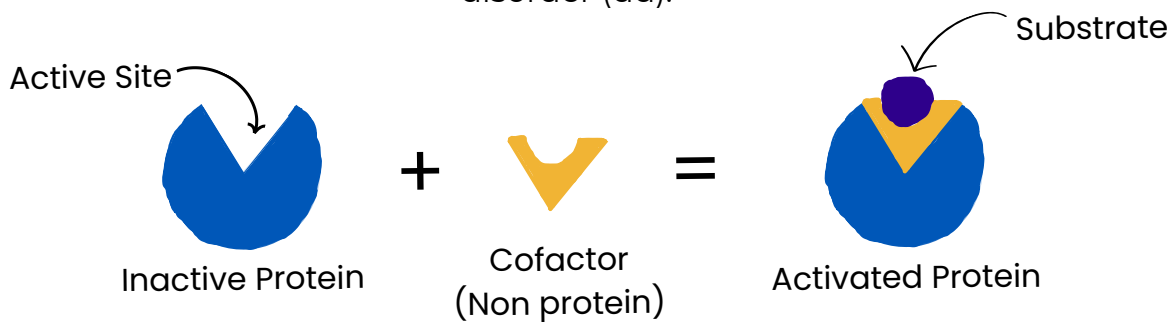


# Using Punnett Squares to understand Molybdenum Cofactor Deficiency (Moco D)

Molybdenum is a micronutrient that multicellular organisms need to break down toxins in the body. In order for this to work, it must bind to Molybdenum cofactor (Moco). A cofactor binds to an enzyme to make it active. If a person does not have the cofactor, toxins build up and can cause problems starting at birth. These problems include developmental issues, seizures, and troubles with feeding. Patients with this disorder typically do not survive past childhood. The cofactor deficiency is an autosomal recessive disorder (dd).



1. One parent is heterozygous (Dd) for Molybdenum cofactor deficiency (Moco D) and the other has two typical copies of the gene (DD).
  - a. Draw a Punnett Square for the possible genotypes of their kids. List the possible genotypes next to the Punnett Square.

	D	d	
D	DD	Dd	1/2 DD 1/2 Dd
D	DD	Dd	4/4 "Normal"

- b. What are the chances they will have a child with the deficiency? Show the chances as a fraction and a percentage.

They will have a 0% chance of having a child with MoCo deficiency.

2. Susan has family members with Moco deficiency, so she decides to see a genetic counselor to learn about her genotype. She wants to have kids but wants to know the risk of Moco deficiency ahead of time. She and her husband get tested and are both heterozygous.

a. Draw a Punnett Square of the possible genotypes of their children.

	D	d
D	DD	Dd
d	Dd	dd

1/4 DD  
 1/2 Dd  
 1/4 dd  
  
 3/4 "normal"  
 1/4 MoCo deficiency

b. What is the likelihood (in a percentage) that their child will have Moco D?

25% chance of MoCo Deficiency

c. Genetic counselors often have difficult conversations with patients. What is one thing you would discuss with Susan regarding the results of this genotype?

You have a 25% chance of having a child with MoCo deficiency.

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3. Ron is only a couple weeks old, has had some seizures, and is not developing as quickly as he should be. Ron's doctor suggested that Ron get a genetic test for Moco D and the test revealed that Ron has Moco D. Additionally, Ron's mom knows that she is heterozygous.

a. What is the genotype of Ron's dad? Explain how you know. (Hint: Refer back to the introduction paragraph for a clue.)

Ron's dad has to be heterozygous in order for there to be a chance of having a baby with the disorder.

	D	d
D	DD	Dd
d	Dd	dd

b. What is the probability that Ron's future siblings have Moco D?

There is a 25% for each future pregnancy that the child will have Moco D.



4. The Warnhoff Lab at Sanford Research uses a worm called *C. elegans* to study MocoD. A lab technician wants to breed some of the *C. elegans* to have the deficiency and some of the *C. elegans* to show the wild-type phenotype. Help the lab technician breed the worms to get the outcomes below.

Genotypes of some of the *C. elegans* in the lab:

1. DD
2. Dd
3. dd
4. Dd
5. dd

a. In order to get offspring that will **all** have Moco D, breed worm # 3 and # 5.

	d	d
d	dd	dd
d	dd	dd

b. In order to get offspring that will **all** have a normal phenotype, breed worm # \_\_\_ and # \_\_\_.


Could be any combination of any worms that are not #3 or #5

c. If 152 offspring are produced between worm 2 and worm 4, and they matched the probability of the punnett square, how many *C. elegans* would there be of each genotype?

	D	d
D	DD	Dd
d	Dd	dd

Number of offspring

DD: 38

Dd: 76

dd: 38

