Bacteria: Life Cycle

A. Growth Rate

Because of the way that bacteria divide, they tend to grow exponentially! One cell becomes 2, which becomes 4, which becomes 8, which becomes 16, . . . Under favourable conditions, some bacteria can divide every 20 minutes! At this rate, how many bacteria would you find after 12 hours if the initial colony contained 1 member?

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**Lag Phase:** adjusting to the environment; slower growth

**Exponential Growth Phase:** very rapid growth; reproduction rate > death rate

**Stationary Phase:** reproduction rate = death rate

**Death Phase:** reproduction rate < death rate
B. Bacterial Reproduction

I. Binary Fission (asexual – daughter cells identical)
II. Conjugation (exchange of genetic material between two cells)

The genetic information transferred is often beneficial to the recipient. Benefits may include antibiotic resistance, xenobiotic tolerance or the ability to use new metabolites.

C. Endospore Formation

A few types of cells have a special trick up their “sleeve” that allows them to go dormant when environmental conditions become inhospitable. These bacteria can form resistant bodies called endospores: structures that can weather the hostile conditions that kill vegetative cells.

When the living, vegetative cells of these genera are exposed to harsh environmental conditions, they undergo a process called sporulation and ultimately generate endospores. As one of the hardiest “life” forms, endospores are able to withstand high temperatures, drying out, freezing, radiation, chemicals and many other environmental conditions that would easily kill a vegetative cell.

Endospores are metabolically inactive, like a seed that is able to wait for the environment to again become favorable. Once environmental conditions improve, the endospore then germinates back into a living, vegetative cell that can grow and thrive!
D. Endospores and Infectious Disease

Although only a few groups of bacteria are able to form spores, people do frequently come in contact with them. Many types of soil bacteria produce these dormant structures, so if you come in contact with dirt, you probably will come in contact with spores.

Luckily, most endospore-producing bacteria are non-pathogenic microbes that are no threat to humans. There are, however, some medically significant endospore producers that cause serious infectious disease, namely members of the genera *Bacillus*, *Clostridium* and *Sporosarcina*.

- anthrax, caused by *Bacillus anthracis*;
- tetanus, caused by *Clostridium tetani*;
- botulism, caused by *Clostridium botulinum*; and
- gas gangrene, caused by *Clostridium perfringens*.