

Name:

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Biology Lab Activities: Chromosomes and DNA Structure

Last updated: 05/12/25

> **Background Questions**

Read through the Overview of DNA and Chromosomes article on the Visible Body Biology Learn Site (<https://www.visiblebody.com/learn/biology/dna-chromosomes/overview>).

Based on what you've learned in class, in your textbook, from the Biology Learn Site article, and from using Visible Body, answer the following questions about chromosomes and DNA structure.

1. What are chromosomes?
2. Complete the following sentences on the number of chromosomes in eukaryotes and prokaryotes.
 - a. Eukaryotic organisms that reproduce sexually get two copies of each chromosome, one from each parent. Since each regular body cell has two copies of each kind of chromosome, they are considered to be
 - i.
 - ii.
 - b. Humans get _____ chromosomes from each parent, for a total of _____ chromosomes, and the chromosomes they get from each parent may be slightly different versions.
 - c. Prokaryotes only have one chromosome and usually reproduce by cell fission. The chromosome gets copied and each cell gets a new chromosome. Thus, prokaryotes are considered to be
 - i.
 - ii.

- d. If a diploid cell has 23 different kinds of chromosomes, how many chromatids per cell would be present after replication?
- 3. What is DNA and how does it relate to genetic inheritance?
- 4. What are the three main functions of DNA, which make it essential for the survival of cells and organisms?

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Lab 1: Eukaryotic Chromosome Structure

> Activity 1: Label a eukaryotic chromosome

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search tool to view the Eukaryotic Chromosome model.
2. Label the image below
 - Explore the 3D model of the eukaryotic chromosome to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Word List:

Centromere

DNA double helix

P arm

Chromatid

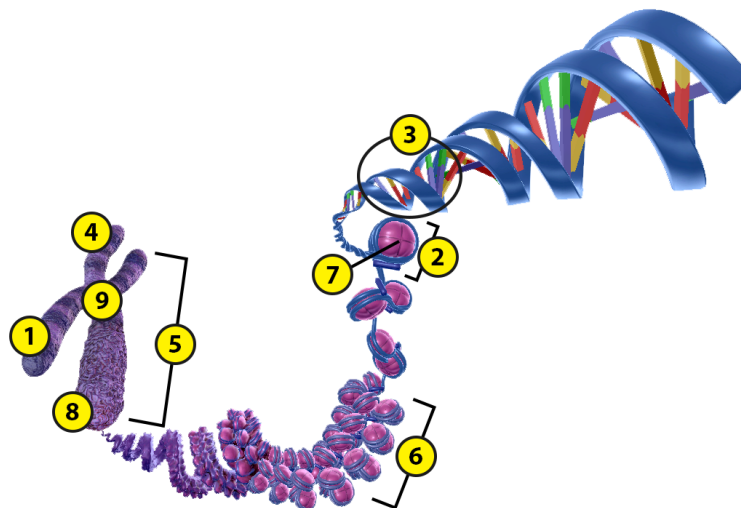
Histone

Q arm

Chromatin (or DNA molecule)

Nucleosome

Telomere



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Lab 1: Eukaryotic Chromosome Structure

> **Activity 2: Explore the functions of eukaryotic chromosome structures**

Refer to your labeled eukaryotic chromosome from Activity 1 and the content in Visible Body. Based on what you've learned about eukaryotic chromosomes, match each of the following chromosome structures with its description.

Structures:

- a. Centromere
- b. Chromatid
- c. Chromatin
- d. Histones
- e. P arm
- f. Q arm
- g. Telomere
- h. Nucleosome

Descriptions:

- ___ A repetitive DNA sequence that caps and protects the chromosome's ends
- ___ Two complementary strands of DNA coiled tightly around protein
- ___ The longer arm of the chromosome
- ___ One of the two identical DNA molecules within a replicated chromosome
- ___ A DNA segment wrapped around a cluster of histones
- ___ The shorter arm of the chromosome
- ___ The region where kinetochores or spindles attach; it also separates the two arms and joins two sister chromatids (when two are present)
- ___ Proteins that eukaryotic DNA coils around

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Lab 2: Prokaryotic Chromosome Structure

> Activity 1: Label a prokaryotic chromosome

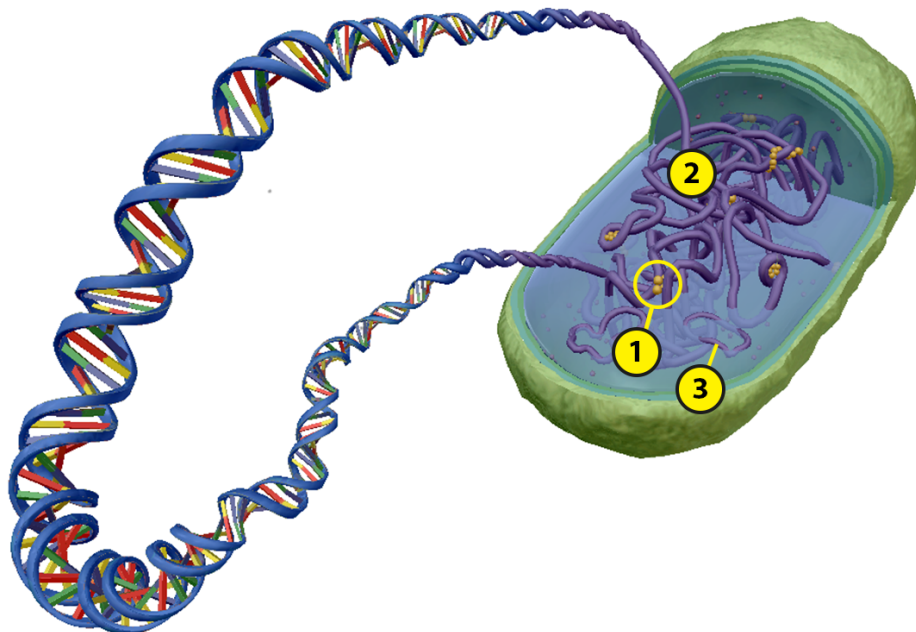
1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search tool to view the Prokaryotic Chromosome model.
2. Label the image below
 - Explore the 3D model of the prokaryotic chromosome to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Word List

Chromosome

Nucleoid-associated protein (NAP) _____

Plasmid _____



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Lab 2: Prokaryotic Chromosome Structure

> **Activity 2: Explore the functions of prokaryotic chromosome structures**

Refer to your labeled prokaryotic chromosome from Activity 1 and the content in Visible Body. Based on what you've learned about prokaryotic chromosomes, match each of the following structures with its description.

Structures:

- a. Chromosome
- b. Plasmid
- c. Nucleoid-associated proteins (NAPs)

Descriptions:

- ___ A small, circular DNA molecule that contains the cell's nonessential genes
- ___ A coiled, circular DNA molecule, located in the nucleoid, that contains the cell's essential genes
- ___ Various proteins that compact prokaryotic DNA

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Lab 3: Compare Eukaryotic and Prokaryotic Chromosomes

Based on your labeled eukaryotic and prokaryotic chromosomes from Labs 1 and 2, you've probably noticed that these two types of chromosomes are very different, in terms of structure. Refer to your labeled images, as well as the 3D eukaryotic and prokaryotic chromosomes in Visible Body, to help you answer the following questions on the structural differences between eukaryotic and prokaryotic chromosomes.

1. How many chromosomes do prokaryotic and eukaryotic cells have?
2. Where are eukaryotic and prokaryotic chromosomes located within the cell?
3. How would you describe the shape of prokaryotic versus eukaryotic chromosomes?
4. Eukaryotic chromosomes are _____ in size than prokaryotic chromosomes.
5. Only _____ chromosomes are associated with proteins called histones. Although _____ chromosomes do not have this type of protein, they are compacted by various nucleoid-associated proteins (NAPs).
6. _____ organisms have extra DNA structures called plasmids, which contain nonessential genes.
 - a. Are plasmids associated with the cell's chromosome, which contains its essential genes?

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Lab 4: DNA Structure

> Activity 1: Label a DNA double helix

1. Launch the view
 - a. Launch Visible Body.
 - b. Browse or use the Search tool to view the Molecular Level of DNA model and explore the components that make up the DNA double helix.
2. Label the image below
 - a. Explore the 3D model of the molecular level of DNA to find the structures you need to label.
 - b. Fill in the blanks to label the structures from the list below.

Word List:

Adenine ____

Guanine ____

Sugar-phosphate backbone ____

Cytosine ____

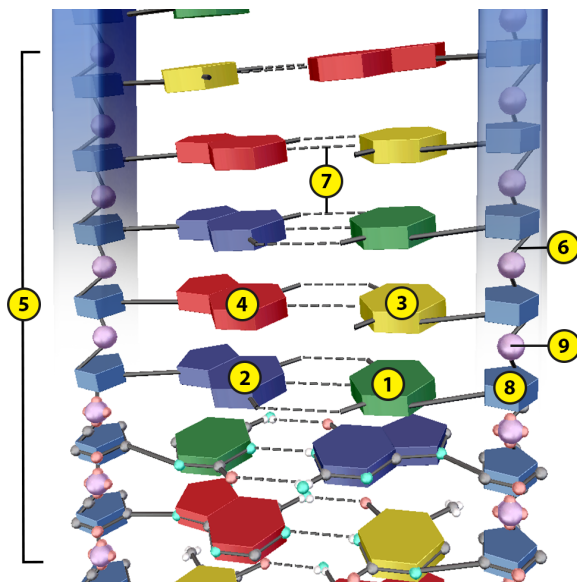
Hydrogen bonds ____

Phosphate group ____

Covalent bond ____

Sugar molecule ____

Thymine ____



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Lab 4: DNA Structure

> Activity 2: Explore the components of DNA

Refer to your labeled DNA double helix from Activity 1 and the content in Visible Body to help you answer the following questions about the structure of DNA.

1. As you've learned, each DNA strand is composed of a long chain of units called nucleotides. Answer the following questions about the components that make up nucleotides.
 - a. DNA nucleotides can have one of four different types of nitrogen-containing bases. What are they?
 - b. What are the other two components found in nucleotides?
2. The DNA double helix is composed of two long strands of nucleotides called polynucleotides. Which of the following statements accurately describes how these two polynucleotides compare, in terms of the biological information they contain?
3. As you probably noticed when you were labeling the DNA double helix in Activity 1, DNA consists of several components that are bound together. Complete the following sentences on the two types of chemical bonds that hold DNA together.
 - a. Nucleotides on each DNA strand are joined by covalent bonds, which form between the sugar of one nucleotide and the _____ of the next nucleotide.
 - b. The two DNA strands are joined by _____ bonds that bind adenine with _____ and cytosine with _____ in a process called base pairing.