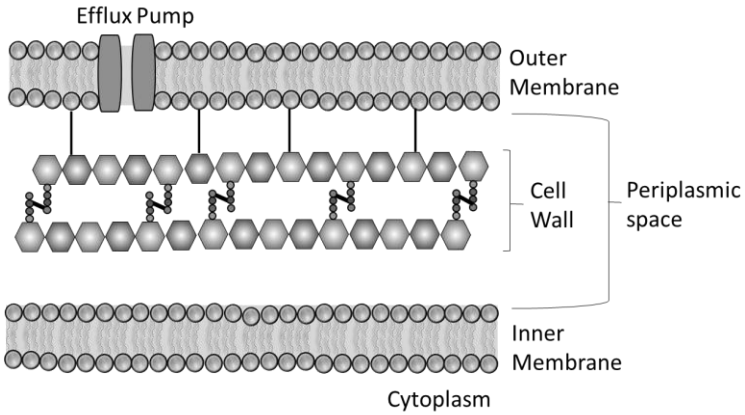
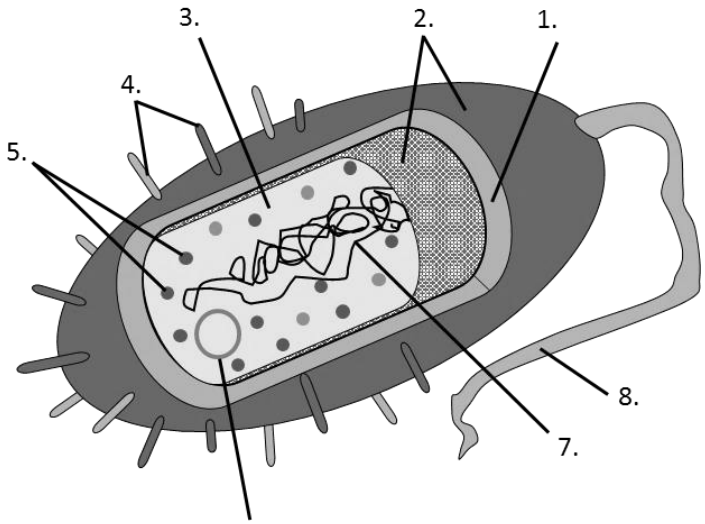
Name _____

Bacteria Structure Study Guide

1. To understand how antibiotics work, we need to review prokaryotic cell structures. In the lab that we will conduct throughout this unit, we will use *Escherichia coli*, which is one of the largest rod-shaped bacteria that has a thin cell wall. An individual cell can be up to 4 µM in length. Label the numbered structures of the bacteria using the terms in the table below.





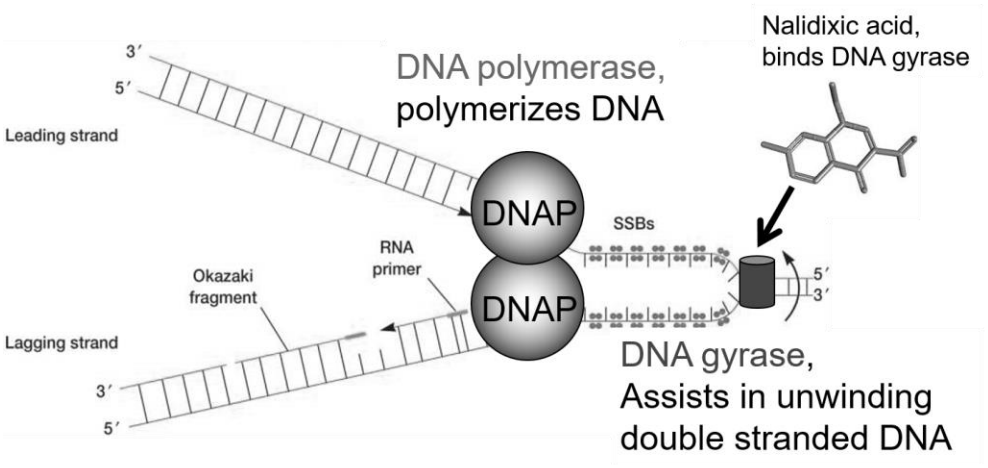
2. Complete the table below:

Cell Structure	Function
Cell Wall	
Cell Membrane (Inner and Outer)	
Pili	
Flagellum	
Cytoplasm	
Chromosome	
Plasmid	
Ribosomes	

Background on antibiotics:
Some organisms make and secrete chemicals that inhibit the growth of other organisms. These chemicals are called, "antibiotics," meaning "against life." We use antibiotics to stop bacterial infections in humans. To be useful to humans, the antibiotic must have **selective toxicity**. In other words, the antibiotic must prevent the growth of some organisms (bacteria) but not harm or prevent the growth in other organisms (humans). Therefore, the target of the antibiotic needs to be a structure, enzyme or chemical pathway that humans do not have. Some possible targets for antibiotics could be cell wall synthesis, protein synthesis in bacterial ribosomes (they are different from human ribosomes) or DNA replication, which uses different enzymes than humans.

3. If you were designing an antibiotic to kill or inhibit the growth of bacteria, what bacterial structures would you target? List two possible choices and explain your rationale. Caution: You don't want the antibiotic to affect human cells.

Background on Nalidixic Acid:
We will use the antibiotic Nalidixic Acid in our lab to help us understand how/why antibiotics become useless. Nalidixic Acid kills bacteria by inhibiting DNA Replication. Nalidixic Acid binds to an enzyme called DNA gyrase. DNA gyrase is part of the protein complex that helps to unwind the DNA strand during DNA replication. Nalidixic Acid binds to DNA gyrase and, prevents the double-stranded DNA from being unwound, which stalls DNA replication. Thus, the bacterial chromosome fragments and, eventually, the bacterium dies.



4. Why would targeting DNA Replication be an advantageous target for an antibiotic?

5. How does the use of Nalidixic Acid display selective toxicity? (HINT: you may have to do a little bit of research!)

6. How do you think bacteria could combat the effects of nalidixic acid? What could make a bacterium resistant to nalidixic acid?