Deltaproteobacteria

By-

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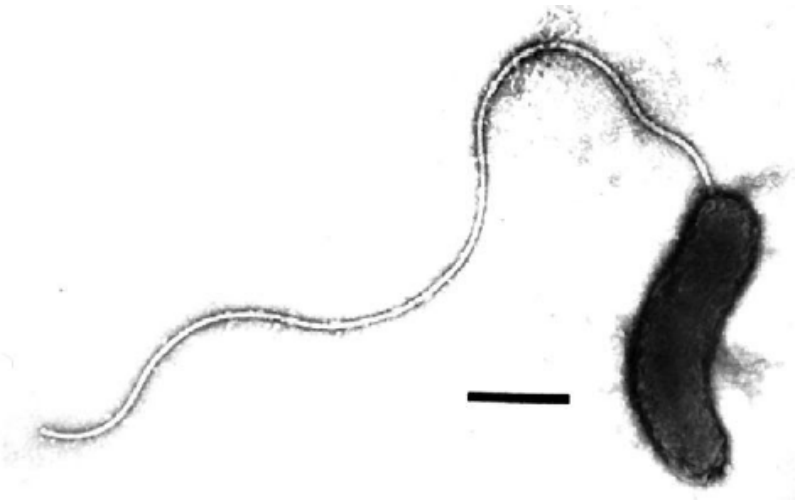
δ-proteobacteria

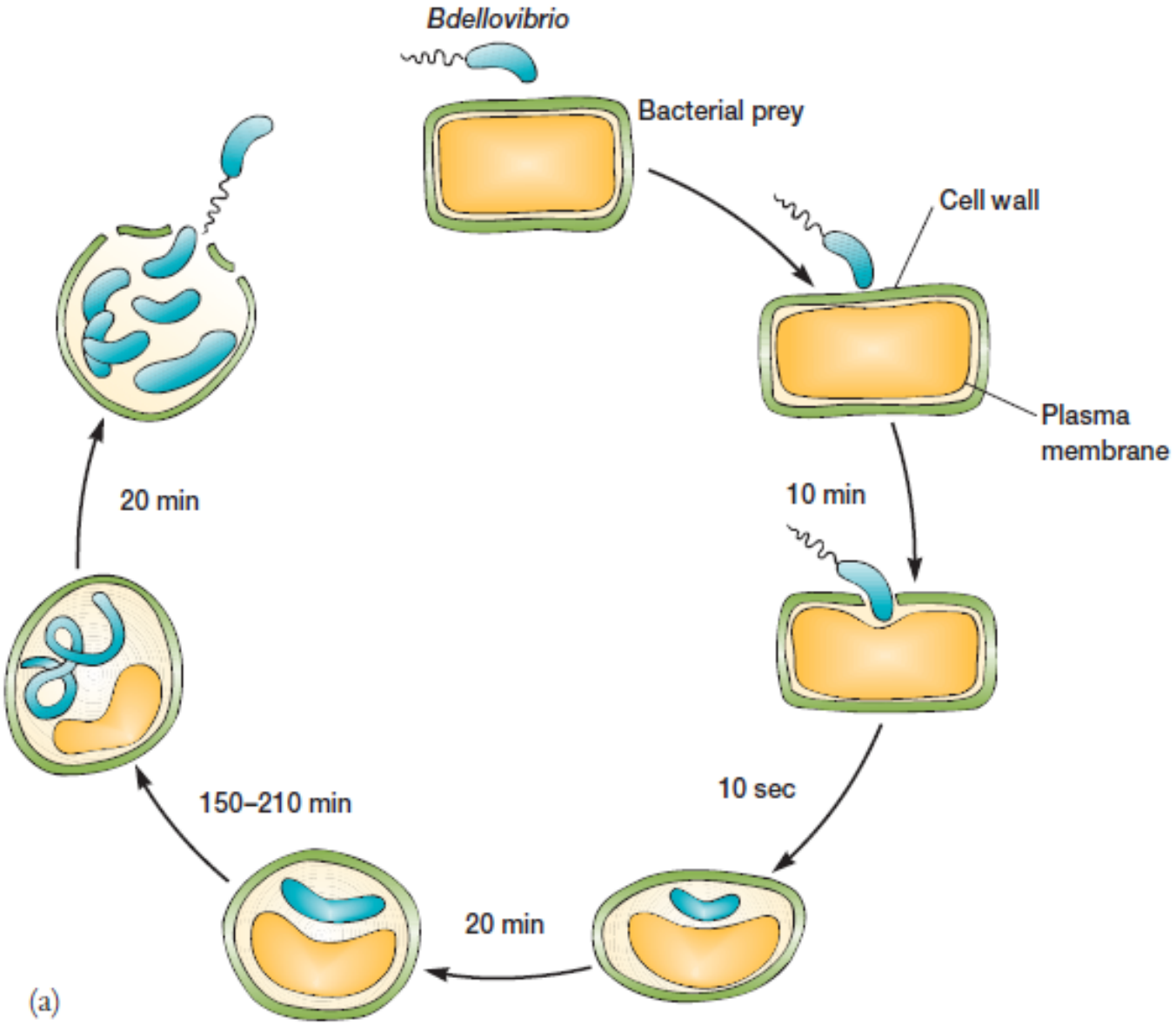
- Although the δ-**proteobacteria are not a large assemblage of** genera, they show considerable morphological and physiological diversity.
- These bacteria can be divided into two general groups, all of them chemoorganotrophs.
- Some genera are predators such as the bdellovibrios and myxobacteria.
- Others are anaerobes that generate sulfide from sulfate and sulfur while oxidizing organic nutrients.
- The class has seven orders and 17 families.

Order Bdellovibrionales

- The order has only the family Bdellovibrionaceae and three genera.
- The genus *Bdellovibrio* [Greek bdella, leech] contains aerobic gram-negative, curved rods with polar flagella (**figure 22.32).**
- The flagellum is unusually thick due to the presence of a sheath that is continuous with the cell wall.
- *Bdellovibrio has a distinctive* life-style: it preys on other gram-negative bacteria and alternates.



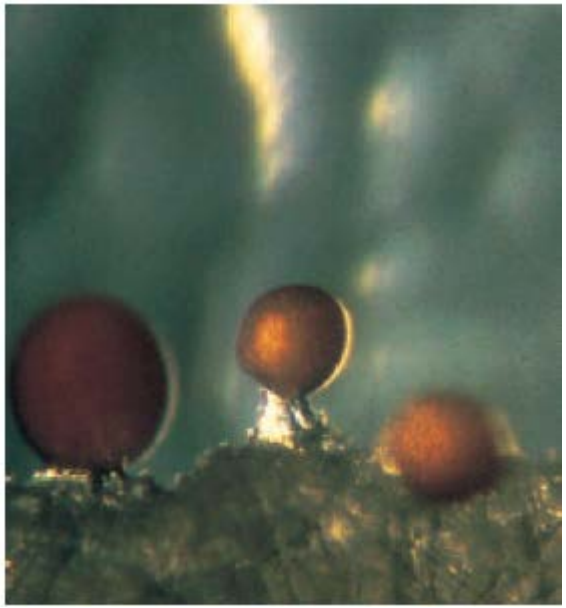
- The life cycle of Bdellovibrio is complex although it requires only 1 to 3 hours for completion**.**
- **The free bacterium** swims along very rapidly (about 100 cell lengths per second) until it collides violently with its prey.
- It attaches to the bacterial surface, begins to rotate at rates as high as 100 revolutions per second, and bores a hole through the host cell wall in 5 to 20 minutes with the aid of several hydrolytic enzymes that it releases.
- Its flagellum is lost during penetration of the cell.
- After entry, *Bdellovibrio takes control of the host cell and* grows in the space between the cell wall and plasma membrane while the host cell loses its shape and rounds up.
- The predator inhibits host DNA, RNA, and protein synthesis within minutes and disrupts the host's plasma membrane so that cytoplasmic constituents can leak out of the cell.
- The growing bacterium uses host amino acids as its carbon, nitrogen, and energy source.
- It employs fatty acids and nucleotides directly in biosynthesis, thus saving carbon and energy. The bacterium rapidly grows into a long filament under the cell wall and then divides into many smaller, flagellated progeny, which escape upon host cell lysis.

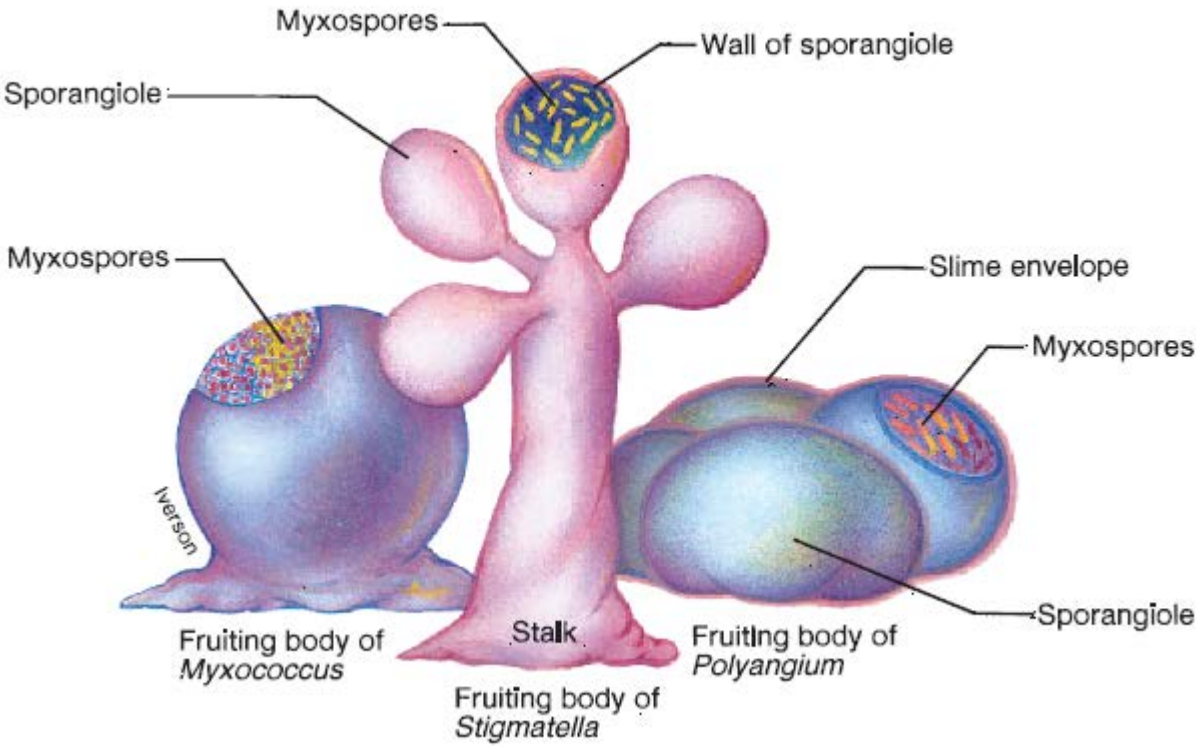

Bdellovibrio
Bacterial prey
Cell wall
Plasma membrane
10 min
10 sec
20 min
150–210 min
20 min
(a)

Order Myxococcales

- The **myxobacteria are gram-negative, aerobic soil bacteria characterized** by gliding motility, a complex life cycle with the production of fruiting bodies, and the formation of dormant myxospores.
- In addition, their G C content is around 67 to 71%, significantly higher than that of most gliding bacteria.
- Myxobacterial cells are rods, about 0.6 to 0.9 by 3 to 8 μm long, and may be either slender with tapered ends or stout with rounded, blunt ends**.**
- **The order *Myxobacteriales is divided into*** four families based on the shape of vegetative cells, myxospores, and sporangia.

- Most myxobacteria are micropredators or scavengers.
- They secrete an array of digestive enzymes that lyse bacteria and yeasts.
- Many myxobacteria also secrete antibiotics, which may kill their prey.
- The digestion products, primarily small peptides, are absorbed.
- Most myxobacteria use amino acids as their major source of carbon, nitrogen, and energy.
- All are chemoheterotrophs with respiratory metabolism.
- In the presence of a food supply, myxobacteria migrate along a solid surface, feeding and leaving slime trails.
- When their nutrient supply is exhausted, the myxobacteria aggregate and differentiate into a **fruiting body.**
- Some cells develop into dormant **myxospores that frequently are enclosed in** walled structures called sporangioles or sporangia.
- Each species forms a characteristic fruiting body.




Myxospores
Wall of sporangiole
Sporangiole
Myxospores
Slime envelope
Myxospores
Iverson
Sporangiole
Fruiting body of
Myxococcus
Stalk
Fruiting body of
Polyangium
Fruiting body of
Stigmatella

- Myxospores are not only dormant but desiccation-resistant, and they may survive up to 10 years under adverse conditions.
- They enable myxobacteria to survive long periods of dryness and nutrient deprivation.
- The use of fruiting bodies provides further protection for the myxospores and assists in their dispersal.
- Myxobacteria are found in soils worldwide.
- They are most commonly isolated from neutral soils or decaying plant material such as leaves and tree bark, and from animal dung.
- Although they grow in habitats as diverse as tropical rain forests and the arctic tundra, they are most abundant in warm areas.