

The Genetics Home Reference Challenge

Created March 2009

DNA	Chromosomes	Inheritance	Mutations	Genes
<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
<u>200</u>	<u>200</u>	<u>200</u>	<u>200</u>	<u>200</u>
<u>300</u>	<u>300</u>	<u>300</u>	<u>300</u>	<u>300</u>
<u>400</u>	<u>400</u>	<u>400</u>	<u>400</u>	<u>400</u>
<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>

[Final Question](#)

DNA – 100 points

What do the letters D-N-A stand for?

Answer



DNA – 100 points

What do the letters D-N-A stand for?

Deoxyribonucleic acid



DNA – 200 points

Name the 4 bases that make up DNA

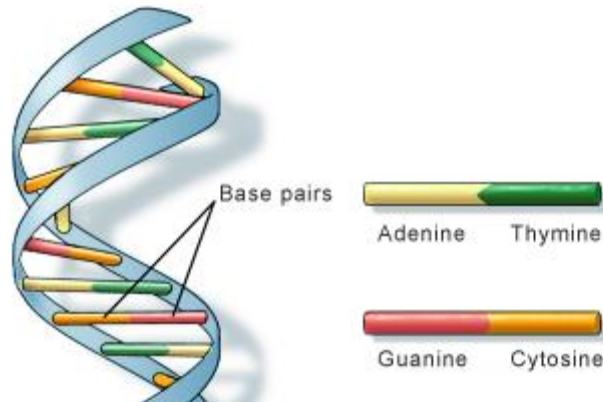
Answer



DNA – 200 points

Name the 4 bases that make up DNA

Adenine (A), Thymine (T),
Guanine (G), and Cytosine (C)



DNA – 300 points

What is the structure of DNA called?

Answer



DNA – 300 points

What is the structure of DNA called?



Double helix



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Genetics Home Reference
Your Guide to Understanding Genetic Conditions

DNA – 400 points

Name 2 areas in the cell where DNA is located

Answer



DNA – 400 points

Name 2 areas in the cell where DNA is located

Most DNA is located in the **cell nucleus.**

A small amount is located within the **mitochondria.**



DNA – 500 points

What molecule carries the information from the DNA out of the nucleus?

Answer



DNA – 500 points

What molecule carries the information from the DNA out of the nucleus?

Messenger RNA (mRNA)



Chromosomes – 100 points

Which chromosome is the largest?

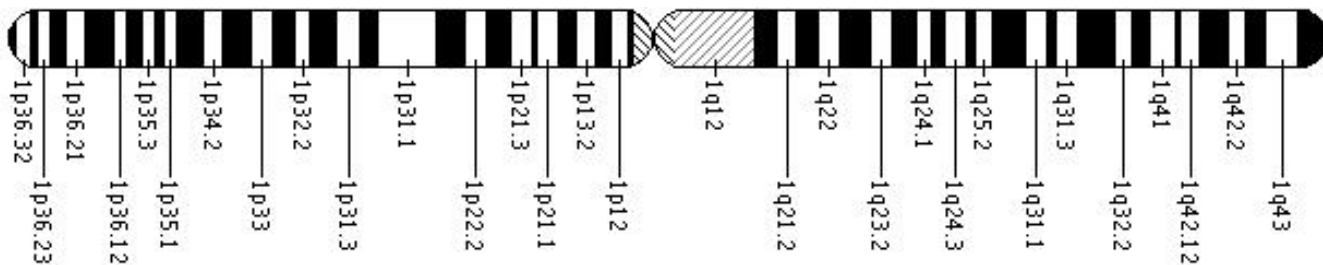
Answer



Chromosomes – 100 points

Which chromosome is the largest?

Chromosome 1



Chromosomes – 200 points

What is the constriction point of a chromosome called?

Answer



Chromosomes – 200 points

What is the constriction point of a chromosome called?

Centromere



Chromosomes – 300 points

How many chromosomes are in a normal sperm or egg cell?

Answer



Chromosomes – 300 points

How many chromosomes are in a normal sperm or egg cell?

23



Chromosomes – 400 points

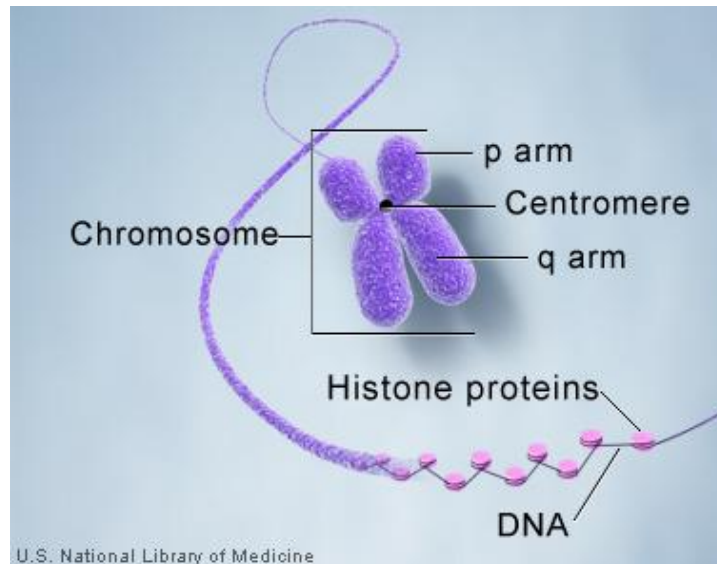
Chromosomes are made up of DNA tightly coiled around proteins called _____

Answer



Chromosomes – 400 points

Chromosomes are made up of DNA tightly coiled around proteins called _____



Histones



← Back

Chromosomes – 500 points

How many autosomes does a person have
in their skin cells?

Answer



Chromosomes – 500 points

How many autosomes does a person have
in their skin cells?

44



Inheritance – 100 points

Name any 3 patterns of inheritance

Answer



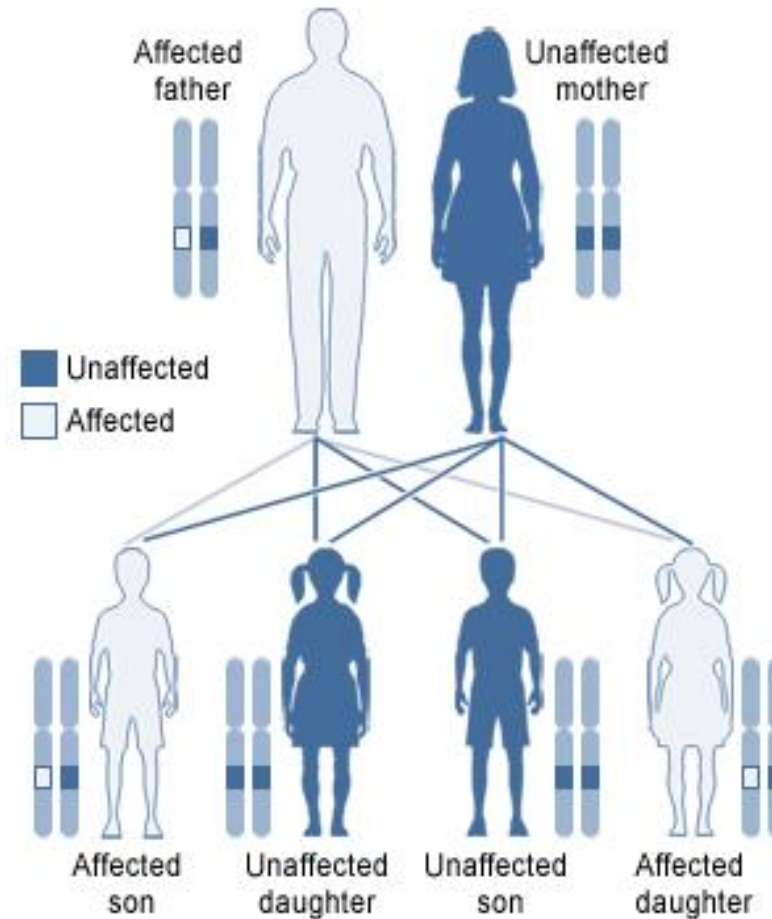
Inheritance – 100 points

Name any 3 patterns of inheritance

- Autosomal dominant
- Autosomal recessive
- X-linked recessive
- X-linked dominant
- Codominant
- Mitochondrial



Autosomal Dominant Inheritance

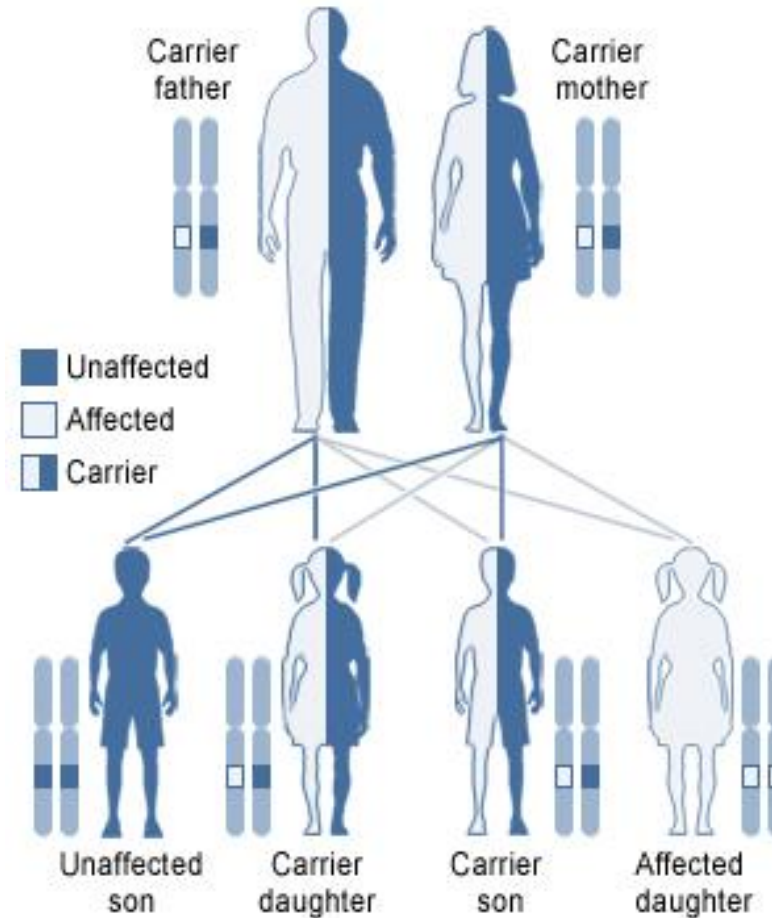


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[Back to Answer](#)

Autosomal Recessive Inheritance



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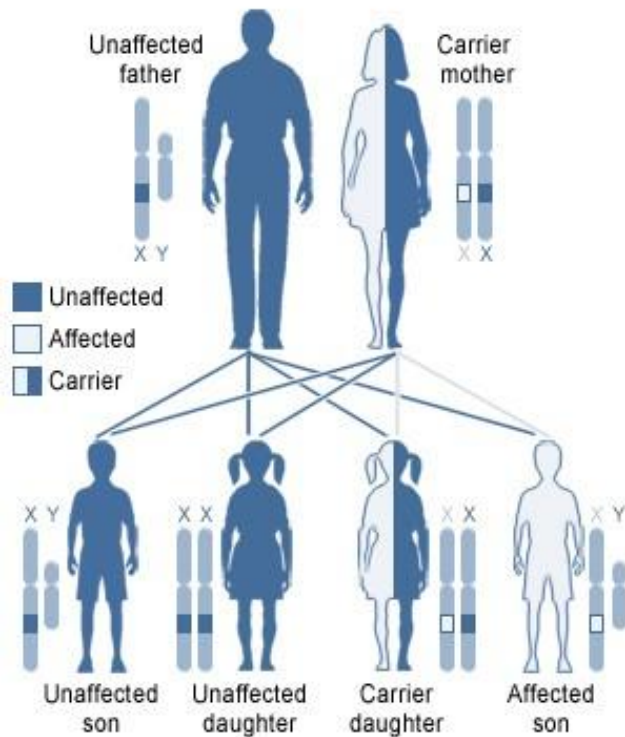


← Back

[Back to Answer](#)

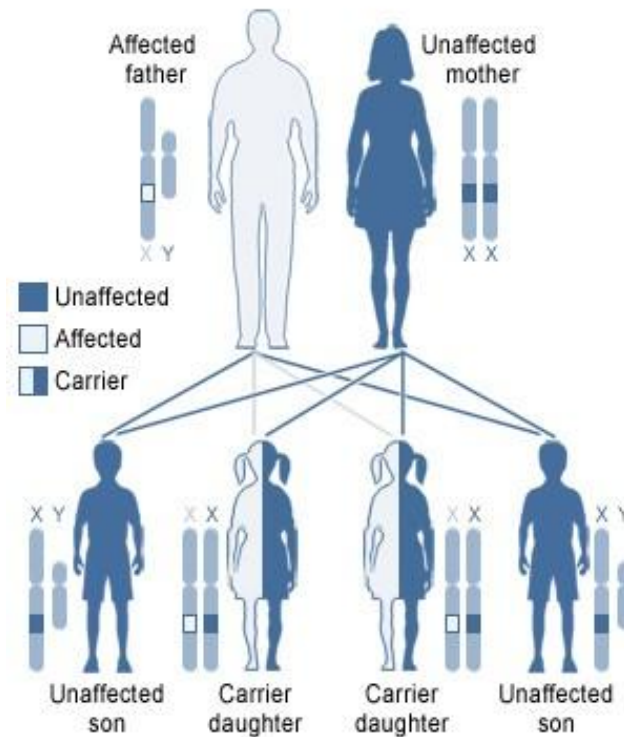
X-Linked Recessive Inheritance

X-linked recessive, carrier mother



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X-linked recessive, affected father



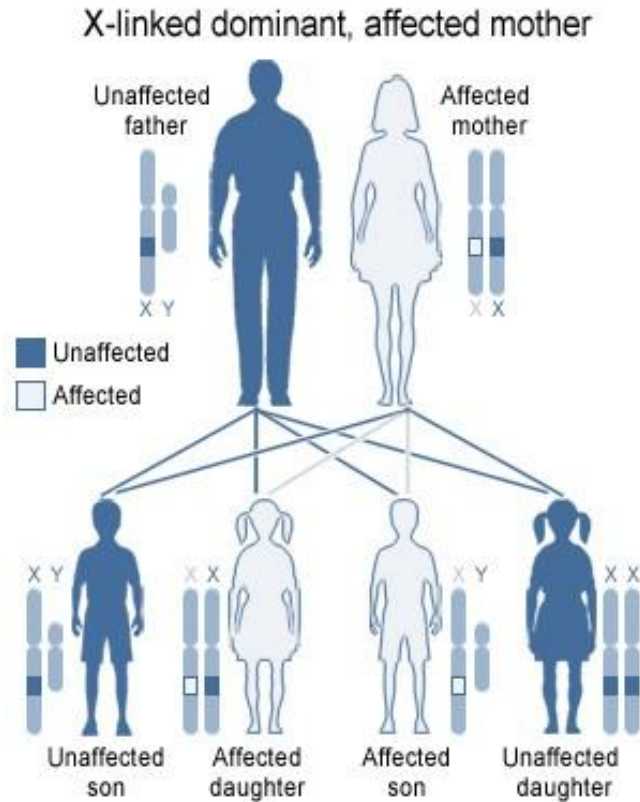
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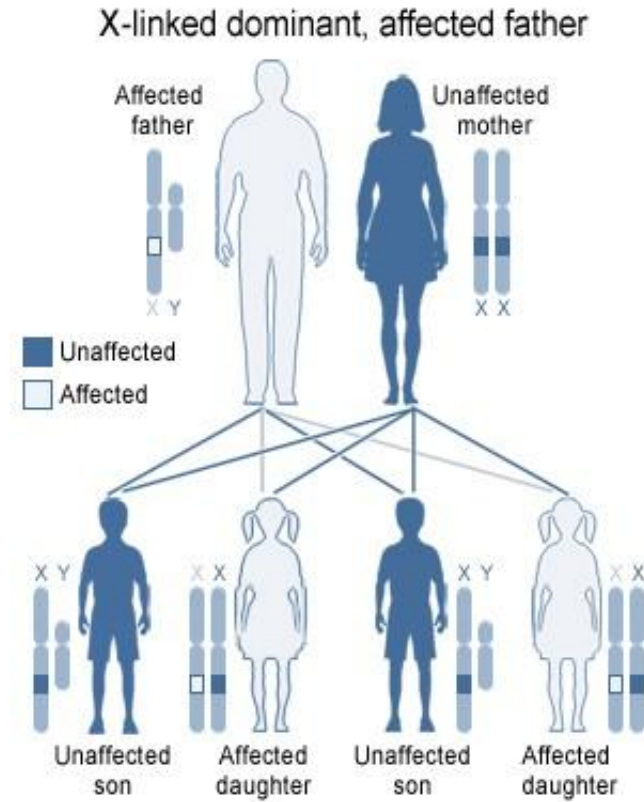
← Back

[Back to Answer](#)

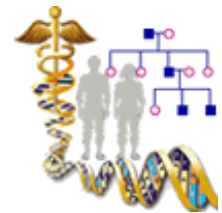
X-Linked Dominant Inheritance



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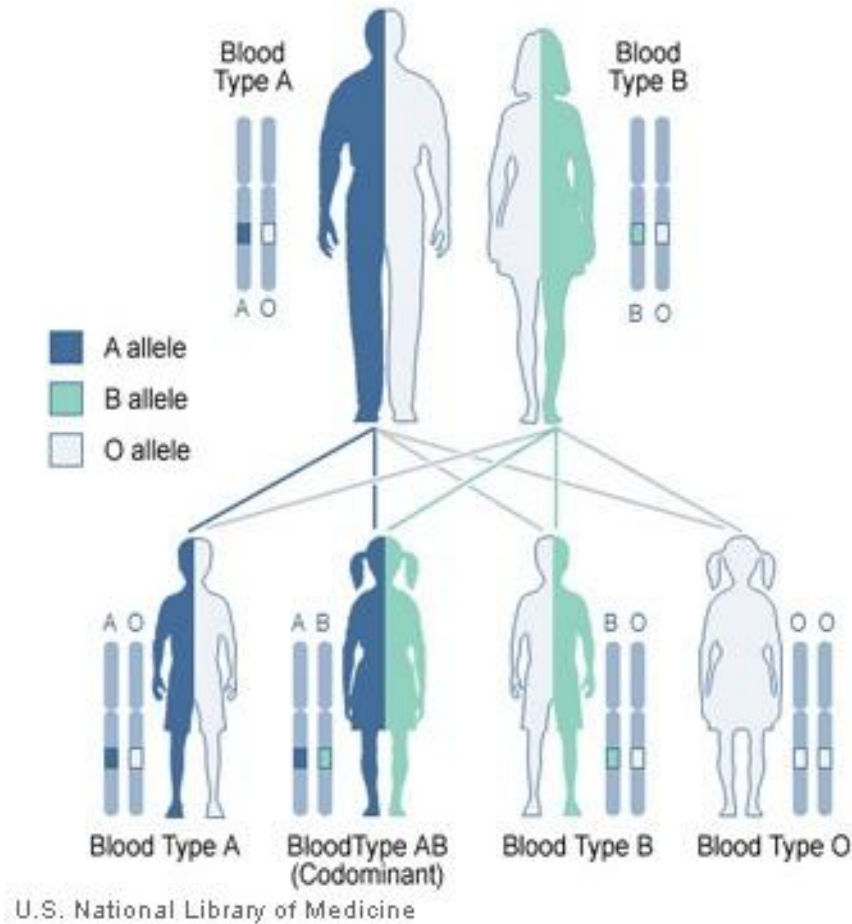
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← Back

[Back to Answer](#)

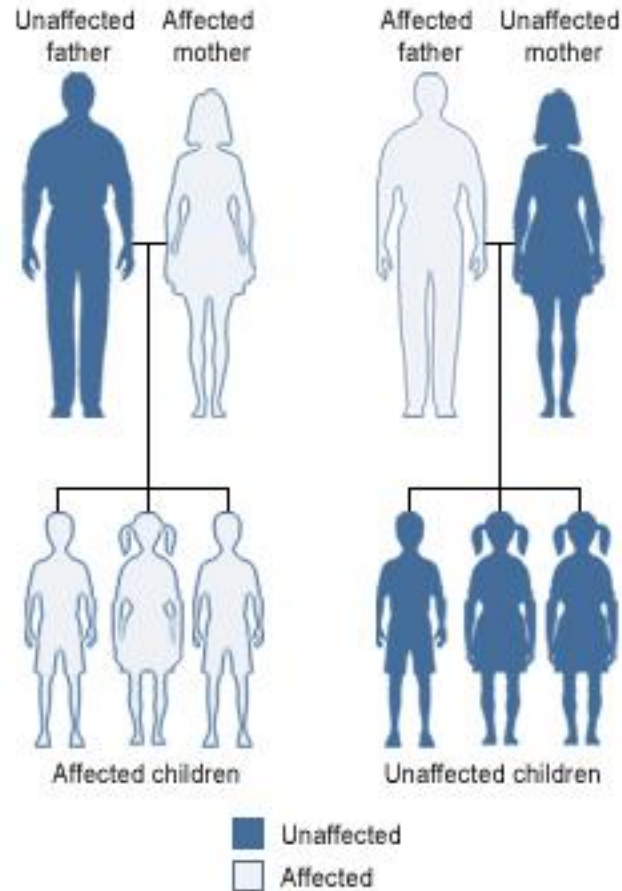
Codominant Inheritance



← Back

[Back to Answer](#)

Mitochondrial Inheritance



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[Back to Answer](#)

Genetics Home Reference
Your Guide to Understanding Genetic Conditions

Inheritance – 200 points

How many mutated copies of a gene are present in each cell in someone with an autosomal dominant disorder?

Answer



Inheritance – 200 points

How many mutated copies of a gene are present in each cell in someone with an autosomal dominant disorder?

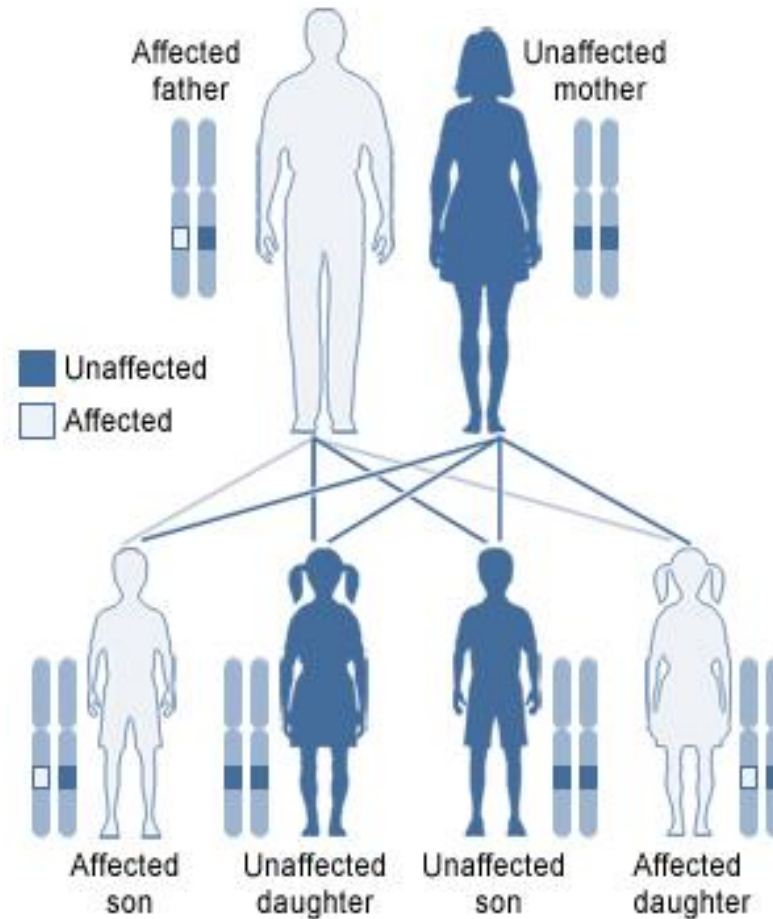
1

[Diagram of autosomal dominant inheritance](#)



Back

Autosomal Dominant Inheritance



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[Back to Answer](#)

Inheritance – 300 points

What makes X-linked inheritance different from other patterns of inheritance?

Answer



Inheritance – 300 points

What makes X-linked inheritance different from other patterns of inheritance?

Fathers cannot pass X-linked traits to their sons

(no male-to-male transmission)

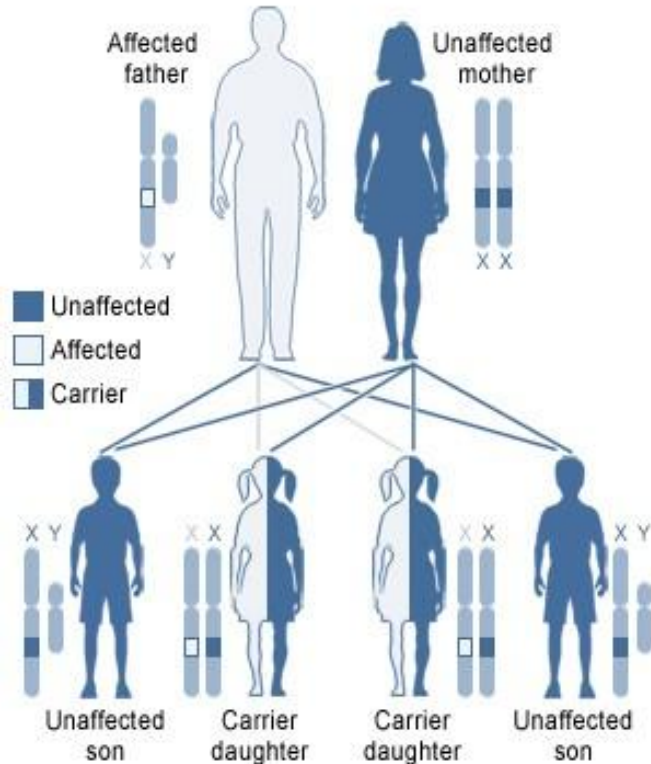


[Diagram of X-linked inheritance](#)

Back

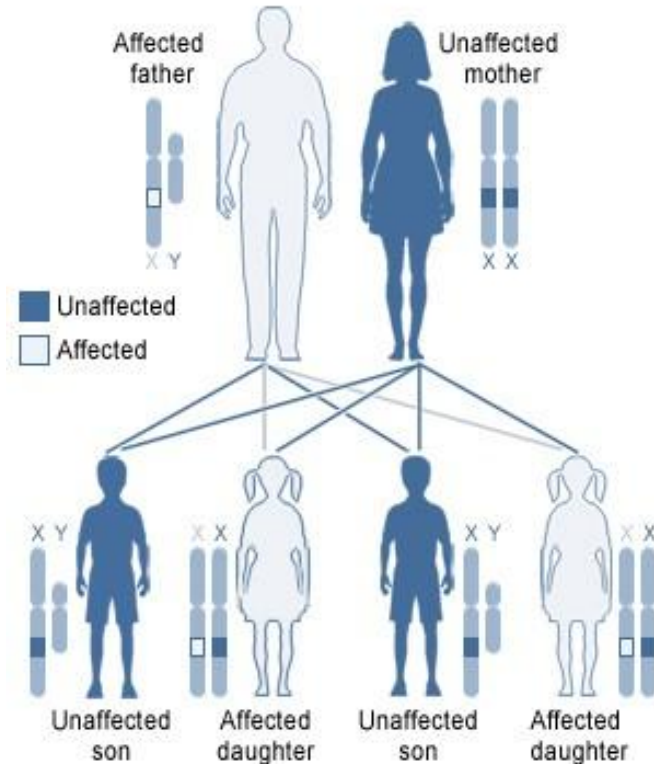
X-Linked Inheritance

X-linked recessive, affected father



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X-linked dominant, affected father



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← Back

[Back to Answer](#)

Inheritance – 400 points

Two unaffected people each carry one copy of a mutated gene for cystic fibrosis (CF), an autosomal recessive disorder. What is the chance their first child will have CF?

Answer



Inheritance – 400 points

Two unaffected people each carry 1 copy of a mutated gene for cystic fibrosis (CF), an autosomal recessive disorder. What is the chance their first child will have CF?

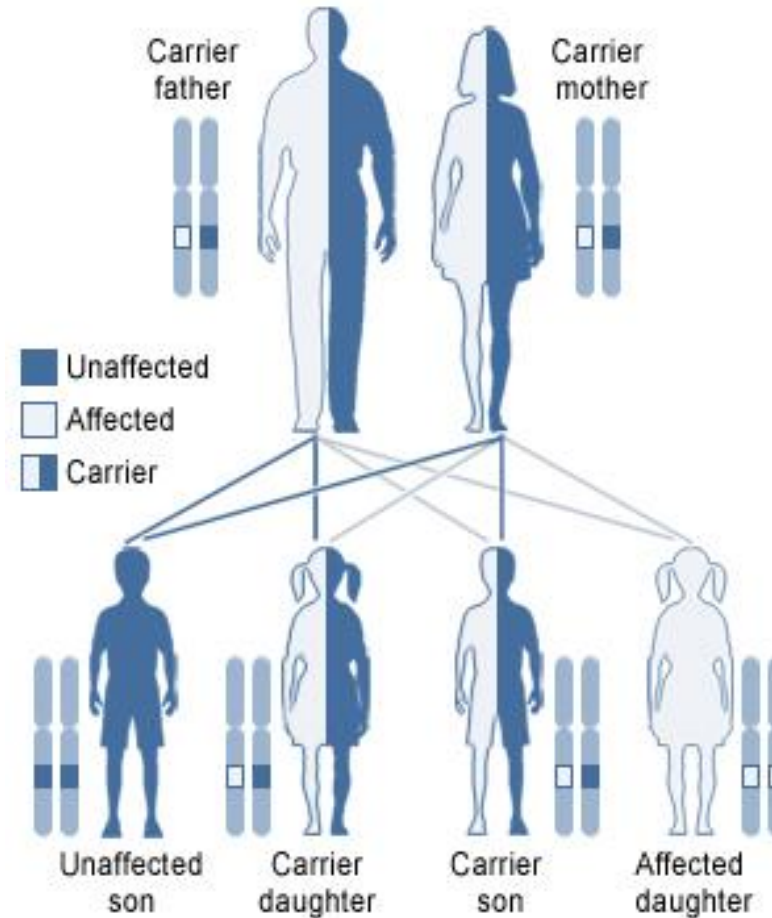
25 percent chance

[Diagram of autosomal recessive inheritance](#)



Back

Autosomal Recessive Inheritance



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← Back

[Back to Answer](#)

Genetics Home Reference
Your Guide to Understanding Genetic Conditions

Inheritance – 500 points

Hemophilia is a bleeding disorder with X-linked recessive inheritance. What is the chance that a man with this condition will have a daughter who is a carrier?

Answer



Inheritance – 500 points

Hemophilia is a bleeding disorder with X-linked recessive inheritance. What is the chance that a man with this condition will have a daughter who is a carrier?

100 percent chance
(All his daughters will be carriers)



Mutations – 100 points

What is a gene mutation?

Answer



Mutations – 100 points

What is a gene mutation?

A permanent change in the DNA sequence
that makes up a gene



Mutations – 200 points

True or False:

All gene mutations cause health problems

Answer



Mutations – 200 points

True or False:

All gene mutations cause health problems

False

Only a small percentage of mutations cause genetic disorders—most have no impact on health or development.



Mutations – 300 points

Mutations that occur in cells during a person's life are called _____

Answer



Mutations – 300 points

Mutations that occur in cells during a person's life are called _____

Acquired or somatic mutations



Mutations – 400 points

Name any 3 types of mutations

Answer



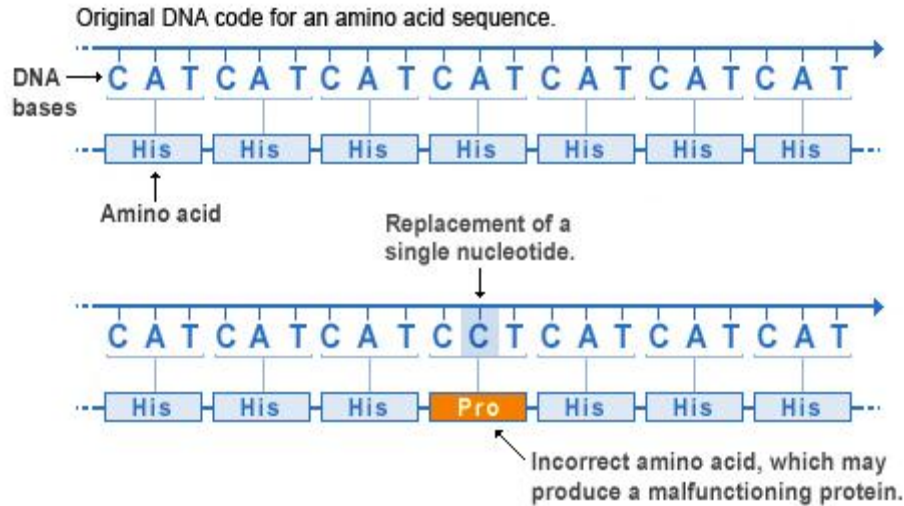
Mutations – 400 points

Name any 3 types of mutations

- Missense
- Nonsense
- Insertion
- Deletion
- Duplication
- Frameshift
- Repeat expansion



Missense Mutation



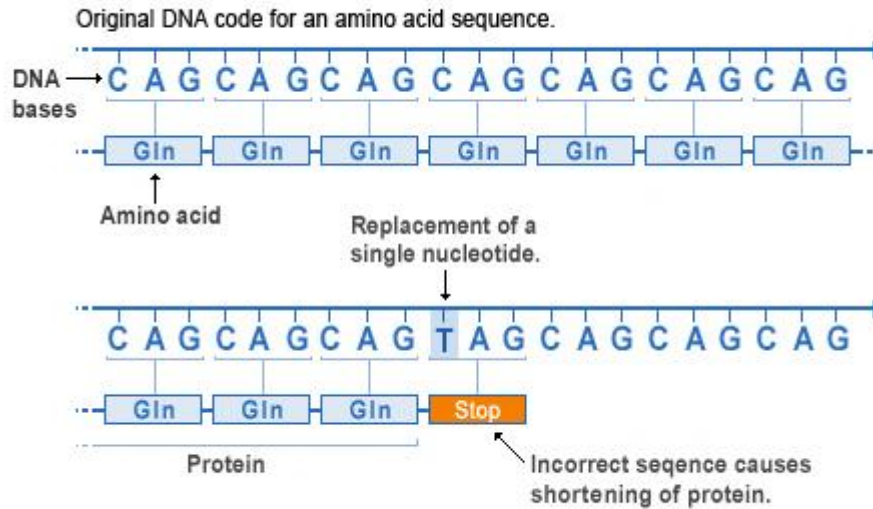
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In this example, the nucleotide adenine is replaced by cytosine in the genetic code, introducing an incorrect amino acid into the protein sequence.



[Back to Answer](#)

Nonsense Mutation



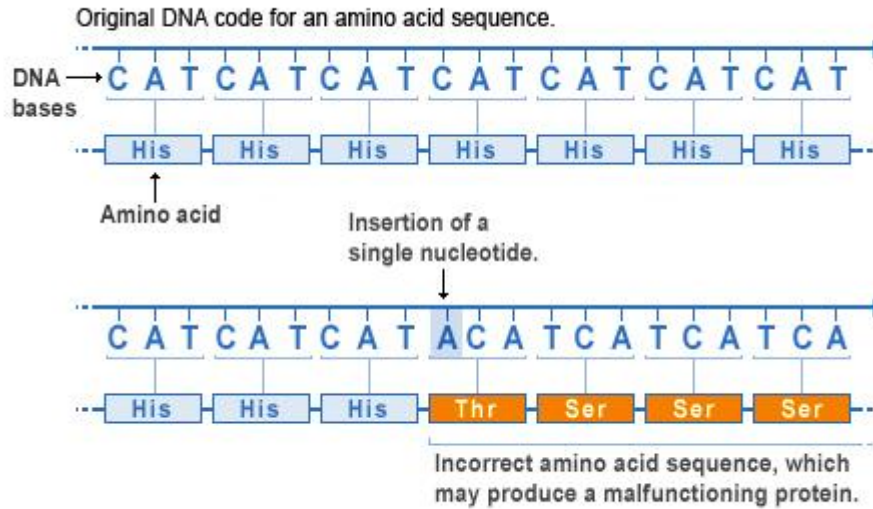
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In this example, the nucleotide cytosine is replaced by thymine in the DNA code, signaling the cell to shorten the protein.



[Back to Answer](#)

Insertion Mutation



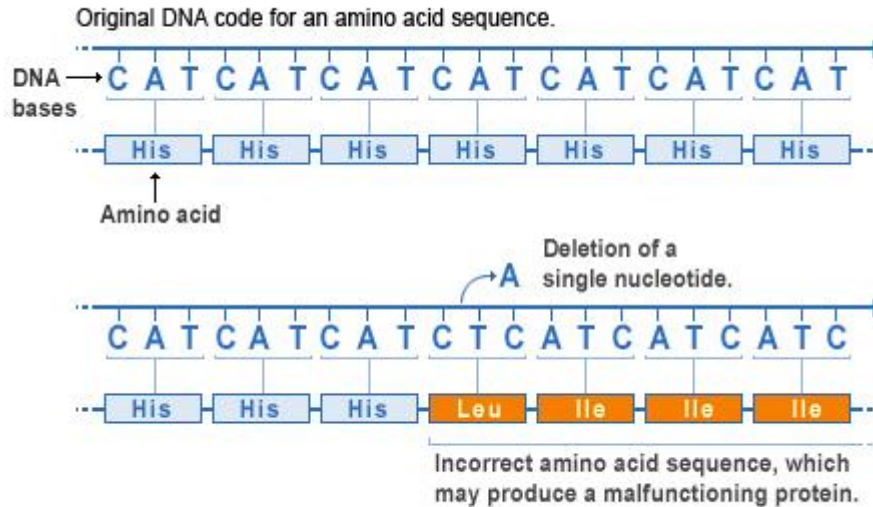
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In this example, one nucleotide (adenine) is added in the DNA code, changing the amino acid sequence that follows.



[Back to Answer](#)

Deletion Mutation



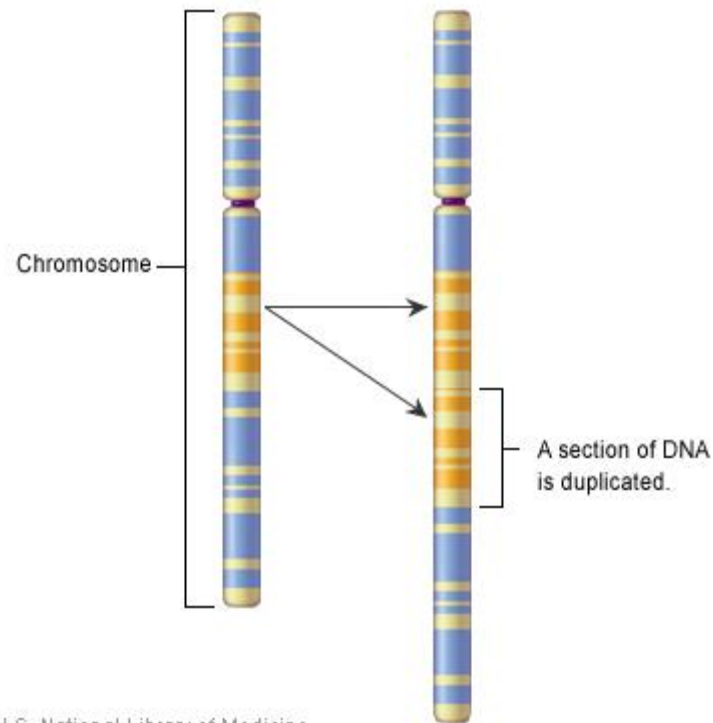
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In this example, one nucleotide (adenine) is deleted from the DNA code, changing the amino acid sequence that follows.



[Back to Answer](#)

Duplication Mutation

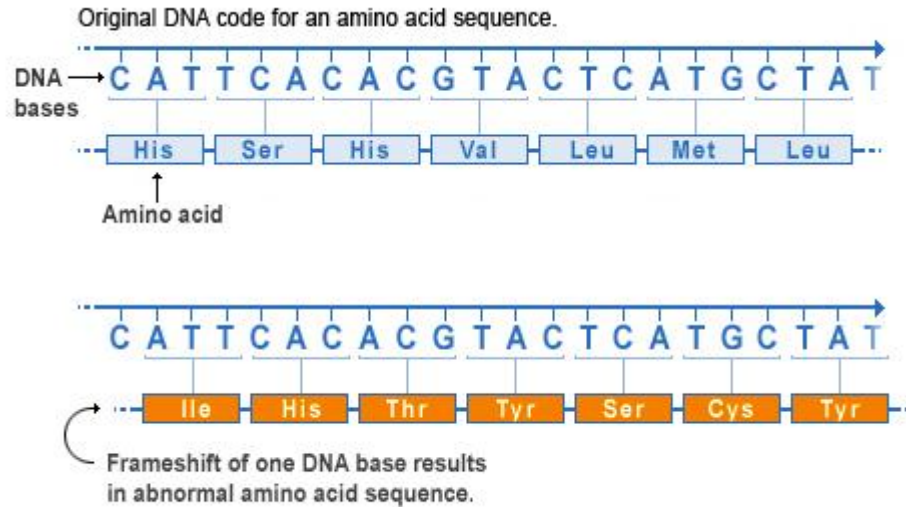


A section of DNA is accidentally duplicated when a chromosome is copied.



[Back to Answer](#)

Frameshift Mutation



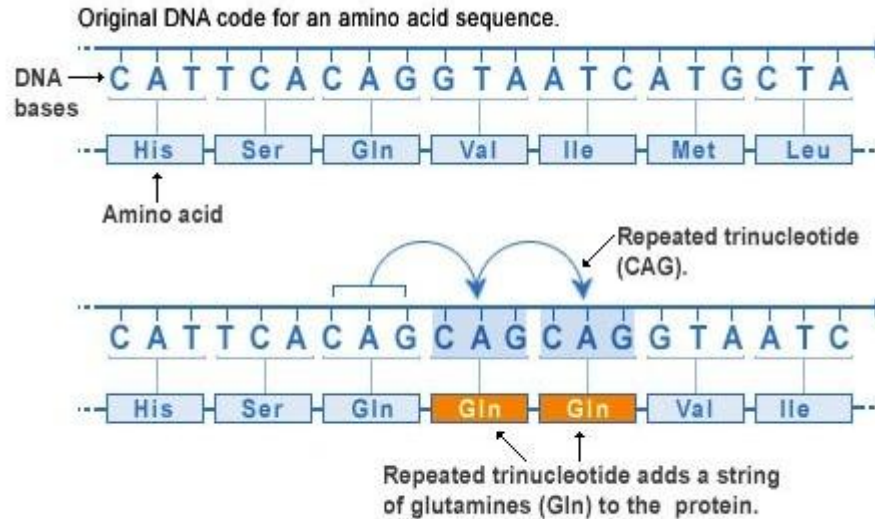
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A frameshift mutation changes the amino acid sequence from the site of the mutation.



[Back to Answer](#)

Repeat Expansion Mutation



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In this example, a repeated trinucleotide sequence (CAG) adds a series of the amino acid glutamine to the resulting protein.



Back

[Back to Answer](#)

Genetics Home Reference
Your Guide to Understanding Genetic Conditions

Mutations – 500 points

Genetic changes that occur in more than 1 percent of the population are called _____

Answer



Mutations – 500 points

Genetic changes that occur in more than 1 percent of the population are called _____

Polymorphisms



Genes – 100 points

What are alleles?

Answer



Genes – 100 points

What are alleles?

Varying forms of the same gene with small differences in the DNA sequence



Genes – 200 points

What are proteins made of?

[Answer](#)



Genes – 200 points

What are proteins made of?

Amino acids



Genes – 300 points

What are the two major steps of gene expression?

Answer



Genes – 300 points

What are the two major steps of gene expression?

Transcription and translation



Genes – 400 points

What is gene regulation?

[Answer](#)



Genes – 400 points

What is gene regulation?

The process of turning genes on and off



Genes – 500 points

What is a gene family?

[Answer](#)

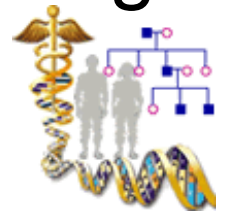


Genes – 500 points

What is a gene family?

A group of genes that share important characteristics.

They may have a similar DNA sequence, or they may provide instructions for making proteins that work together or have a similar function.



Back

Final Question – 2000 points

How many chromosomes are present in a triploid cell?

Answer



Final Question – 2000 points

How many chromosomes are present in a triploid cell?

69

The cell has an extra set of chromosomes

$$46 + 23 = 69$$

