Beta-proteobacteria

By-

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- The beta**–proteobacteria** use substances that diffuse from organic decomposition in the anaerobic zone of habitats. Some of these bacteria use hydrogen, ammonia, methane, volatile fatty acids, and similar substances.
- As with the -proteobacteria, there is considerable metabolic diversity; the beta-proteobacteria may be chemoheterotrophs, photolithotrophs, methylotrophs, and chemolithotrophs.
- The subgroup contains two genera with important human pathogens: *Neisseria* and *Bordetella.*
- The class *Betaproteobacteria has six orders and 12 families.*

Order *Neisseriales*

- The second edition places one family, Neisseriaceae, within the order and assigns 14 genera to it.
- The best-known and most intensely studied genus is *Neisseria.*
- Members of this genus are nonmotile, aerobic, gram-negative cocci that most often occur in pairs with adjacent sides flattened.
- They may have capsules and fimbriae.
- The genus is chemoorganotrophic, oxidase positive, and almost always catalase positive.
- Species are inhabitants of the mucous membranes of mammals, and some are human pathogens.
- *Neisseria gonorrhoeae* is the causative agent of gonorrhea;
- *Neisseria meningitidis* is responsible for some cases of bacterial meningitis.

Order Burkholderiales

- The order contains five families, three of them with well-known genera.
- The genus *Burkholderia is placed in the family Burkholderiaceae.*
- This genus was established when *Pseudomonas was divided* into at least seven new genera based on rRNA data: *Acidovorax, Aminobacter, Burkholderia, Comamonas, Deleya, Hydrogenophaga,* and *Methylobacterium.*
- *Members of the genus Burkholderia* are gram-negative, aerobic, nonfermentative, non–spore-forming, mesophilic straight rods.

- With the exception of one species, all are motile with a single polar flagellum or a tuft of polar flagella.
- Catalase is produced and they often are oxidase positive.
- Most species use poly--hydroxybutyrate as their carbon reserve.
- One of the most important species is *B. cepacia, which will degrade over 100 different* organic molecules and is very active in recycling organic materials in nature.
- This species also is a plant pathogen and causes disease in hospital patients due to contaminated equipment and medications.
- It is a particular problem for cystic fibrosis patients.

Order *Hydrogenophilales*

- This small order contains *Thiobacillus, one of the best-studied* chemolithotrophs and most prominent of the colorless sulfur bacteria.
- *Thiobacillus is a gram-negative rod and* polarly flagellated.
- *It grows aerobically by oxidizing a variety of inorganic* sulfur compounds (elemental sulfur, hydrogen sulfide, thiosulfate) to sulfate.
- ATP is produced with a combination of oxidative phosphorylation and substrate-level phosphorylation.
- *Although Thiobacillus normally uses CO2 as its major carbon* source, *T. novellus and a few other strains can grow heterotrophically.*
- Some species are very flexible metabolically. For example, *Thiobacillus ferrooxidans also uses ferrous iron as an electron* donor and produces ferric iron as well as sulfuric acid.
- *T. denitrificans* even grows anaerobically by reducing nitrate to nitrogen gas.

- *Thiobacillus grows in soil and aquatic habitats,* both freshwater and marine.
- Because of their great acid tolerance (*T. thiooxidans grows at pH 0.5 and cannot* grow above pH 6), these bacteria prosper in habitats they have acidified by sulfuric acid production, even though most other organisms are dying.
- The production of large quantities of sulfuric acid and ferric iron by *T. ferrooxidans corrodes concrete and pipe* structures.
- Thiobacilli often cause extensive acid and metal pollution when they release metals from mine wastes.
- Thiobacilli are used in processing low-grade metal ores because of their ability to leach metals from ore.