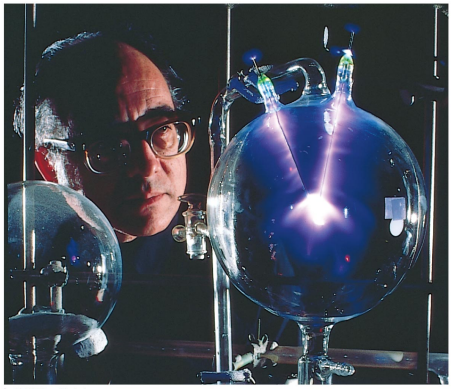
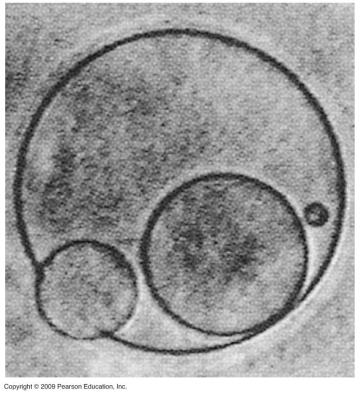
Biology – Chapters 19 & 20
The History of Life
Viruses & Prokaryotes

Honors Biology – Chapter 15b
Tracing Evolutionary History

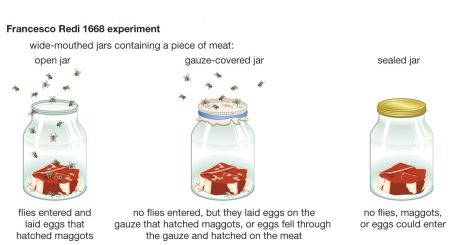
Ridgefield Memorial High School



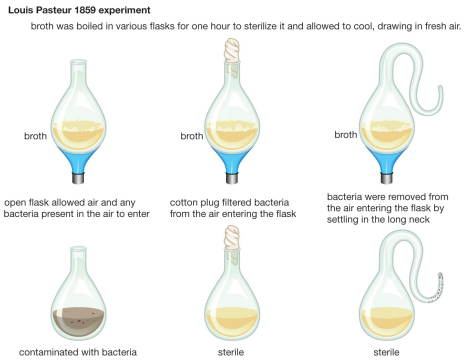
Stanley Miller (and Harold Urey) performed a famous experiment in which they recreated the atmosphere of the early Earth.



Phospholipids were created in Earth's early history to form the first membranes. They were necessary to establish a barrier between the cell and the environment.



Spontaneous generation was the belief that life can be created by non-living matter. The work of Redi and Pasteur helped disprove spontaneous generation.



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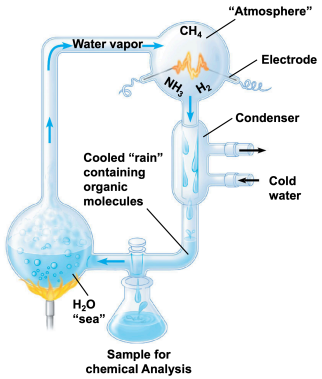
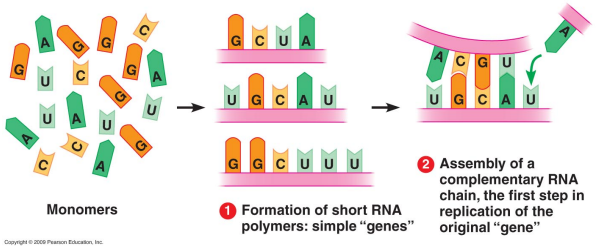
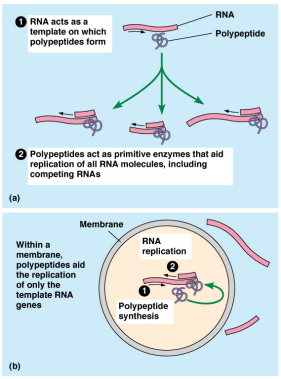


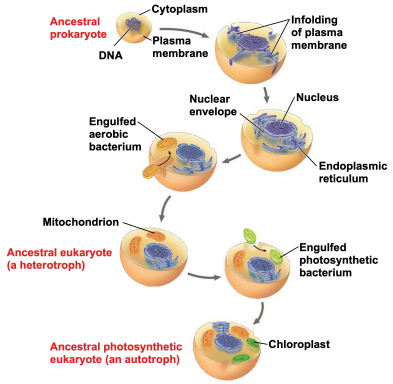
Miller and Urey showed that the toxic gases in Earth's early atmosphere could create protein. The "sample for chemical analysis" contained amino acids.



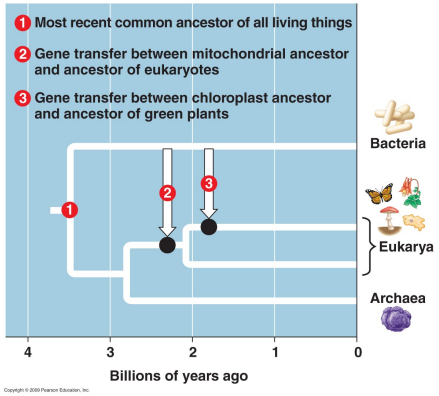
RNA was the first self-replicating genetic material.
"Self-replicating" means that it was capable of making identical copies of itself.



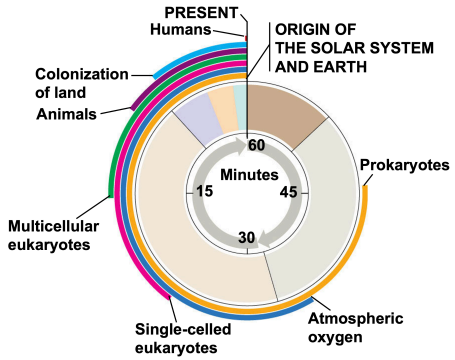
Proteins, RNA, and phospholipids were all needed to form the first cells.



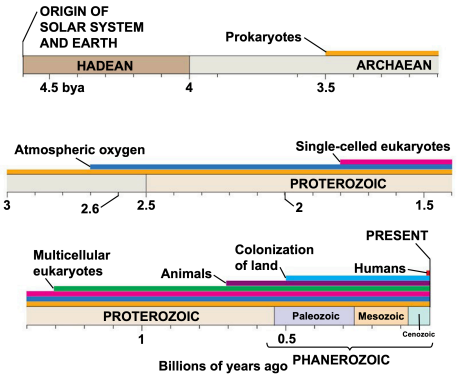
Eukaryotic cells formed due to the endosymbiotic theory: Membranes folded inward around the DNA to form the nucleus. The mitochondrion and chloroplast were "eaten" by a host cell.



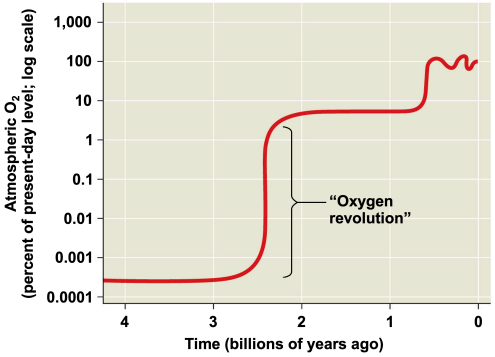
This phylogenetic tree of the 3 domains includes the endosymbiotic events (numbers 2 and 3).



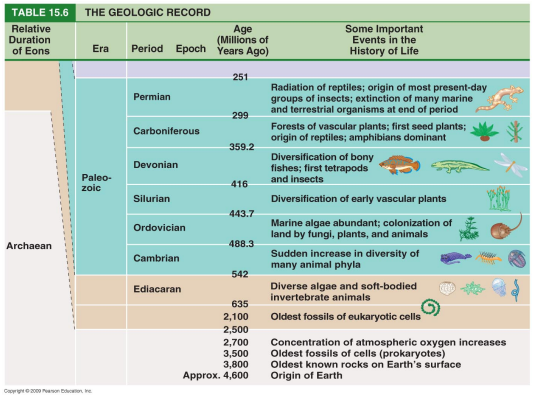
If Earth's 4.6 billion year history was modeled as a clock, humans would not appear until just before midnight.



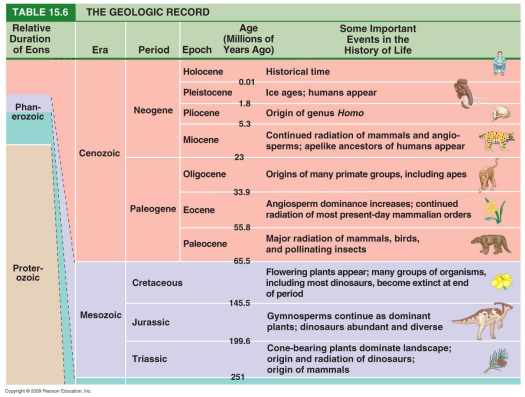
This is a linear model of the geologic timeline.



There were two periods in Earth's history in which the atmospheric O_2 levels increased rapidly.



The Pre-Cambrian Time and Paleozoic Era accounted for almost all of Earth's history.



The Mesozoic and Cenozoic Eras only account for 5% of Earth's geologic history. Many important biological events took place in these two eras.

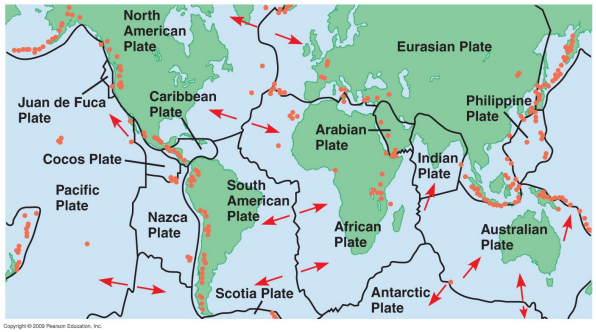
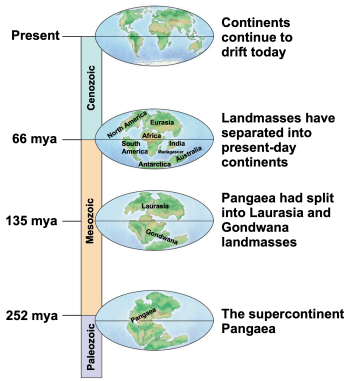
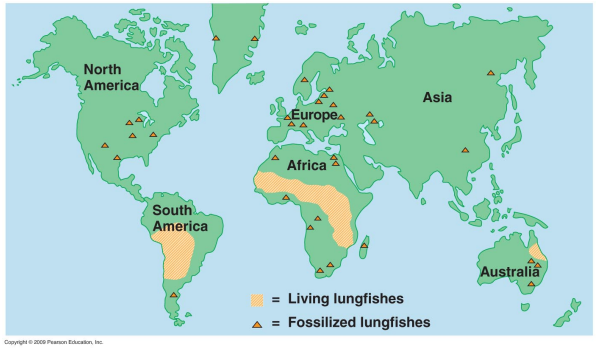


Plate tectonics and continental drift explain why similar species are found in many different places around the world.

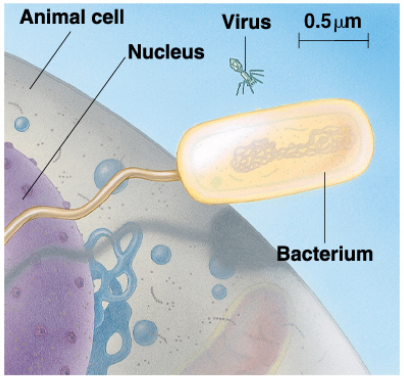


Pangaea formed at the end of the Paleozoic Era and has been separating ever since. Most people do not realize that Pangaea existed pretty recently in terms of Earth's geologic history.

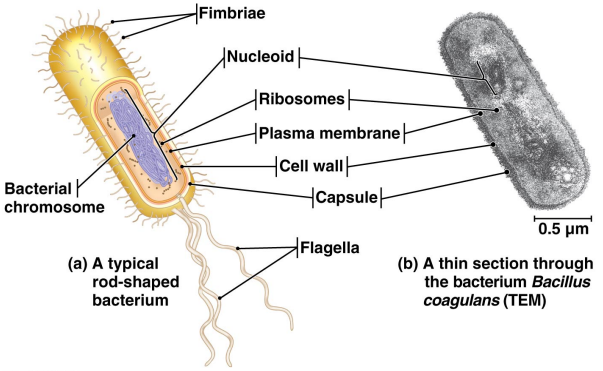
This is an African lungfish...



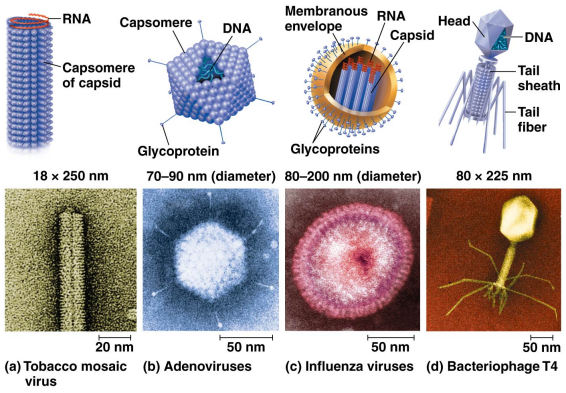
...which lives in freshwater habitats and is found throughout the world (living or as a fossil) due to continental drift.



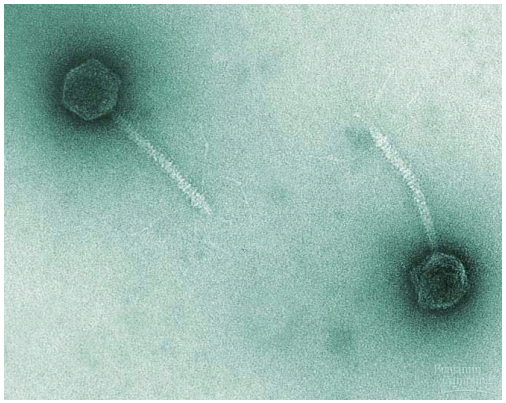
This diagram shows the relative sizes of viruses, bacteria, and eukaryotic cells.



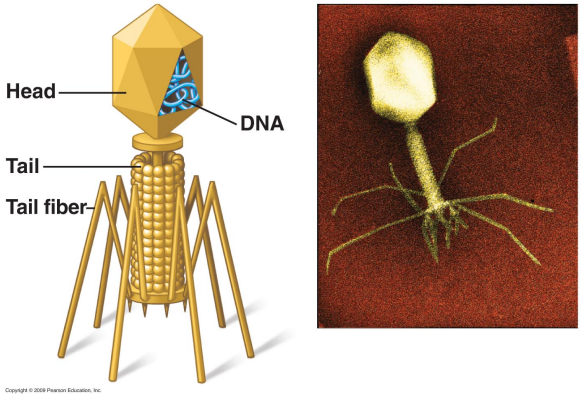
A bacterium (prokaryotic cell) is so much simpler than an animal or plant cell.



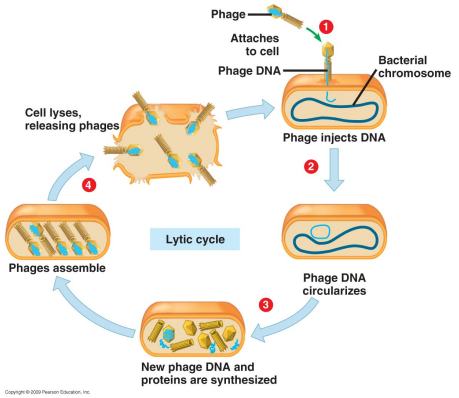
There is a great diversity in the structure of viruses, even though they are non-living. Viruses consist of a protein coat that surrounds genetic material (either DNA or RNA).



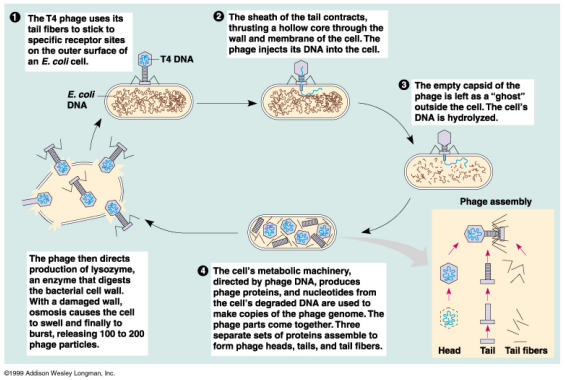
This is a view of a lytic virus shown using a scanning electron microscope.



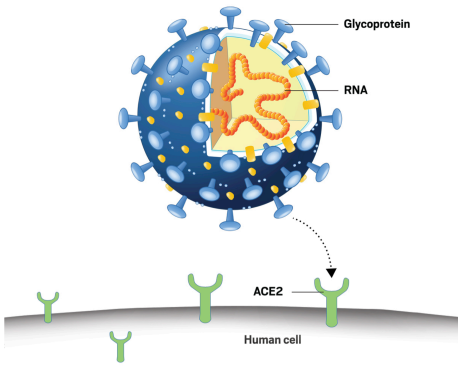
This is a type of lytic virus called a bacteriophage. It uses bacterial cells as its host.



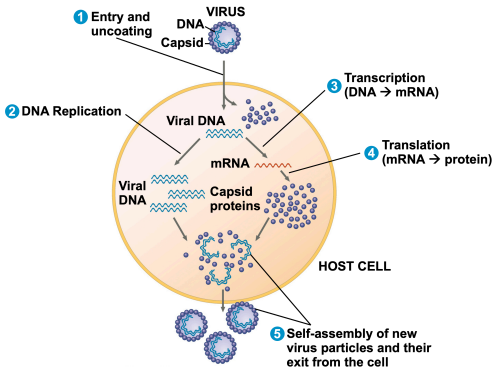
The four steps in the lytic cycle are infection, growth, reproduction, and lysis.



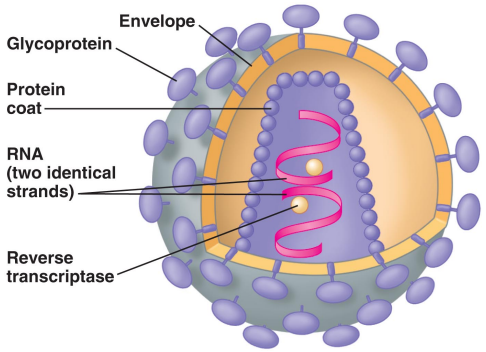
This is a more detailed view of the lytic cycle.



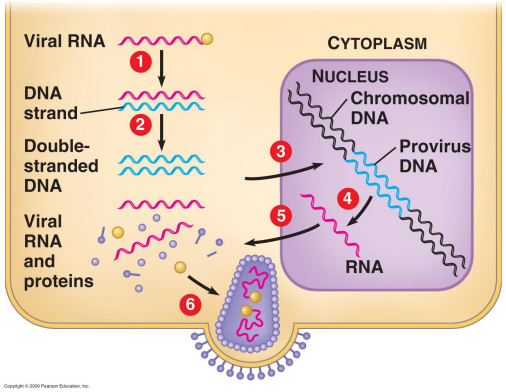
Viruses exhibit specificity. The SARS-CoV-2 coronavirus has a glycoprotein that binds to the ACE2 receptor on epithelial cells that line the human airway.



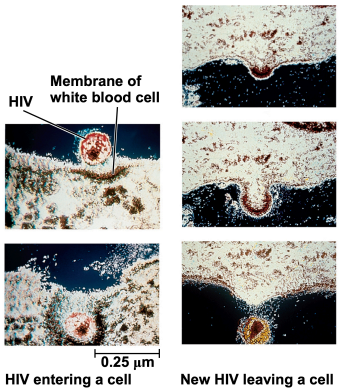
Viruses use the host cell's machinery to produce new viruses.
Note that certain viruses have a more complex reproductive cycle.



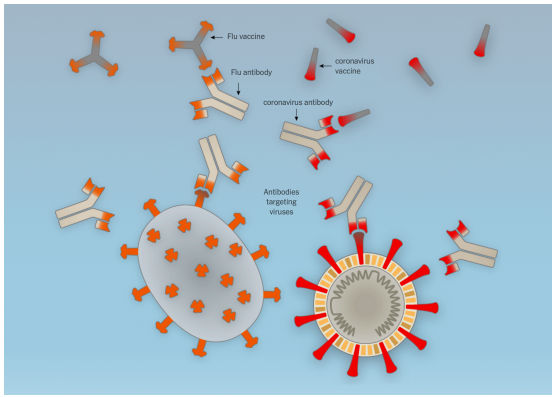
HIV is a retrovirus. It contains RNA which is used to infect a human T-cell.
Viruses can be harmful regardless of whether they contain DNA or RNA.



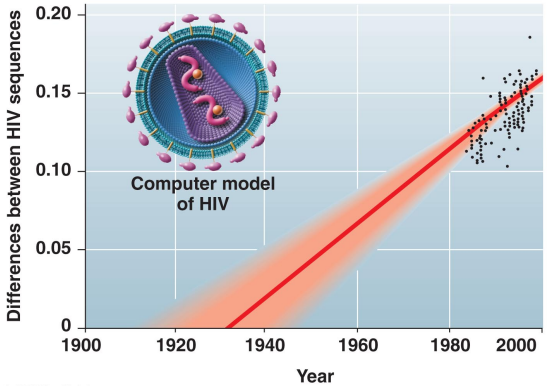
Retroviruses, like HIV, convert their RNA to DNA as part of their reproductive cycle.
This process does not naturally occur in cells.



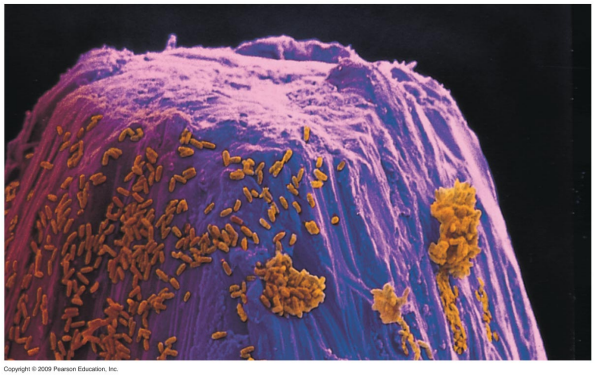
These are actual TEM photos of HIV entering and exiting a white blood cell.



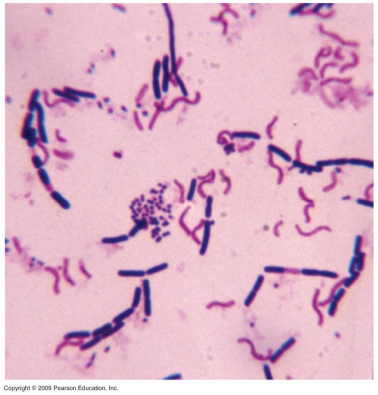
Vaccines help your body produce antibodies. Antibodies are proteins that can neutralize infectious microorganisms, such as bacteria and viruses.



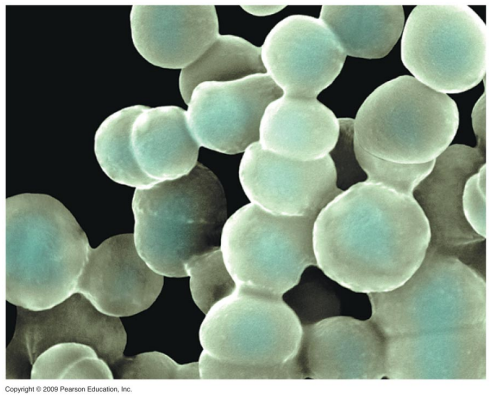
Researchers can study the mutation rate in viruses to estimate the year in which a virus evolved or first appeared.



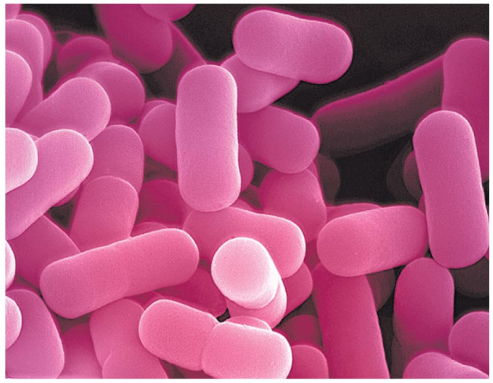
This is a pinhead covered with bacteria. You can tell just how small they are!



Bacteria can be classified by their ability to be stained. "Gram Positive" are purple. "Gram Negative" are pink. The color is an indication of the chemical composition of their cell walls.



A "coccus" is a spherical-shaped bacterium. "Cocci" is the plural name.



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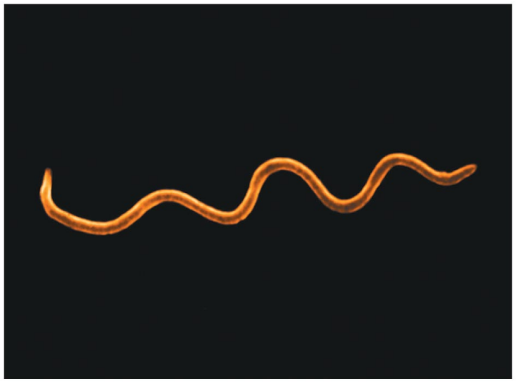
A “bacillus” is a rod-shaped bacterium. “Bacilli” is the plural name.



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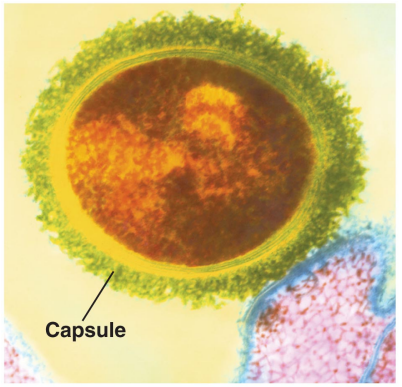
A “spirochete” or “spirillum” is a spiral-shaped bacterial cell.



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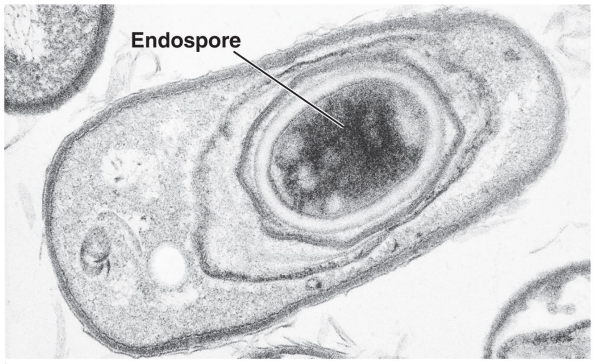
Some bacteria contain a capsule, which helps it stick to (and infect) other cells.



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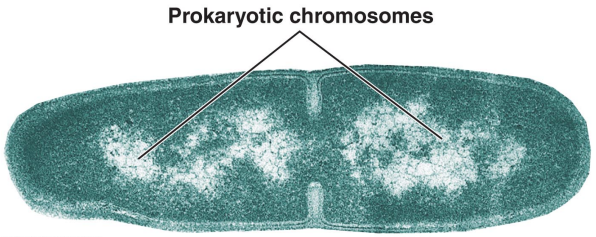
Endospores are bacterial cells that have an extra-thick cell wall to survive in harsh conditions.



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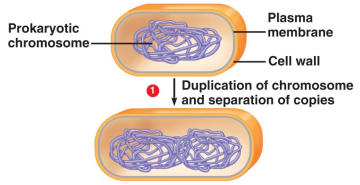
This bacterium is reproducing by binary fission, a form of asexual reproduction.



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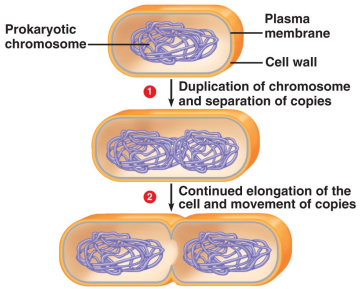
During binary fission, the DNA duplicates, the cell stretches, and then it divides in half. Two identical cells are produced. This is an example of asexual reproduction in bacteria.



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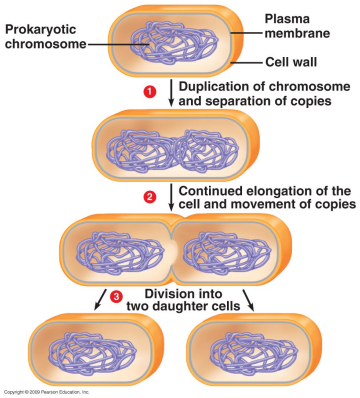

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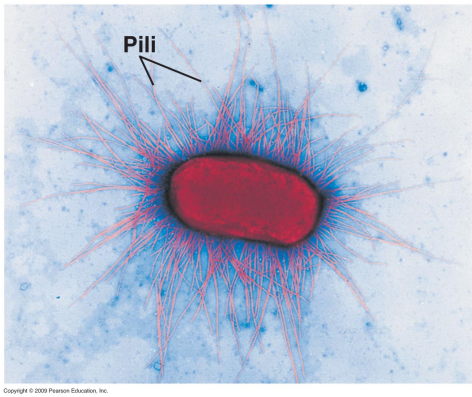

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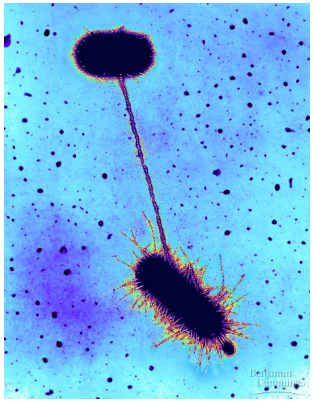
Pili are appendages that help bacteria stick to each other and transfer DNA. A pilus is used during conjugation, a form of sexual reproduction.



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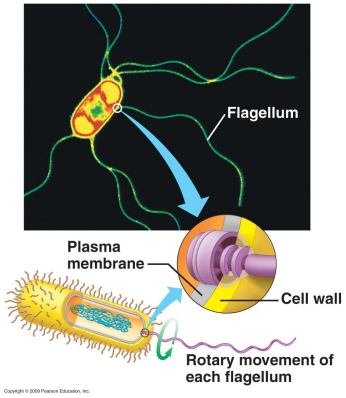

Bacterial often have a flagellum, which is used for movement or swimming.