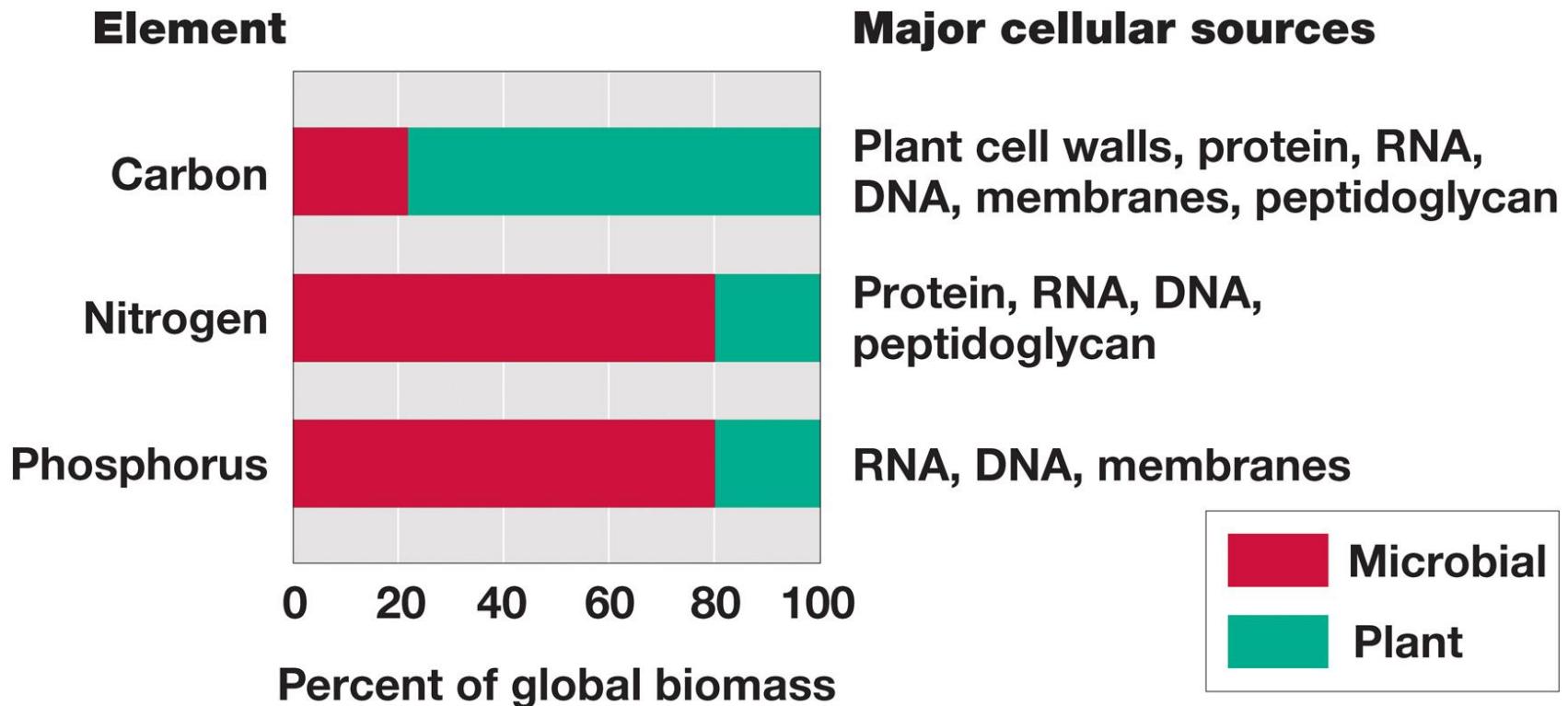


# Welkom bij Microbiologie 1



Jeanine de Keyzer (D0.109)

# figuur 1.12 Contribution of Microbial Cells to Global Biomass

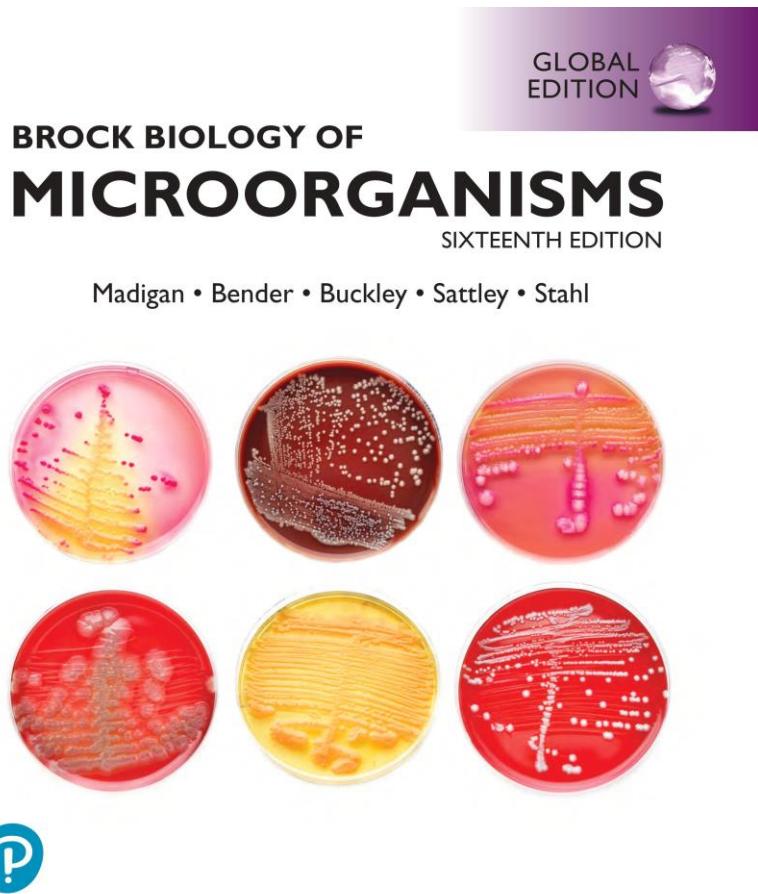


# Na dit blok weet je meer over

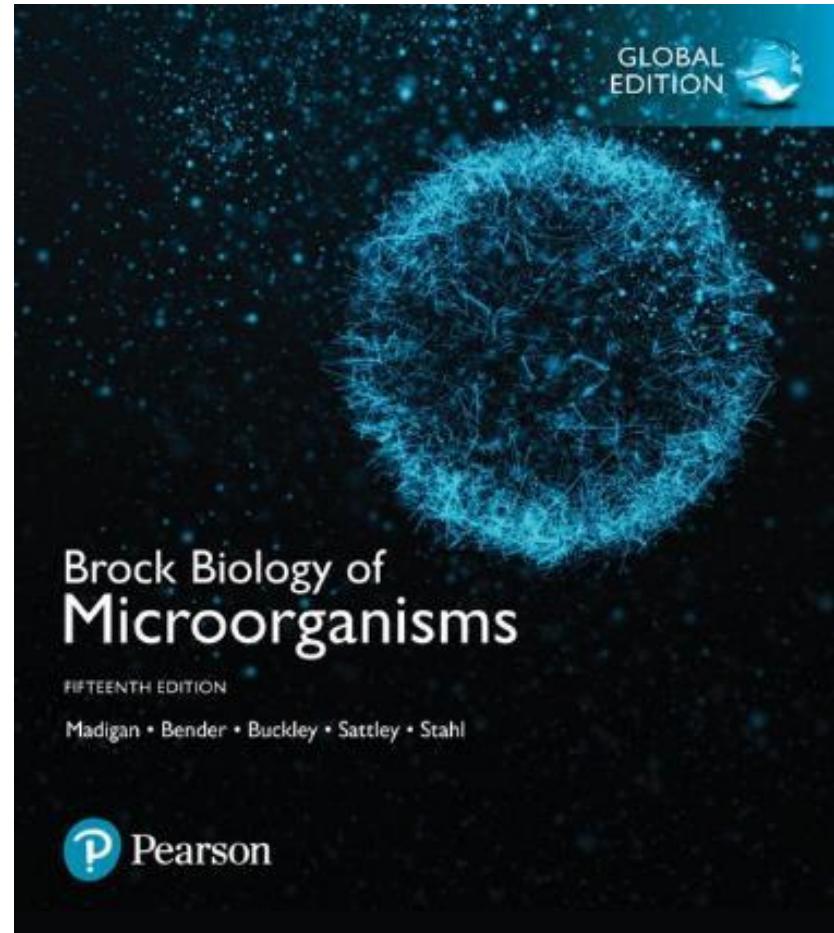
- de moleculaire bouw van de bacteriën en archaea
- het metabolisme van bacteriën
- aanpassingen van micro-organismen aan de omgeving
- de evolutie van micro-organismen
- klassificatie van micro-organismen
- culture-onafhankelijke methoden in de microbiele ecologie

(gedetailleerd overzicht van de leerdoelen op Blackboard)

# Brock Biology of Microorganisms



Hoofdstuk 1 t/m 4 + 19



Hoofdstuk 1 t/m 3 + 5 + 19

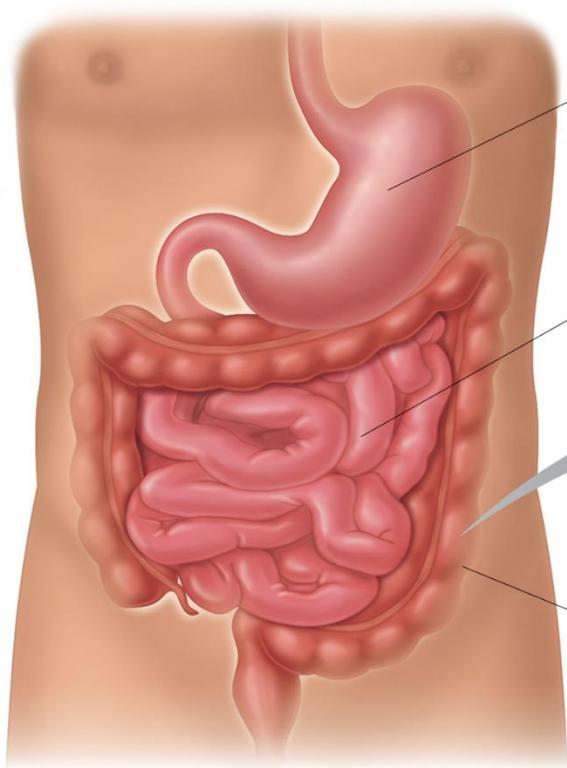
# Micro-organismen en de mens



figuur 1.2

# Humaan microbioom

b.v. in het maag-darmkanaal



(a)

**Stomach**  
(pH 2,  $10^4$  cells/g)

**Small intestine**  
(pH 4–5, up to  $10^8$  cells/g)

**Large intestine**  
(pH 7, about  $10^{11}$  cells/g)



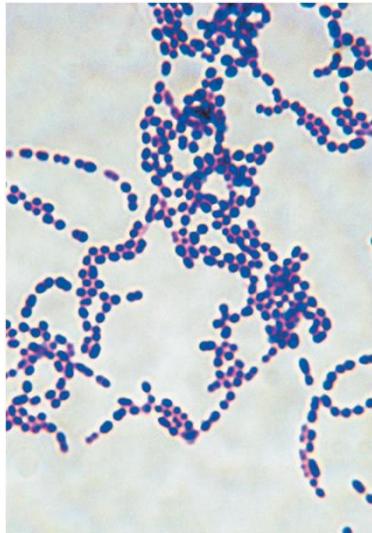
(b)

Figuur 1.15

o.a. synthese van vitamines en andere nutriënten

# Pathogene bacteriën

B.v. *Streptococcus pyogenes*



keelontsteking



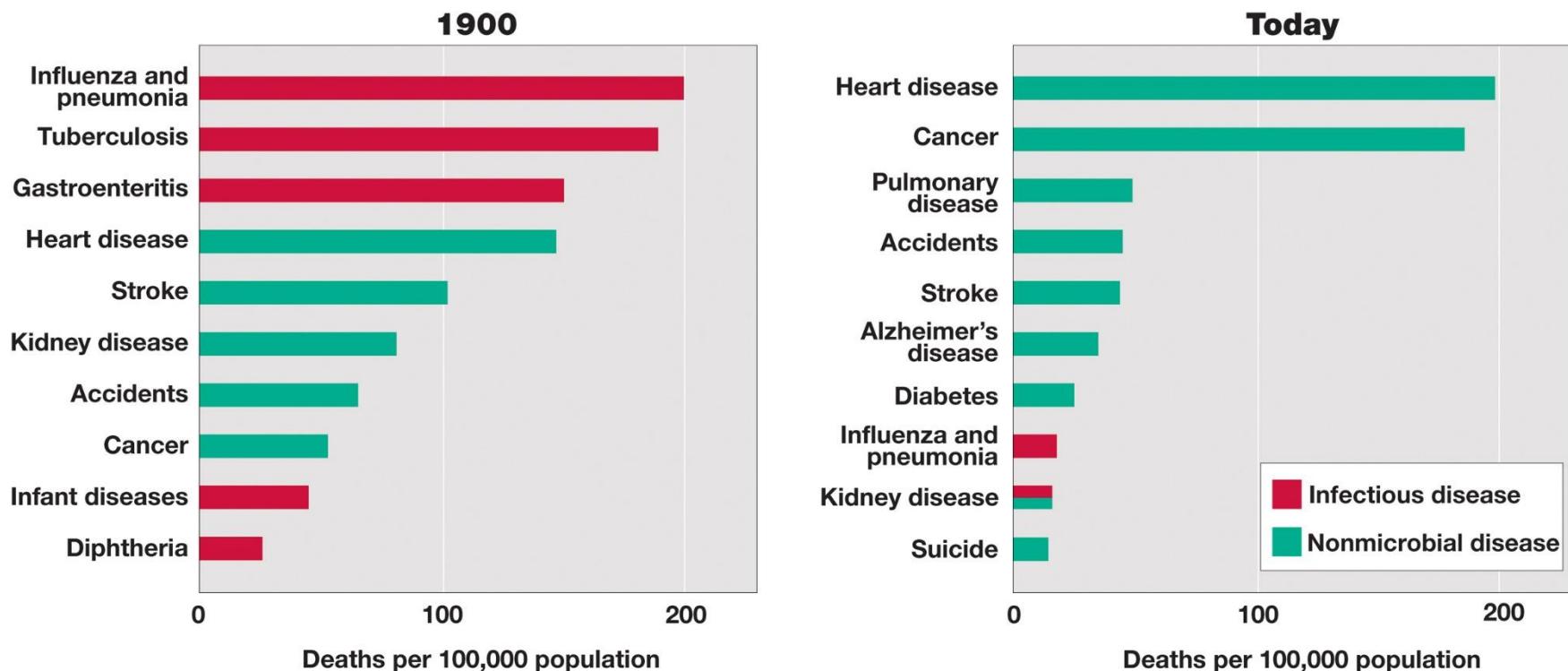
krentenbaard

maar ook:  
necrotiserende fasciitis



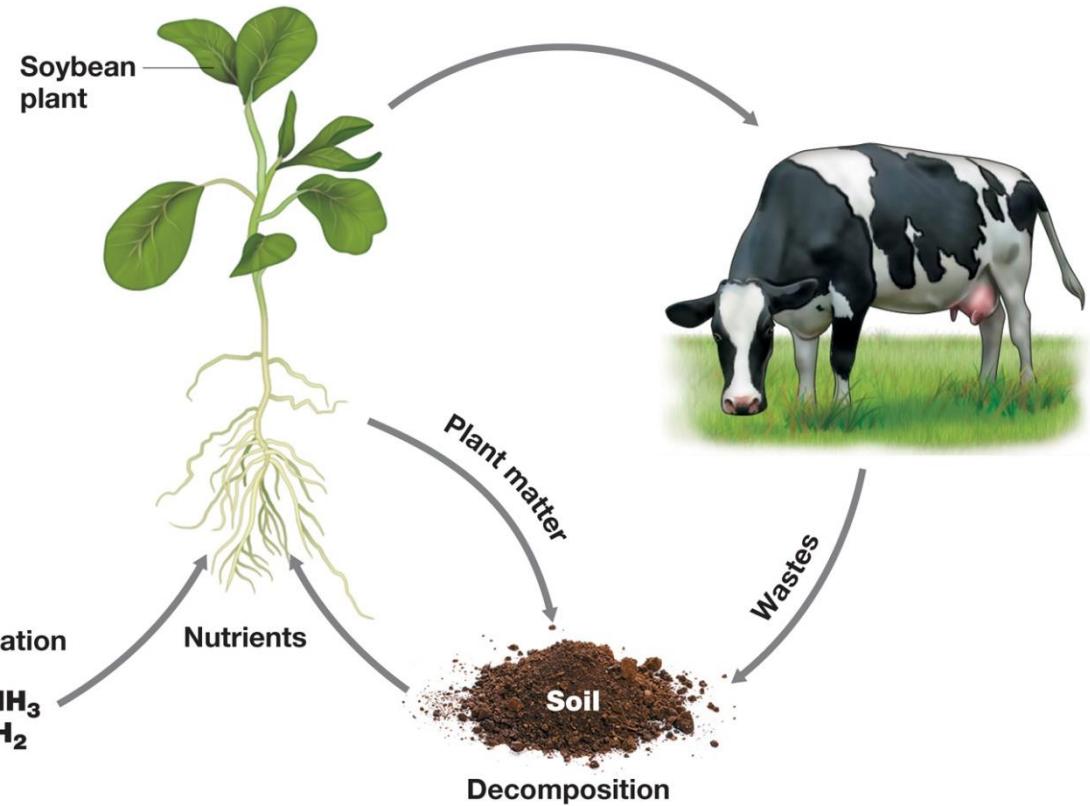
Meer weten? Zie  
pagina 988-990  
(geen tentamenstof)

# Vroeger stierven mensen veel vaker a.g.v. infectieziekten dan nu



Figuur 1.13

# Micro-organismen en landbouw



Stikstoffixatie

Afbraak cellulose m.b.v. micro-organismen in het rumen

Figuur 1.14

# Micro-organismen in de industrie



**Wastewater Treatment:** Microbes are used to clean wastewater.



**Bioremediation:** Microbes are used to clean contaminated environments.



**Biofilms:** Microbes grow on surfaces and can foul pipes and pipelines.



**Biotechnology:** Microbes can be genetically modified to produce high-value products such as pharmaceuticals and enzymes.



**Fermentation:** Microbes are used at industrial scale to make chemicals, solvents, enzymes, and pharmaceuticals.



**Biofuels:** Microbes are used to convert biomass into ethanol and wastes into natural gas (methane).

# Korte geschiedenis van de Microbiologie

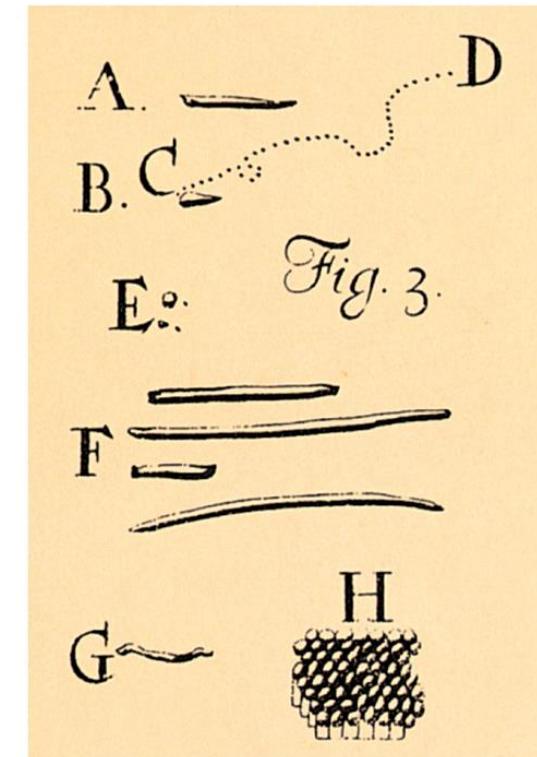
# Antonie van Leeuwenhoek (1632-1723)



Jan Verkolje [Public domain]



(a)



(b)

figuur 1.19

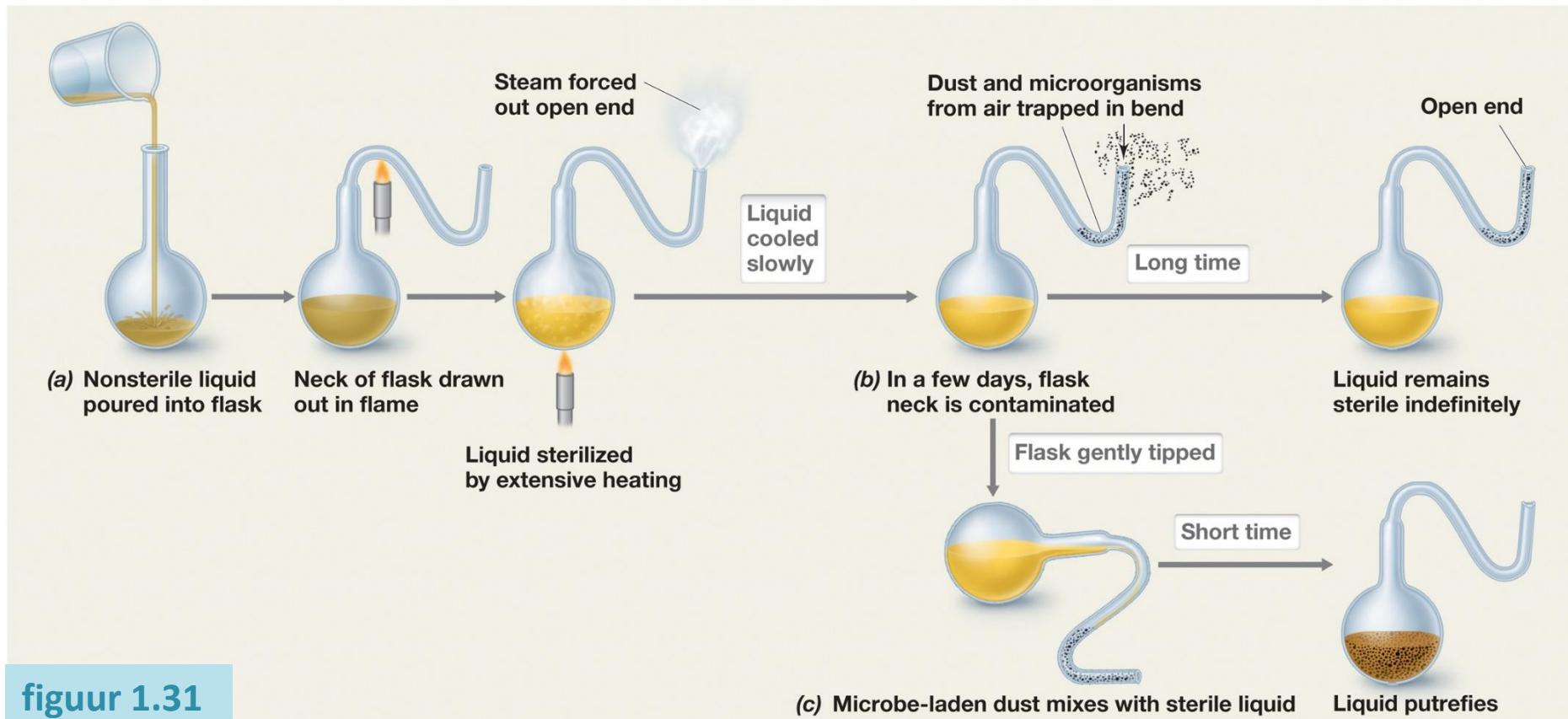
1684: bekeek tandplak en beschreef “animalcules” (bacteriën)

# Louis Pasteur (1822-1895)



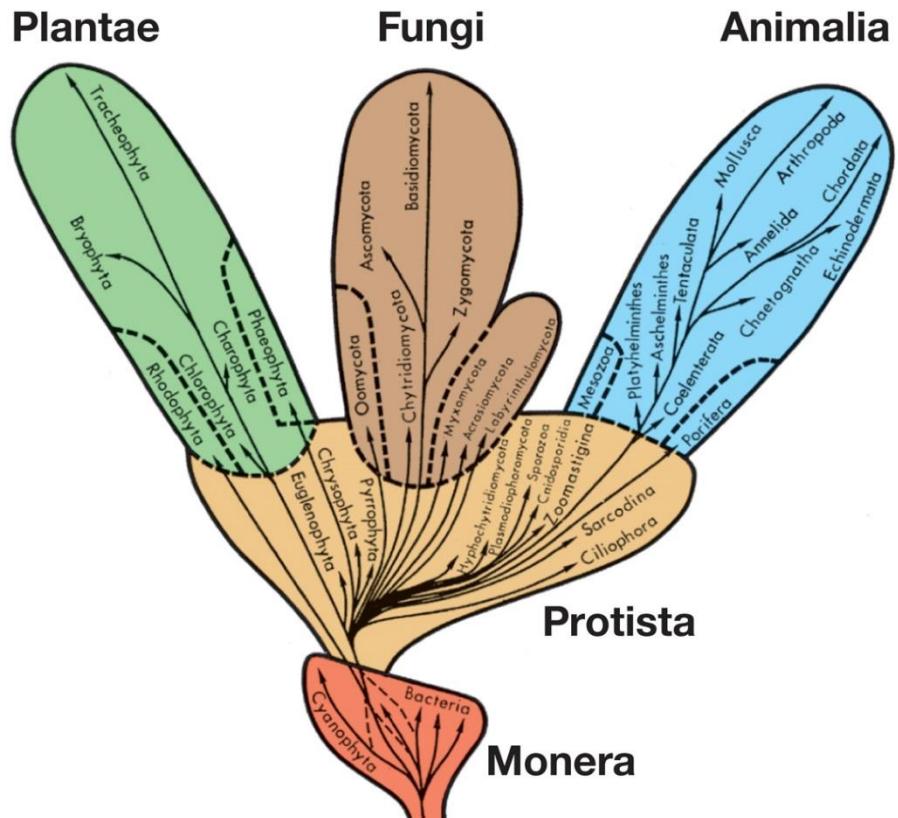
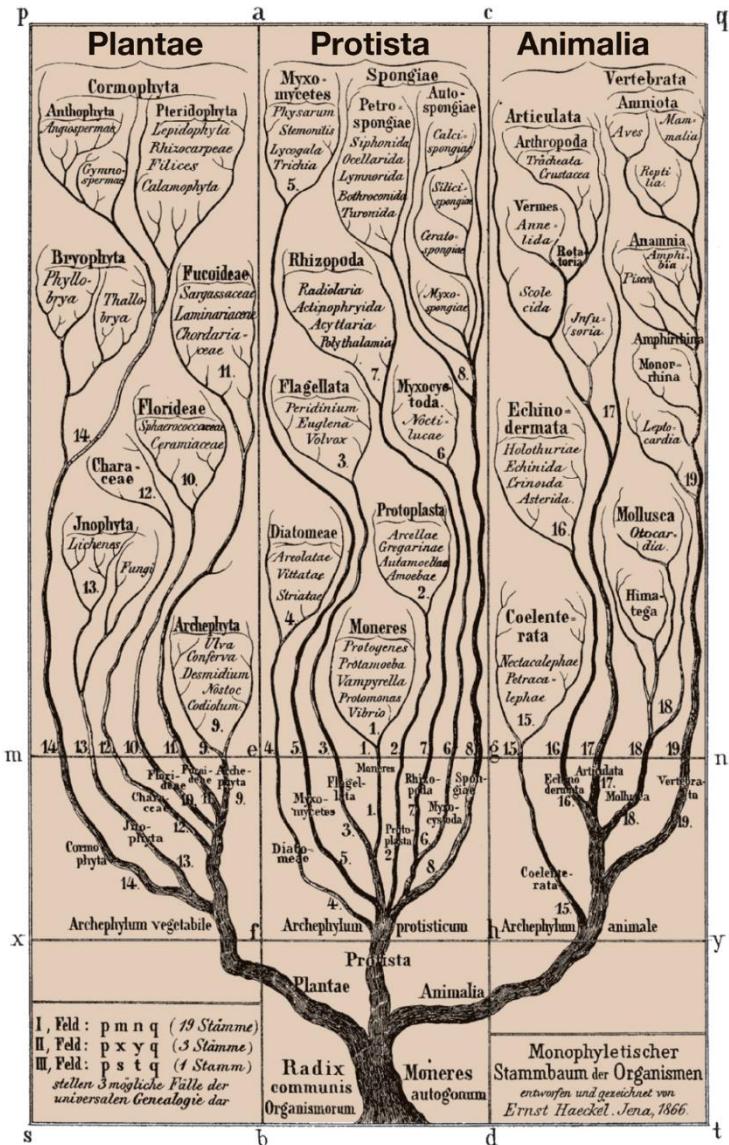
Ontkrachtte het concept **spontane generatie**

Germ theory of disease



figuur 1.31

# Tree of Life (vroege weergave)



From Science 163:150-160, 1969  
Reprinted with permission from AAAS

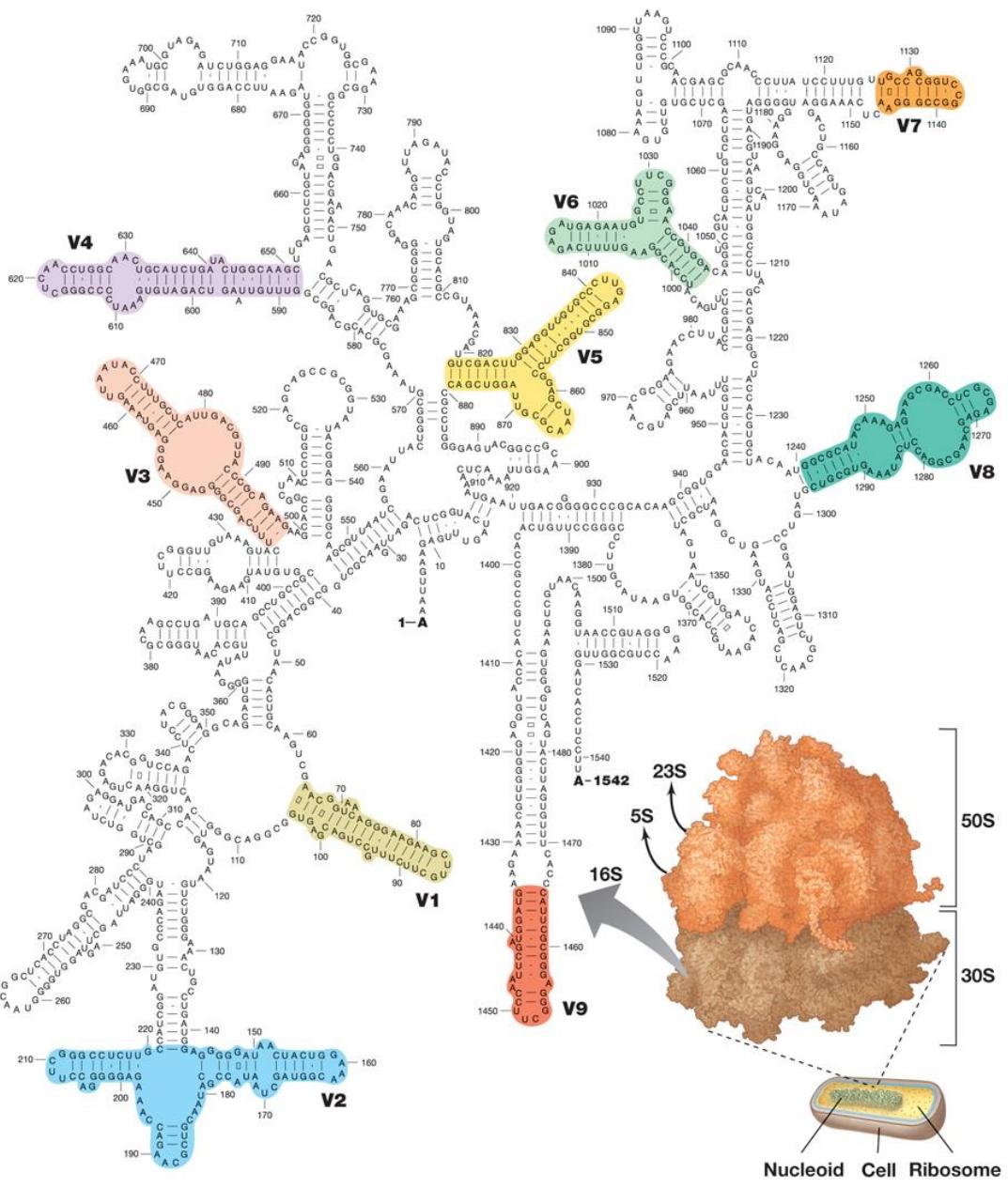
figuur 1.39 en 1.40

# Ribosomaal RNA

Ribosomen bestaan uit twee subunits

Elke subunit bestaat uit rRNA en eiwitten

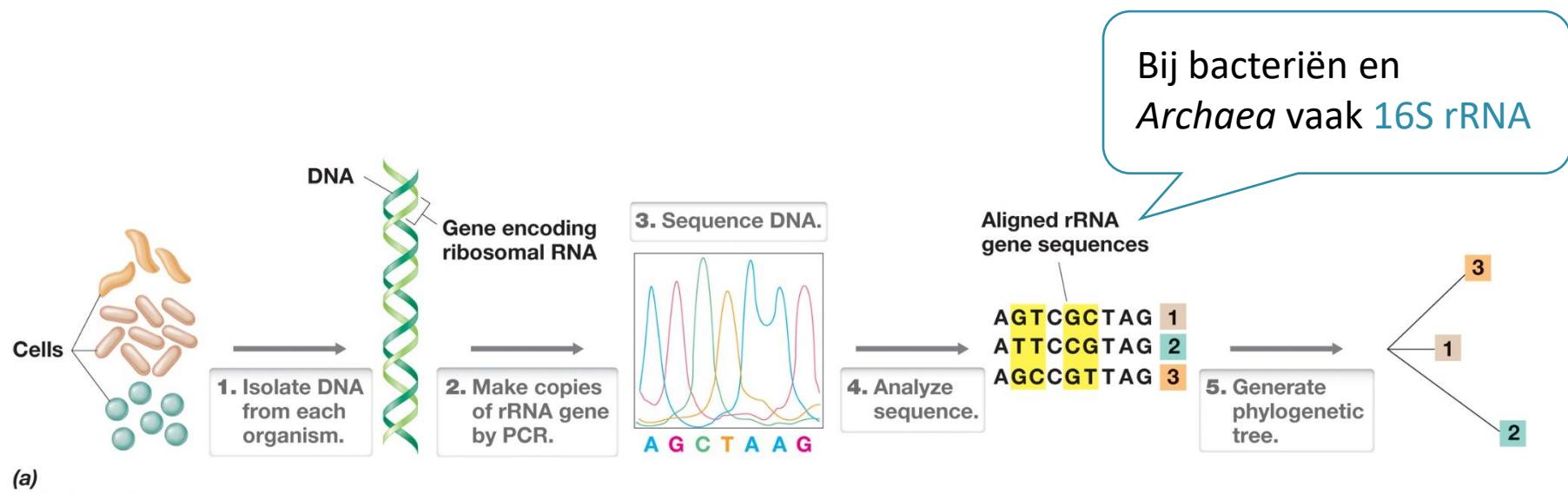
16S rRNA: rRNA van de kleine subunit van de ribosomen van bacteriën en archaea



figuur 13.24

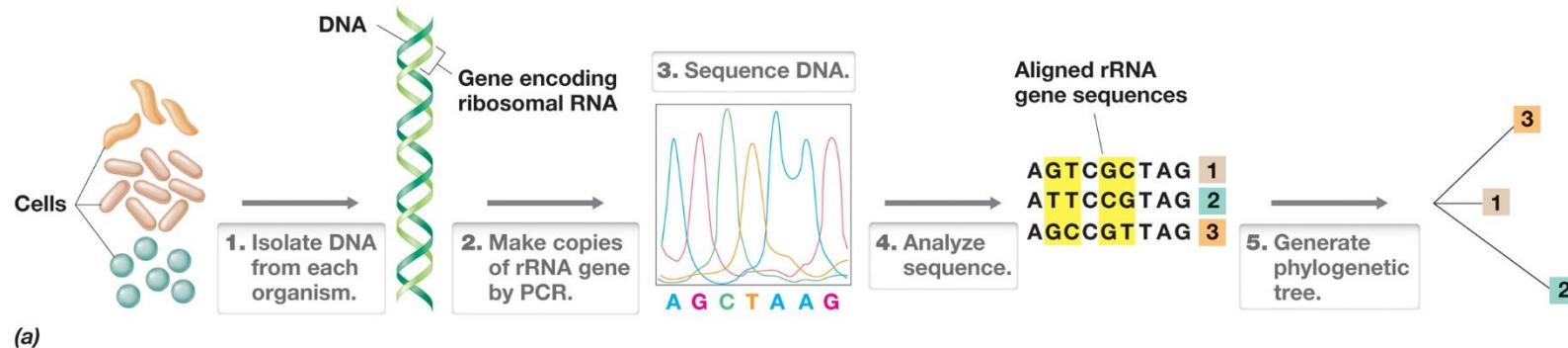
# Ribosomaal RNA

- Aanwezig in alle organismen
- Constante functie
- Sterk geconserveerd
- Lengte geschikt om goed beeld te krijgen van evolutie relaties

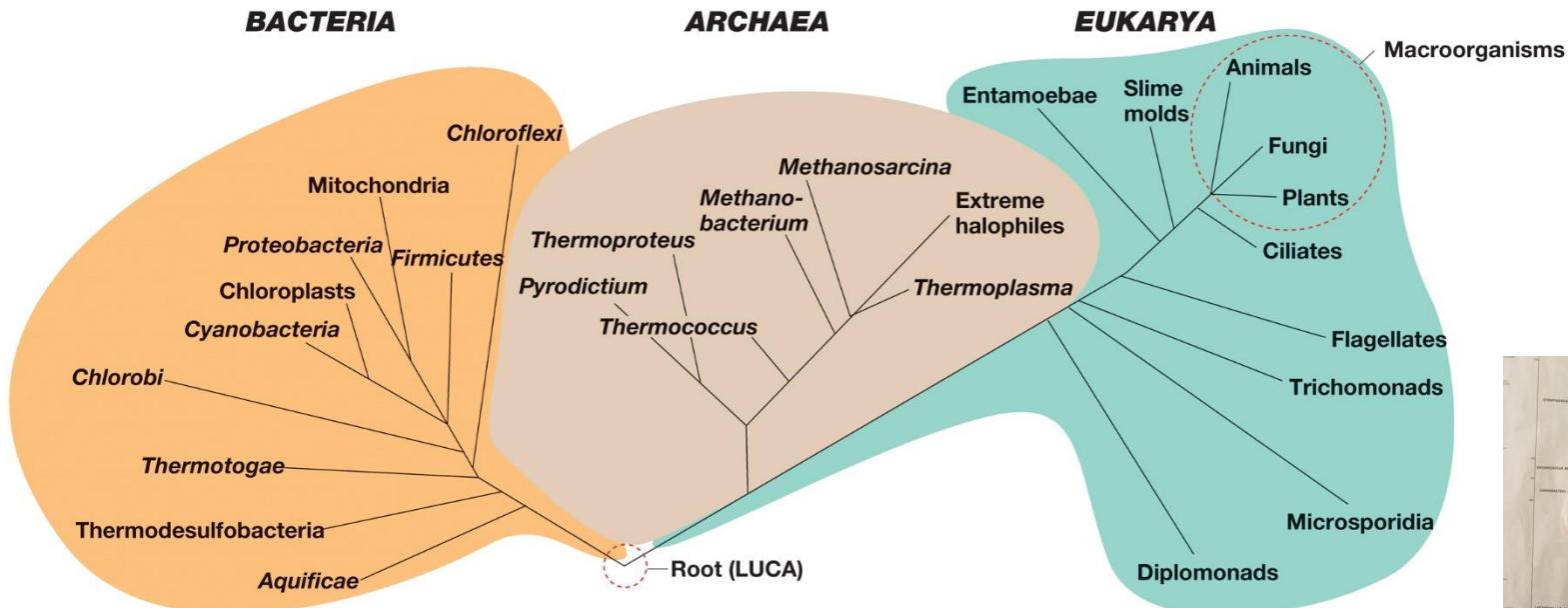


figuur 1.41

# 1977 – Carl Woese en de Tree of Life



(a)

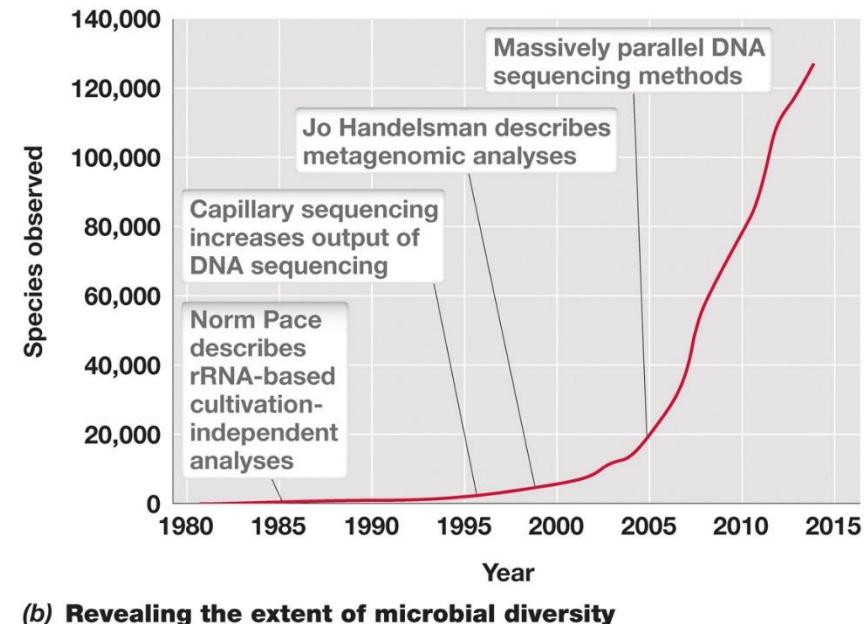
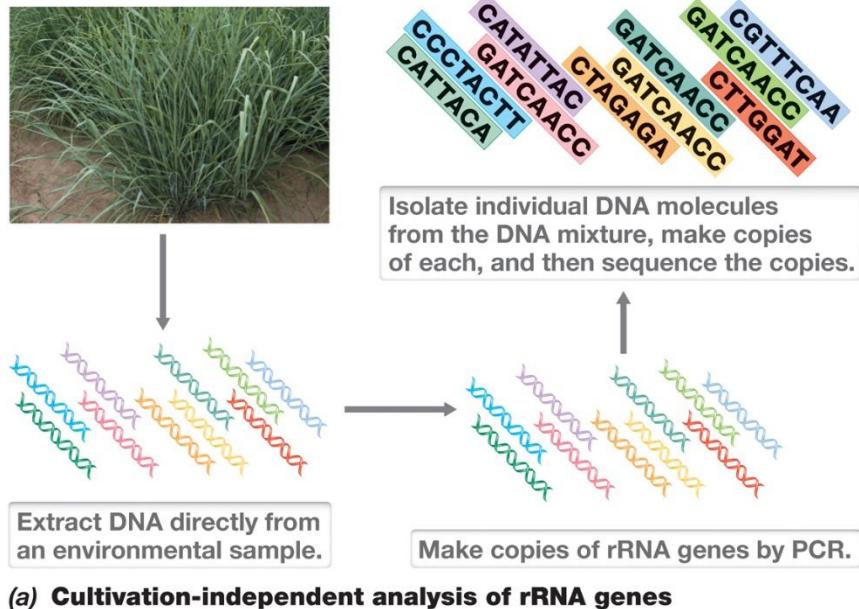


(b)

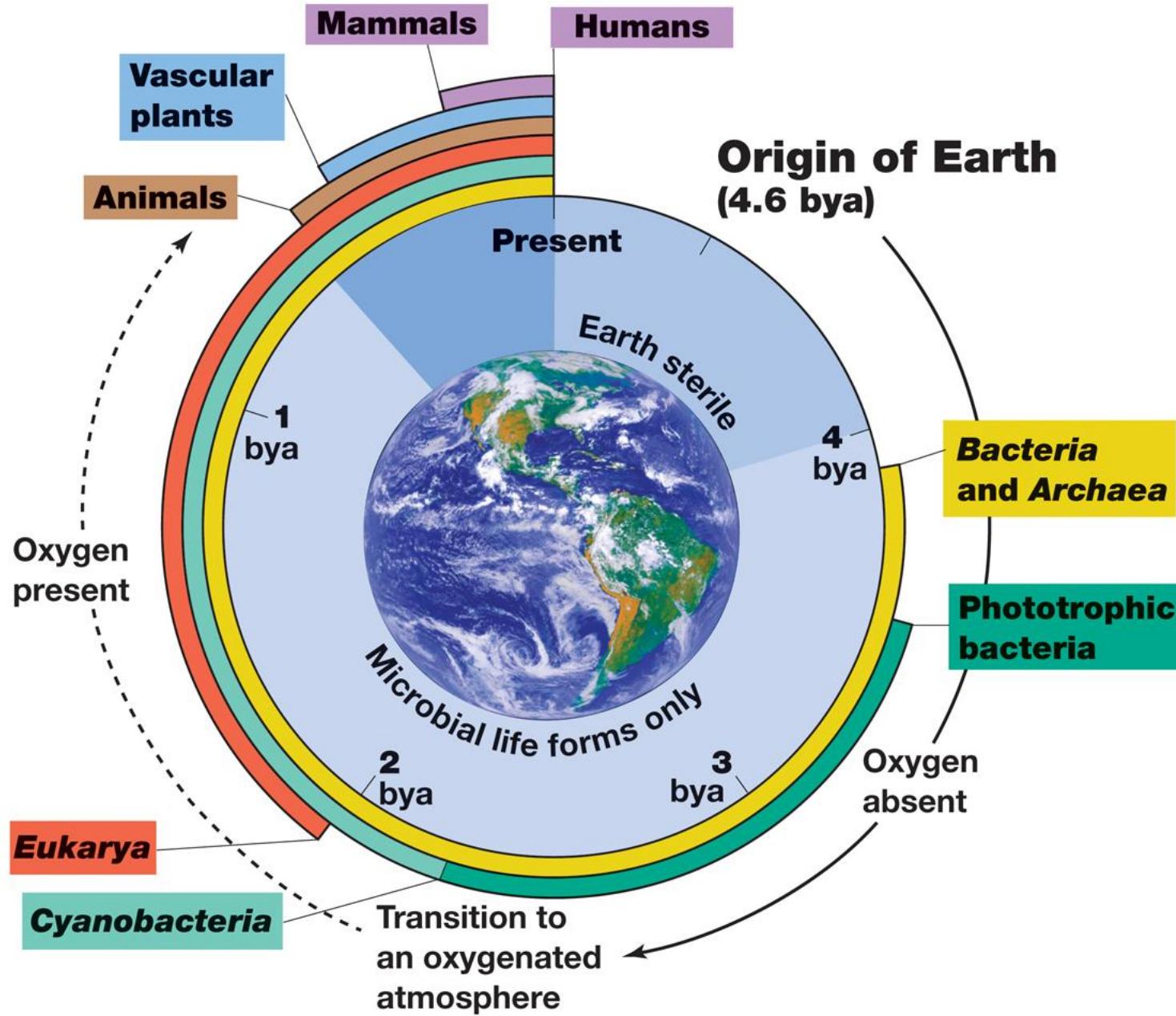


By Don Hamerman [CC BY 3.0 (<http://creativecommons.org/licenses/by/3.0>) or GFDL (<http://www.gnu.org/copyleft/fdl.html>)], via Wikimedia Commons

# Analysis environmental rRNA



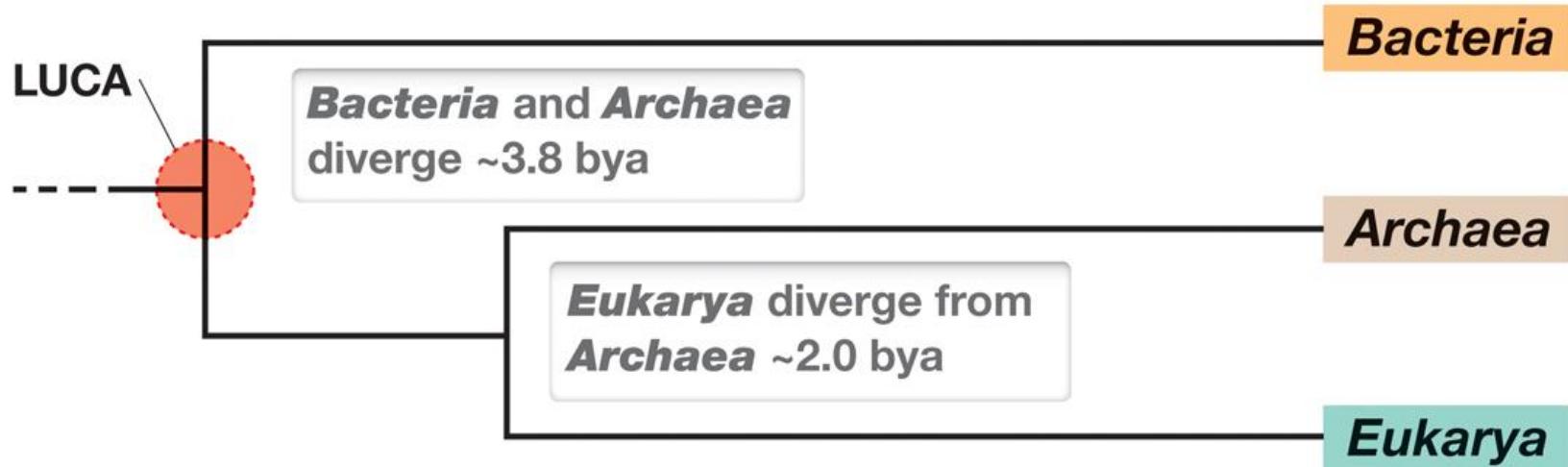
rRNA= ribosomal RNA



(a)

figuur 1.10a

# Universal Tree of Life

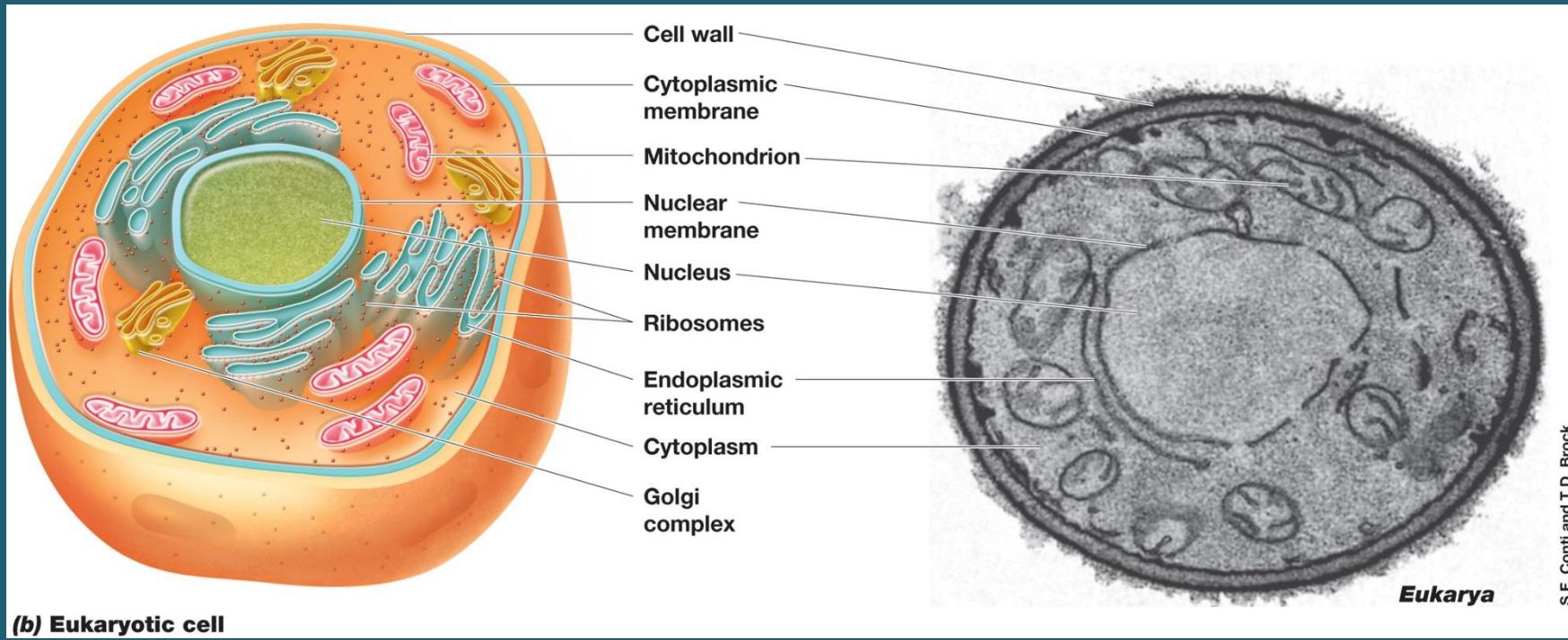


Bacteriën en archaea zijn prokaryoten

LUCA: Last Universal Common Ancestor

# Opdracht

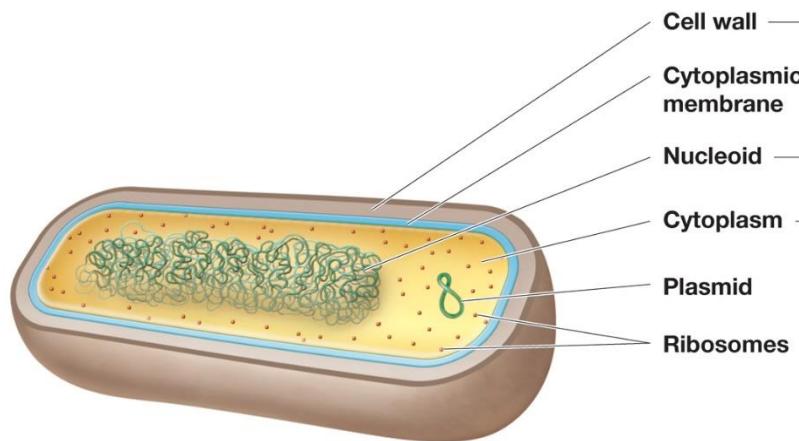
Hieronder staat een plaatje van een eukaryote cel.  
Welke structuren tref je ook aan in prokaryote cellen?



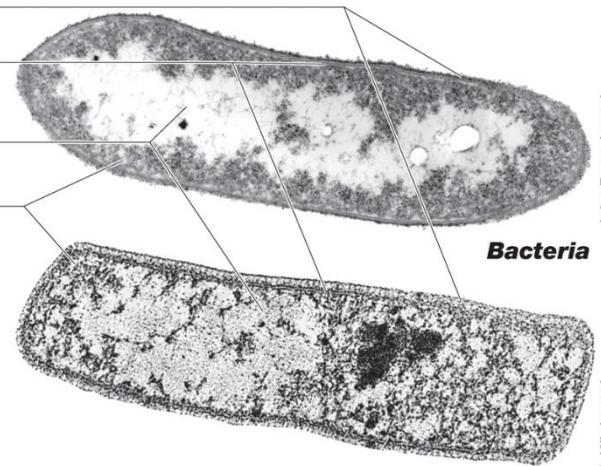
(b) Eukaryotic cell

figuur 1.4b

# Prokaryote en eukaryote cellen

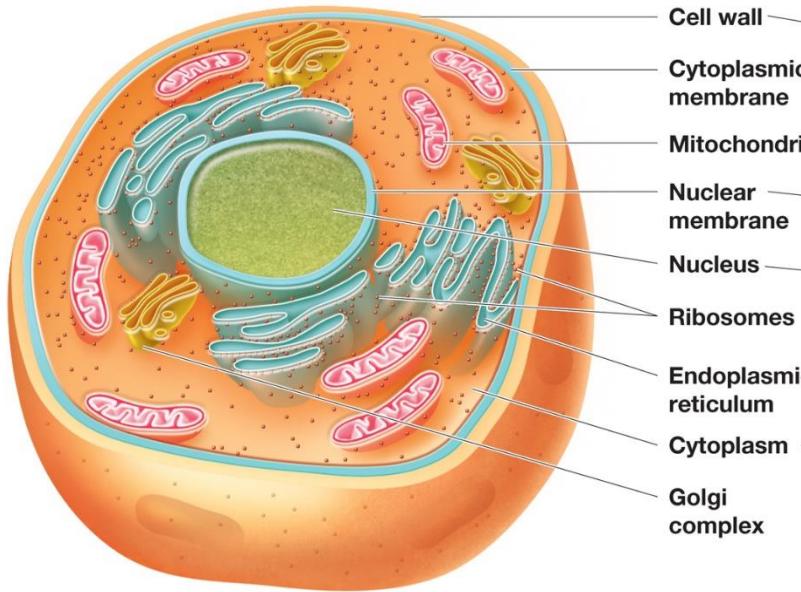


(a) Prokaryotic cell

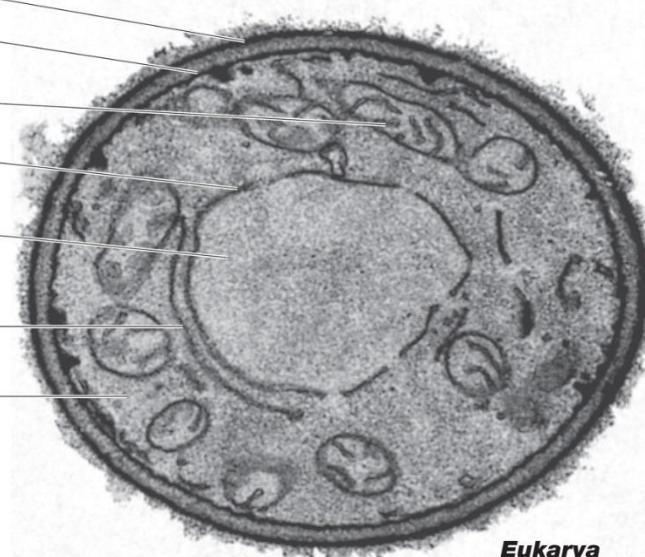


John Bozola and  
M.T. Madigan

H. König and  
K.O. Stetter



(b) Eukaryotic cell



S.F. Conti and T.D. Brock

# Opdracht

Neem de volgende processen over in je schrift:

- metabolisme
- communicatie
- evolutie
- differentiatie
- uitwisseling genetisch materiaal
- groei
- beweeglijkheid

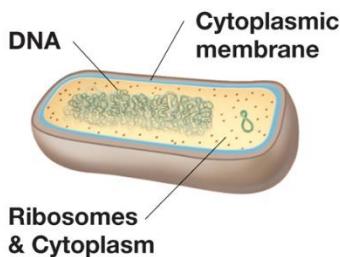
Geef aan welke processen in **alle** microbiële cellen plaatsvinden en welke alleen in **sommige** microbiële cellen

# Eigenschappen van cellen

## Properties of all cells:

### Structure

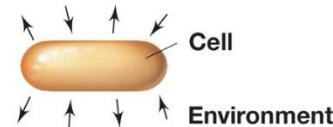
All cells have a cytoplasmic membrane, cytoplasm, a genome made of DNA, and ribosomes.



### Metabolism

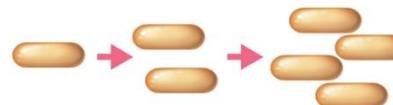
All cells use information encoded in DNA to make RNA and protein. All cells take up nutrients, transform them, conserve energy, and expel wastes.

1. **Catabolism** (transforming molecules to produce energy and building blocks)
2. **Anabolism** (synthesizing macromolecules)



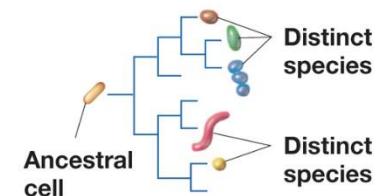
### Growth

Information from DNA is converted into proteins, which do work. Proteins are used to convert nutrients from the environment into new cells.



### Evolution

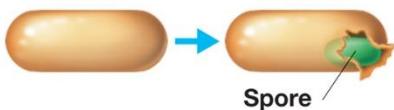
Chance mutations in DNA cause new cells to have new properties, thereby promoting evolution. Phylogenetic trees built from DNA sequences capture evolutionary relationships between species.



## Properties of some cells:

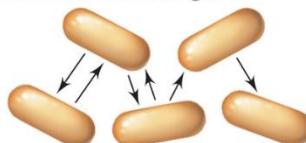
### Differentiation

Some cells can form new cell structures such as a spore.



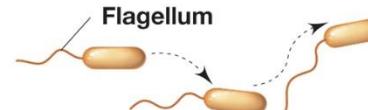
### Communication

Cells interact with each other by chemical messengers.



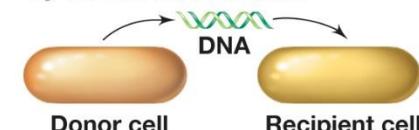
### Motility

Some cells are capable of self-propulsion.



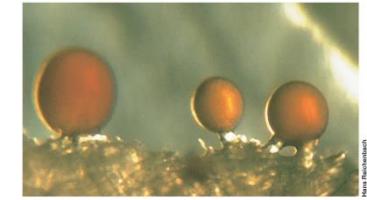
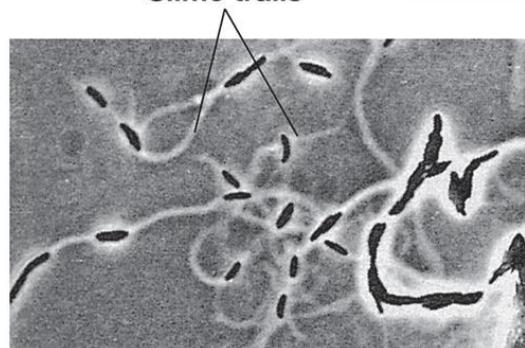
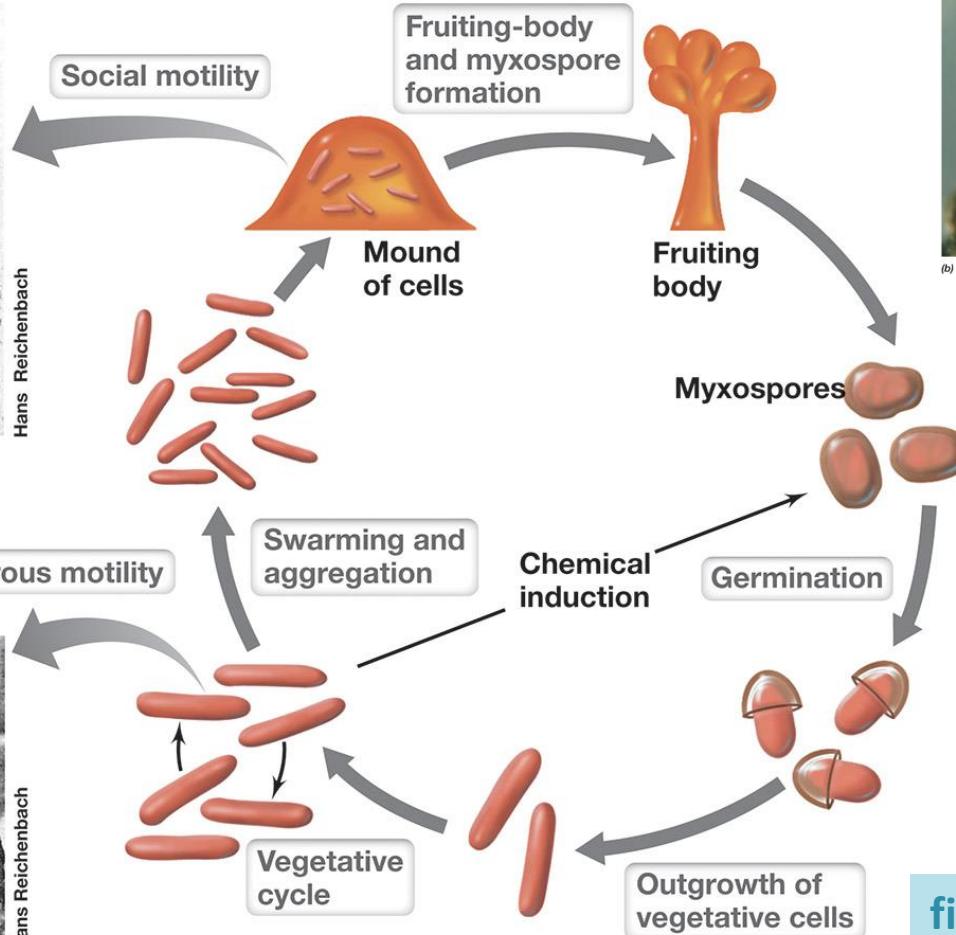
### Horizontal gene transfer

Cells can exchange genes by several mechanisms.



# Voorbeeld differentiatie en communicatie

*Myxococcus* zie p543-544 (geen tentamenstof)



figuur 15.41, 15. 42

Geen tentamenstof

Alle figuren in deze PowerPoint zijn eigen werk of afkomstig uit Brock Biology of Microorganisms (16th edition, Pearson) tenzij anders vermeld.