\frac{1}{4}$
- ☐ c. X-linked recessive, $\frac{1}{3}$
- ☐ d. Autosomal recessive, $\frac{1}{2}$
- ☐ e. Autosomal recessive, $\frac{1}{4}$

If the pedigree from the question above represented autosomal recessive inheritance (this is a hypothetical situation... just go with it), and I told you that ?'s grandparents on her mother's side (? 's mother's parents) were both heterozygous for the trait, what would you estimate to be the probability of '?' expressing the recessive phenotype?

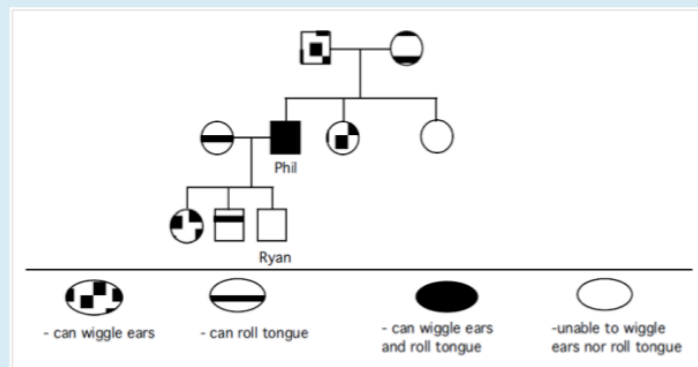
Select one:

- ☐ a. $\frac{1}{2}$
- ☐ b. $\frac{1}{3}$
- ☐ c. $\frac{1}{4}$
- ☐ d. $\frac{2}{3}$
- ☐ e. $\frac{1}{6}$

Part C: Extra

This pedigree analysis is for extra credit if you have time. It's good practice, though, even if you can't complete it during class.

The ability to roll one's tongue in a U shape is an autosomal dominant trait that maps to the same chromosome as another autosomal dominant trait, the ability to wiggle one's ears. Consider the following pedigree:



What are the genotypes of Phil and Ryan with respect to these two genes? Answer for Phil in the box below, and for Ryan in the following box.

Use the letter E for ear wiggling and the letter R for tongue rolling; use capital letters for the dominant alleles and lower case for the recessive alleles, and write dominant alleles first; write E first (e.g., EeRr).

Answer:

Answer for Ryan:

Answer:

What are the genotypes of Phil and Ryan with respect to these two genes? Answer for Phil in the box below, and for Ryan in the following box.

Use the letter E for ear wiggling and the letter R for tongue rolling; use capital letters for the dominant alleles and lower case for the recessive alleles, and write dominant alleles first; write E first (e.g., EeRr).

Answer:

Answer for Ryan:

Answer:

How do you account for the fact that Ryan is unable to roll his tongue or wiggle his ears? Remember, the E and R genes are on the same chromosome, i.e., they are linked.

