



# Biology Lab Activities: Chromosomes and DNA Structure

Adrienne Devlin, Executive Editor at Visible Body

# How to use this manual

This lab manual is intended for use with the [Visible Biology](#) product.

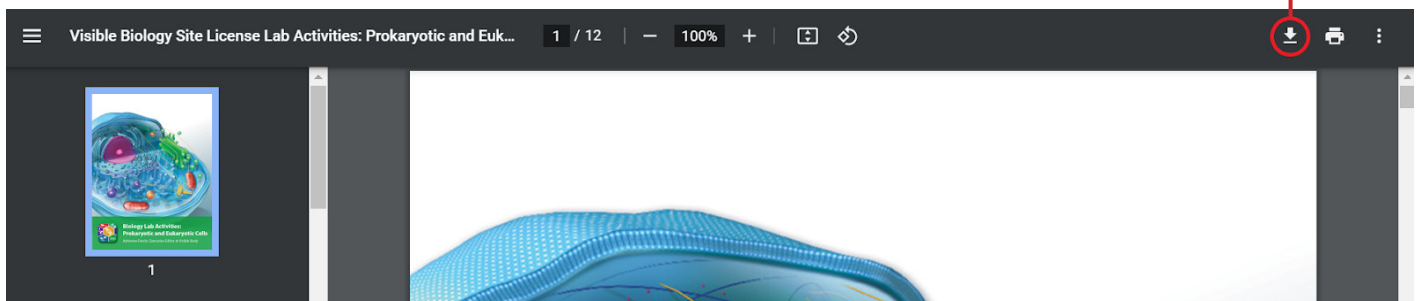
## Where to find 3D models

The screenshot shows the Visible Biology interface. At the top, there are three tabs: 'Units', 'Study', and 'My Library'. The 'Study' tab is selected. Below the tabs, there are three sections: 'Quizzes', 'Lab Activities', and 'Get PDFs'. The 'Lab Activities' section is circled in red, with a red arrow pointing to it from the text 'Under the Study section of Visible Biology, there is a Lab Activities tab.' Below this, there is a section titled 'Prokaryotic and Eukaryotic Cells Lab' with three 3D models: '1. Bacterial Cell', '2. Animal Cell', and '3. Plant Cell'. A red arrow points to these models from the text 'Find the row of 3D views that corresponds to each lab manual and use the views to investigate and find answers.'

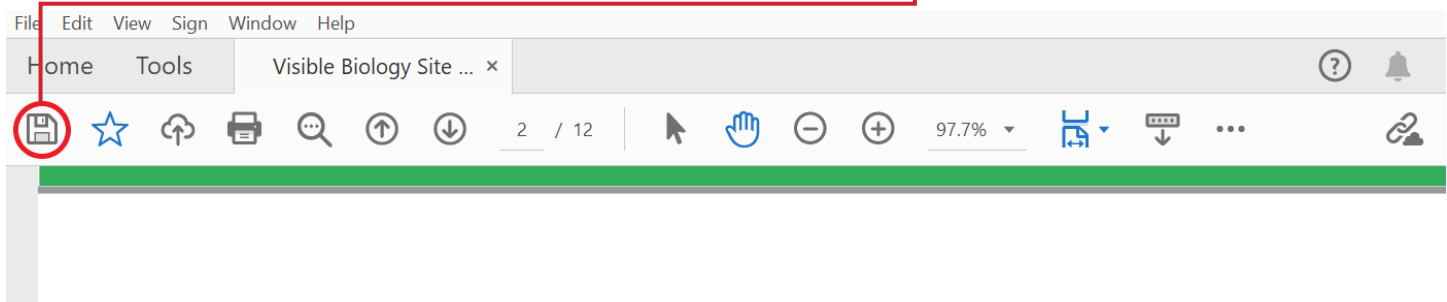
## How to save answers

1. Have Adobe Reader installed on your computer.  
Windows: <https://get.adobe.com/reader/>  
Mac: <https://helpx.adobe.com/acrobat/kb/install-reader-dc-mac-os.html>

2. Download each lab file to your computer.



3. Open the downloaded file in Adobe Reader.  
Right-click on the file. In the menu that appears, go to "Open with..." and select Adobe Reader from the submenu.
4. Type your answers into the boxes to complete the lab and select the "Save" icon to save the lab.



5. Submit your saved version of the lab to your instructor via email, dropbox, Google Drive, or however your instructor has requested.

**Any questions?**  
[visiblebiology.com](http://visiblebiology.com)

Name:

Date:

## Biology Lab Activities: Chromosomes and DNA Structure

### 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 Biology, 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. Haploid
    - ii. Diploid
  - 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. Haploid
    - ii. Diploid
  - d. If a diploid cell has 23 different kinds of chromosomes, how many chromatids per cell would be present after replication?



Name:

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## **Lab 1: Eukaryotic Chromosome Structure**

### **Activity 1: Label a eukaryotic chromosome**

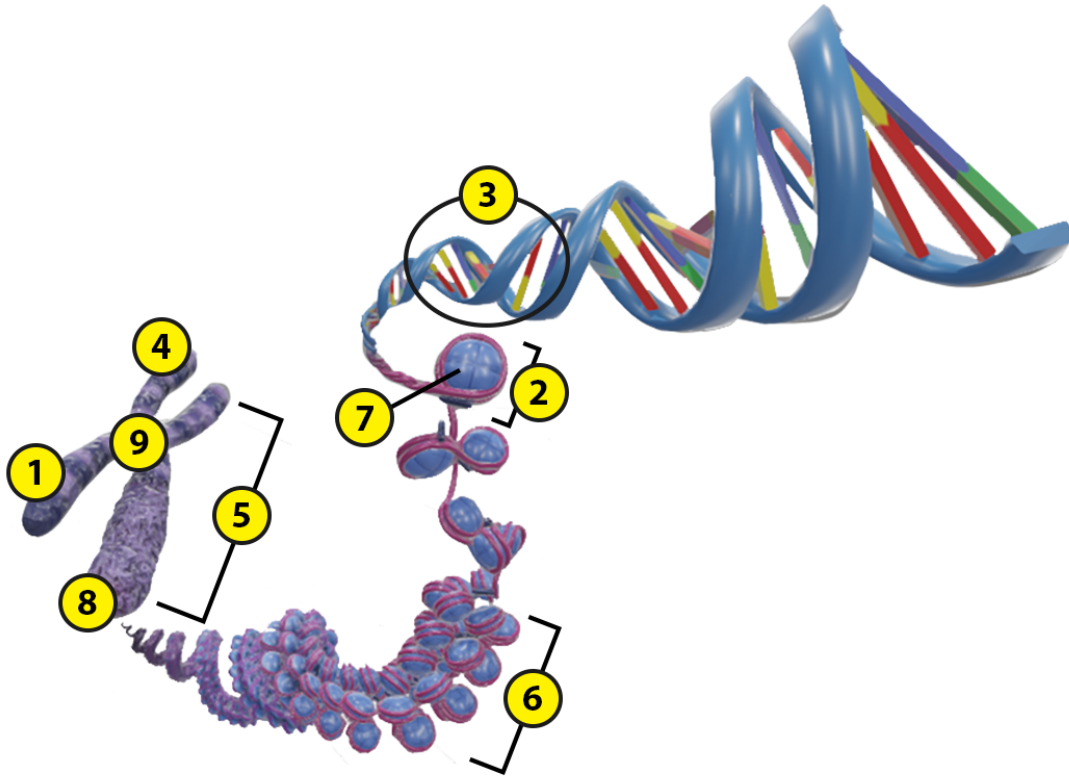
1. Launch the view
  - a. Launch Visible Biology.
  - b. Navigate to Study/Lab Activities, and find the Chromosomes and DNA Structure Lab section.
  - c. Select view 1. Eukaryotic Chromosome.
2. Label the image below
  - a. Explore the 3D model of the eukaryotic chromosome to find the structures you need to label.
  - b. Fill in the blanks to label the structures from the list below.

Word List:

Centromere \_\_\_\_\_  
Chromatid \_\_\_\_\_  
Chromatin (or DNA molecule) \_\_\_\_\_

DNA double helix \_\_\_\_\_  
Histone \_\_\_\_\_  
Nucleosome \_\_\_\_\_

P arm \_\_\_\_\_  
Q arm \_\_\_\_\_  
Telomere \_\_\_\_\_



Name:

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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 Biology. 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
  - a. Launch Visible Biology.
  - b. Navigate to Study/Lab Activities, and find the Chromosomes and DNA Structure Lab section.
  - c. Select view 2. Prokaryotic Chromosome.
2. Label the image below
  - a. Explore the 3D model of the prokaryotic chromosome to find the structures you need to label.
  - b. Fill in the blanks to label the structures from the list below.



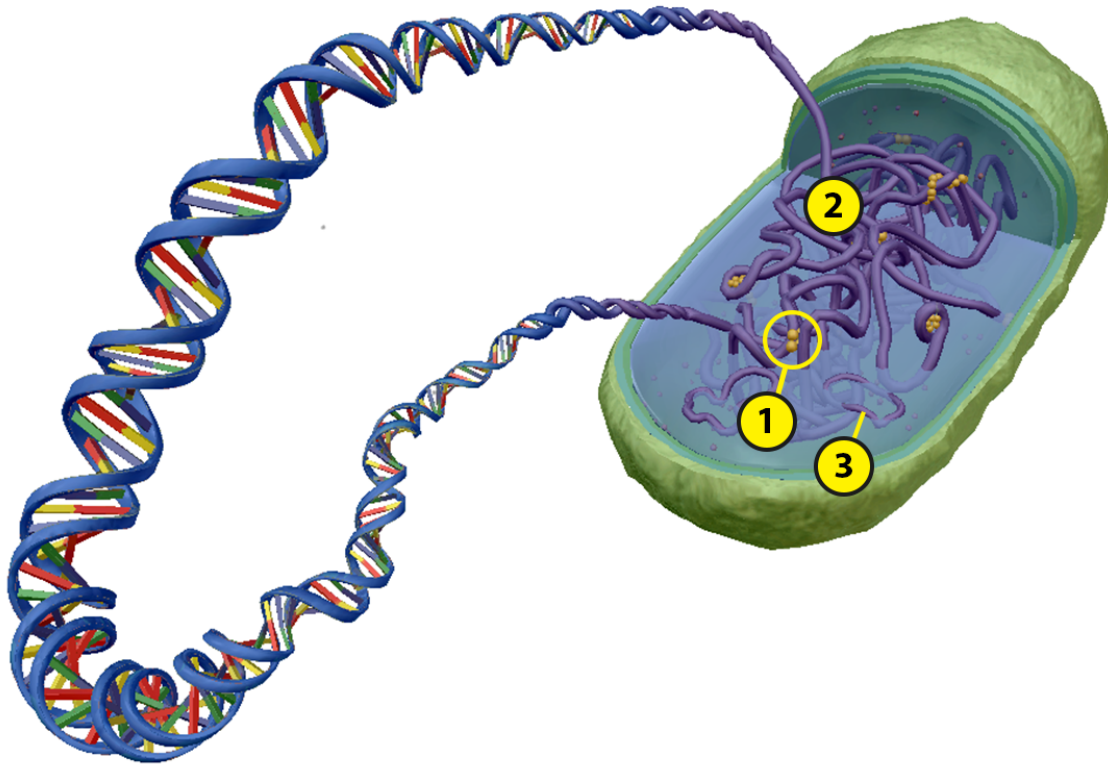
Word List

Chromosome

Nucleoid-associated protein (NAP)

Plasmid

—  
—  
—



Name:

Date:

## 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 Biology. 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

Name:

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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 Biology, 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

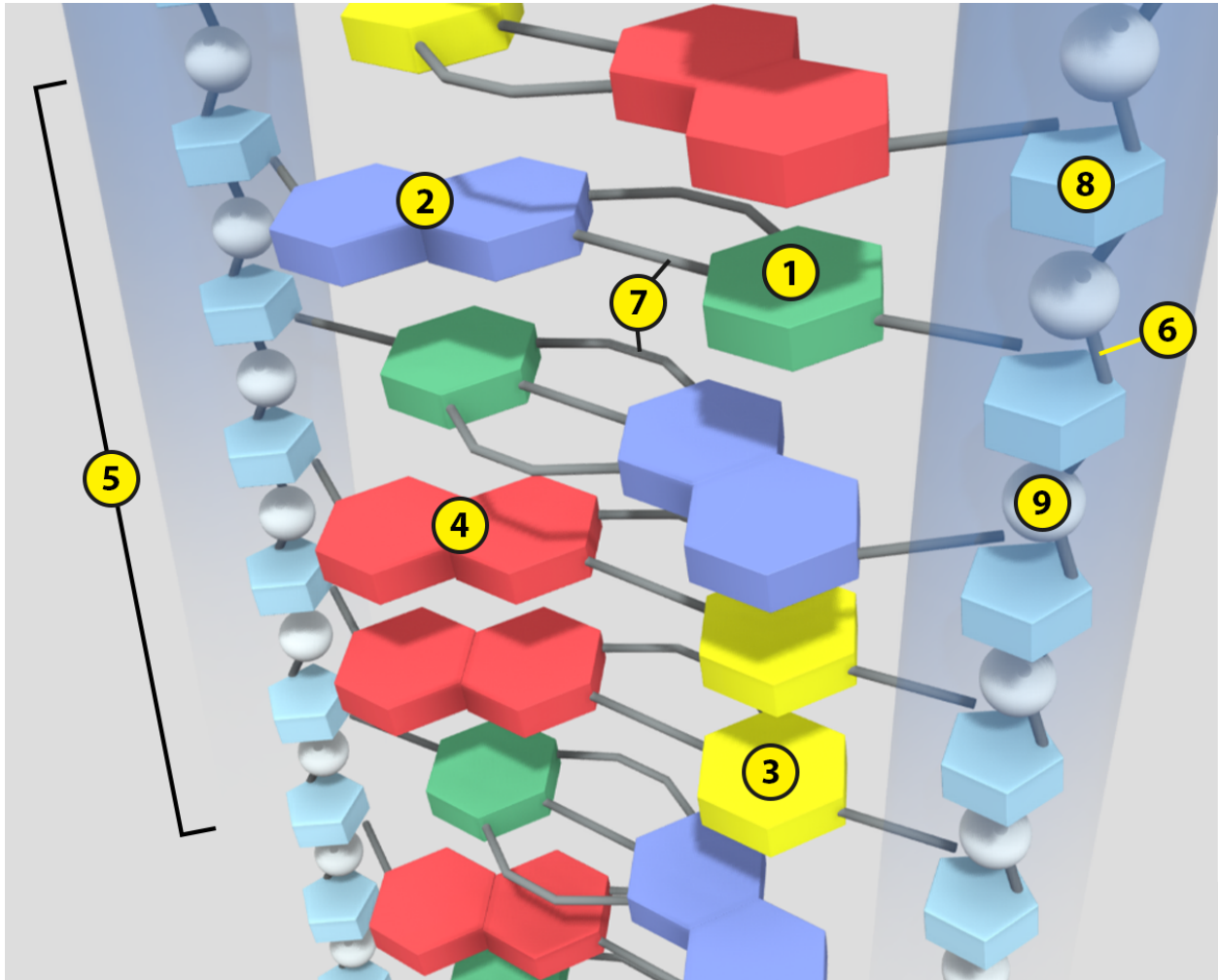
1. Launch the view
  - a. Launch Visible Biology.
  - b. Navigate to Study/Lab Activities, and find the Chromosomes and DNA Structure Lab section.
  - c. Select view 3. Molecular Level of DNA and explore the components that make up the DNA double helix.
2. Label the image below
  - a. Explore the 3D 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 \_\_\_\_\_  
Cytosine \_\_\_\_\_  
Covalent bond \_\_\_\_\_

Guanine \_\_\_\_\_  
Hydrogen bond \_\_\_\_\_  
Sugar molecule \_\_\_\_\_

Sugar-phosphate backbone \_\_\_\_\_  
Phosphate group \_\_\_\_\_  
Thymine \_\_\_\_\_



Name:

Date:

## 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 Biology 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?
  - a. Each contains exactly the same information.
  - b. They are complementary to each other.
  
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.