



Studievereniging Congo

# Samenvatting

Microbiology  
Biologie Jaar 3, Periode 2

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**Proteobacteria** Many of the most commonly encountered bacteria are proteobacteria. They are very diverse in morphology and in metabolism they're most diverse of all bacterial phyla (chemolithotrophy, ghemoorganotrophy, phototrophy)

**Alphaproteobacteria** - **Sphingomonads** *Zymomonas mobilis* is a gram negative, facultative anaerobe. It is one of the fastest ethanol producers, yet unwanted in beverages due to the acetaldehyde and H<sub>2</sub>S "flavours". Using the Entner-Doudoroff Pathway, sugars are degraded to pyruvate, which is fermented to ethanol and CO<sub>2</sub> (like in yeast). The bioethanol production in *Z. mobilis* is advantageous over the production in yeast, because the sugar uptake and ethanol yield is up to 2.5 times higher, the biomass production is lower, and the ethanol tolerance is higher (up to 16 vol.%).

#### **Betaproteobacteria**

**Gammaproteobacteria** - **Enterobacteriales** Enteric bacteria are facultative aerobes. They are rod shaped, nonsporulating, and can be either motile or non-motile. They require relatively simple nutrients and can ferment sugars in a variety of end products.

Mixed-acid fermenters: Escherichia, Salmonella

2,3-butanediol fermenters: Enterobacter, Klebsiella

- **Pseudomonadales** Chemoorganotrophs that can grow in many places (oil, fat, soil, man-made environments) and use a wide variety of organic compounds. They are oxidase- and catalase-positive, and can cause plant and animal diseases.

- **Vibrionales** Oxidase-positive fermenters that usually grow in salt water. They have a curved rod shape.

#### **Deltaproteobacteria**

**Epsilonproteobacteria** - **Campylobacter** A microaerophilic, gram-negative, motile spirilla. They are oxidase- and catalase-positive and pathogenic to humans and other animals. They grow well at 42°C, the internal temperature of most birds.

**Actinobacteria** This phylum has over 30 taxonomic families. They can be rod-shaped to filamentous, and are usually aerobic. They are mostly harmless commensals and valuable for antibiotics and certain fermented dairy products.

**Propionic Acid Bacteria** Gram-positive anaerobes that were first discovered in swiss cheese. They have a metabolic strategy called secondary fermentation in which they obtain energy from fermentation products produced by other bacteria.

**Mycobacterium** Exhibit acid-fastness and not readily stained by gram staining because of high surface lipid content (mycolic acid). They are rod shaped and were first discovered by Robert Koch. They form tight, compact, wrinkled colonies. Their cordlike structure is related to the glycolipids on the cell surface.

**Streptomyces and relatives (filamentous)** Filamentous, gram-positive bacteria that produce mycelium, analogous to mycelium of fungi. Their colonies are colored. They are strict aerobes that produce many extracellular enzymes. *Streptomyces* contains over 500

species. They are sporulating ( spores are called conidia) microorganisms that are primarily found in the soil, and are responsible for the earthy odor of the soil (called geosmins). 50% of all isolated *Streptomyces* produce antibiotics, some produce more than one antibiotic. In total, more than 500 distinct antibiotics are produced. Their genomes are typically quite large and the knowledge of their ecology remains poor.

### **Firmicutes**

***Lactobacillales* - *Lactobacillus*** Some strains are obligate homofermentative, others are heterofermentative. They are common in dairy products and are resistant to acidic conditions (pH as low as 4). They are rod shaped and grow in chains.

- ***Streptococcus*** They are homofermentative and play important roles in the production of dairy products like buttermilk. Some species are pathogenic. They are coccus-shaped and grow in chains.

- ***Leuconostoc*** They are heterofermentative and play an important role in dairy fermentation. They form slimy layers of dextran, of which polymers have a medical use.

***Bacillales and Clostridiales (non-sporulating)* - *Staphylococcus*** A coccus-shaped gram-positive facultative aerobe which is resistant to a reduced water potential and tolerates high salt concentrations. Many species are pigmented.

- ***Listeria*** A coccus-shaped gram-positive obligate aerobe. They are catalase-positive and form chains of 3 to 5 cells long.

- ***Sacina*** Catalase-negative obligate anaerobe, which is extremely acid tolerant and can therefore inhabit and grow in stomachs of monogastric animals.

***Bacillales and Clostridiales (sporulating)*** Generally found in soils. Endospores are advantageous for soil microorganisms, because they are resistant to desiccation, heat and high pressure.

- ***Bacillus*** Many bacilli produce antibiotics and extracellular hydrolytic enzymes that break down polymers. Because of the anaerobic respiration, bacilli can perform denitrification.

- ***Clostridium*** *Clostridium* lacks a respiratory chain, making it an obligate anaerobic fermenter. They are mainly found in anaerobic pockets in the soil, but also in the mammalian intestinal tract. They can perform nitrogen fixation. Some species are pathogenic, causing diseases like botulism, tetanus, and gangrene.

### **Bacteroidetes**