Cell Biology

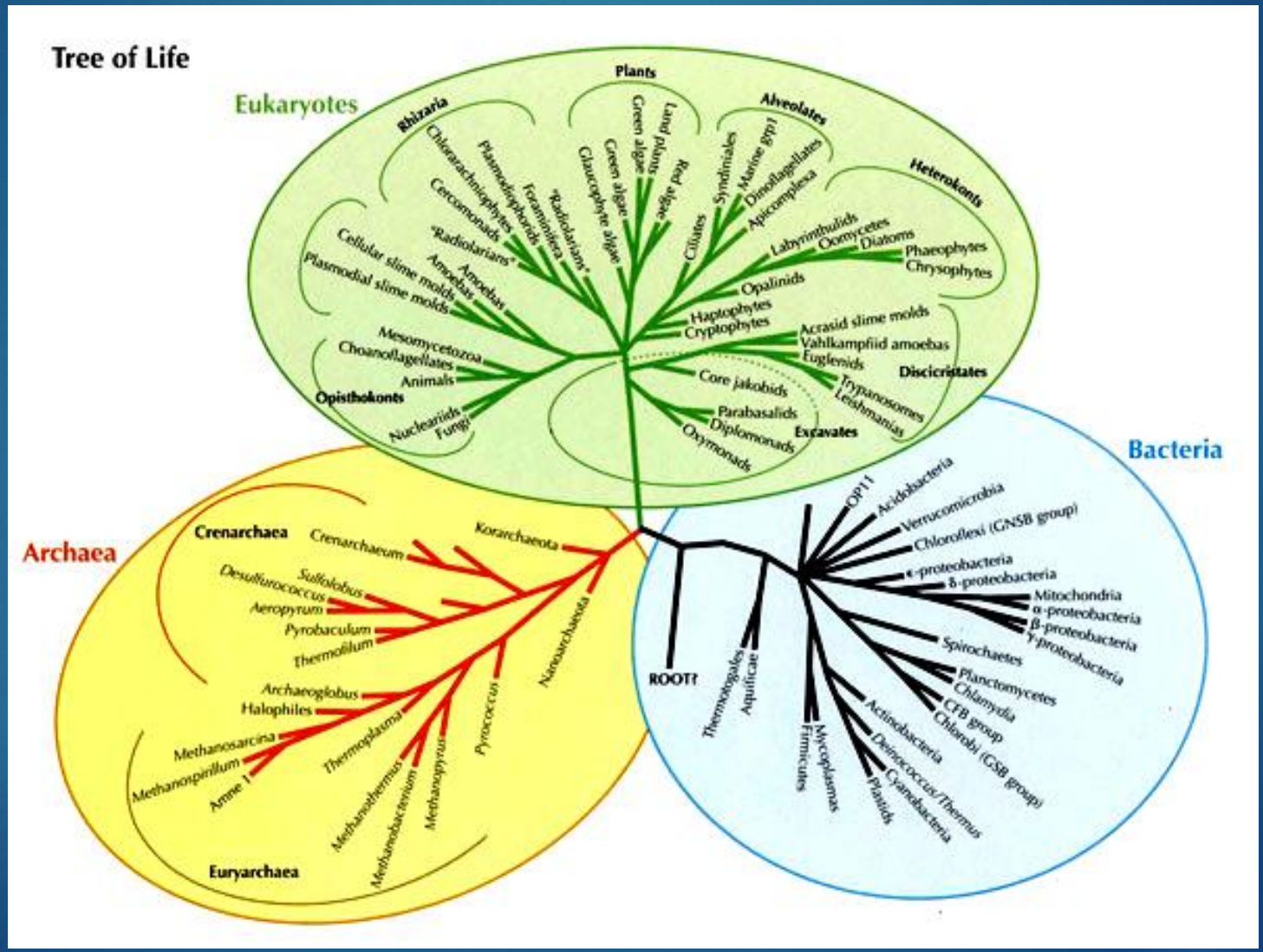
MICROBIOLOGY – PRACTICALS

Microorganisms:

Archeons (P)

Eukaryotes (E)

kingdom: Fungi



Bacteria (P)

Prokaryotes

Microbial diversity:

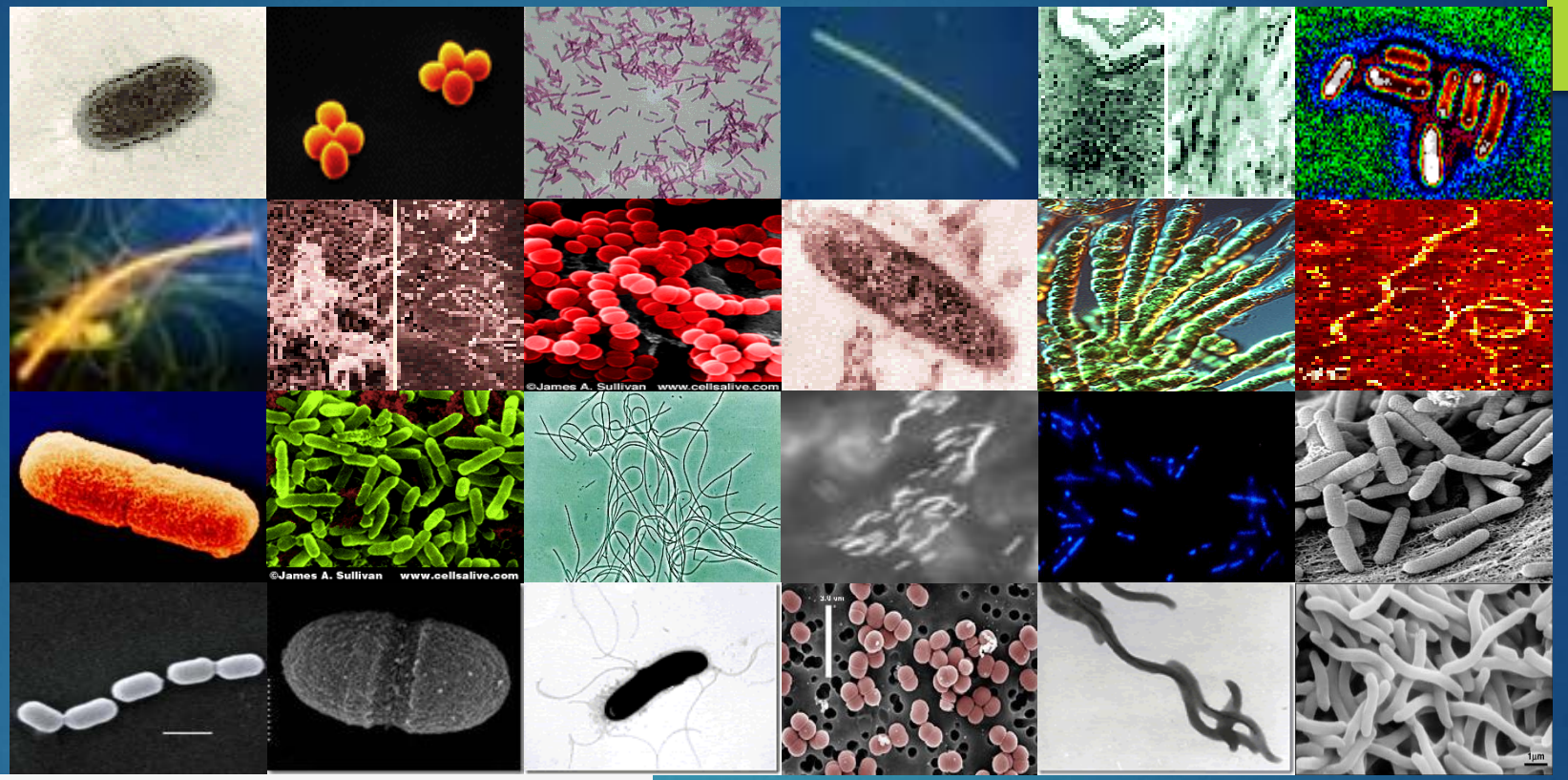
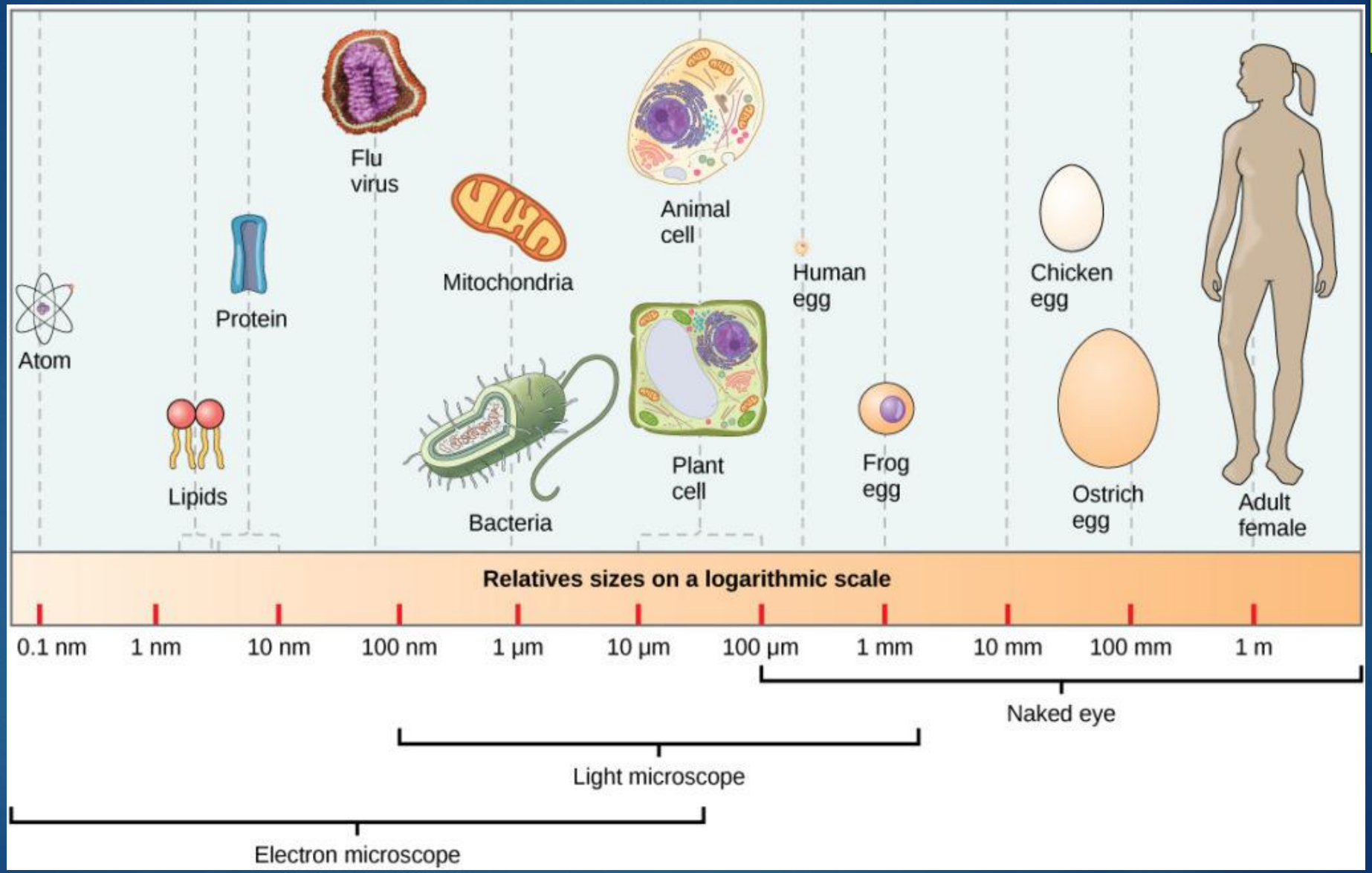


Table 1. Units of Length Commonly Used in Microbiology

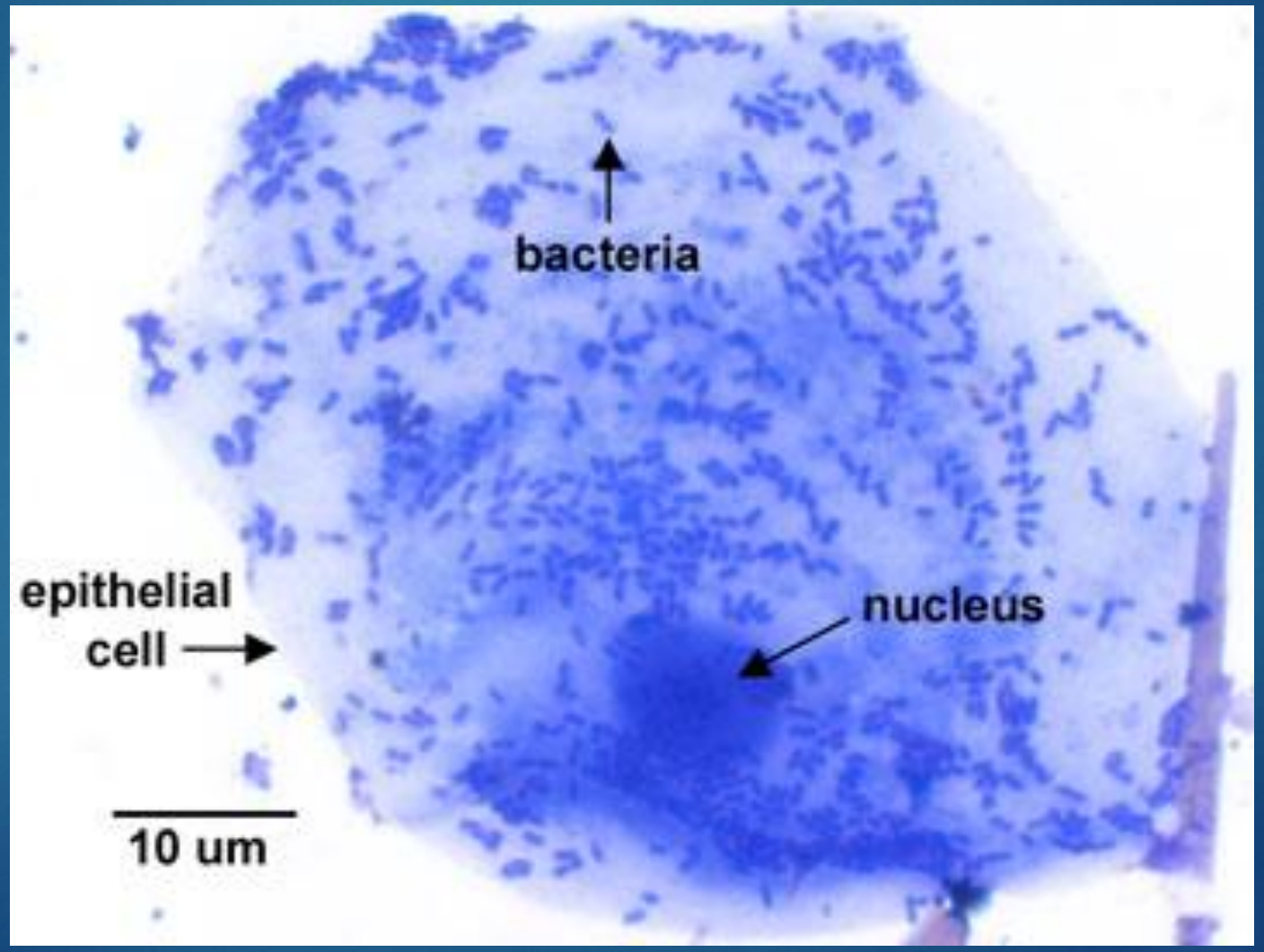
Metric Unit	Meaning of Prefix	Metric Equivalent
meter (m)	—	1 m = 10^0 m
decimeter (dm)	1/10	1 dm = 0.1 m = 10^{-1} m
centimeter (cm)	1/100	1 cm = 0.01 m = 10^{-2} m
millimeter (mm)	1/1000	1 mm = 0.001 m = 10^{-3} m
micrometer (µm)	1/1,000,000	1 µm = 0.000001 m = 10^{-6} m
nanometer (nm)	1/1,000,000,000	1 nm = 0.000000001 m = 10^{-9} m

Size of microbial cells



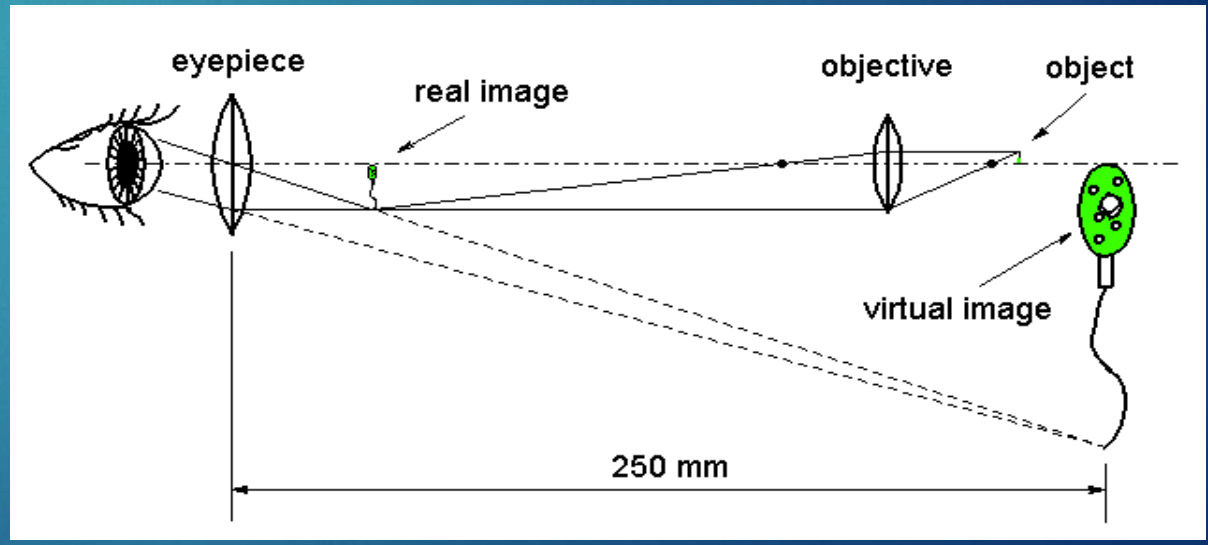
Different type of cells:

- human epithelial cell vs. Bacterial cell (bacillus)
- differences in size and structure / composition of cell



Microscope

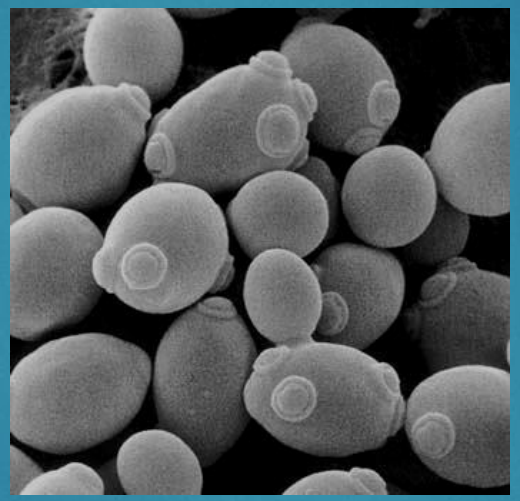
- **Microscopy** is the technical field of using microscopes to view objects and areas of objects that cannot be seen with the naked eye (objects that are not within the resolution range of the normal eye)
- There are three well-known branches of microscopy: optical, electron, and scanning probe microscopy, along with the emerging field of X-ray microscopy.



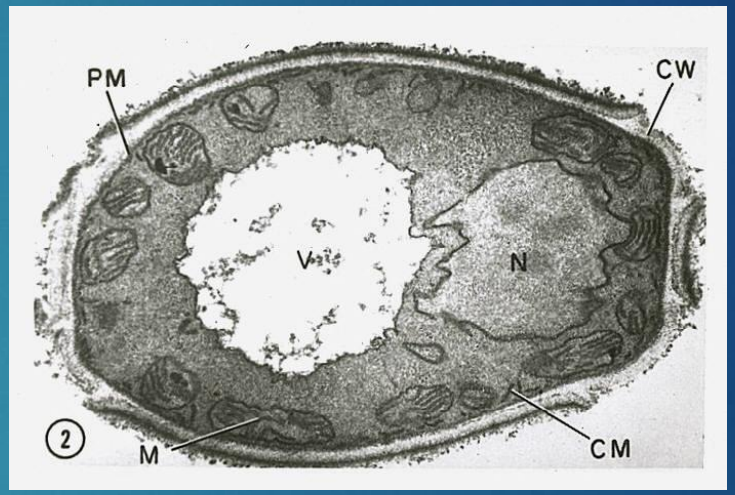
Yeast cell „under“ the different microscopes

Saccharomyces cerevisiae – eukaryotic cell

Light microscopy



SEM



TEM

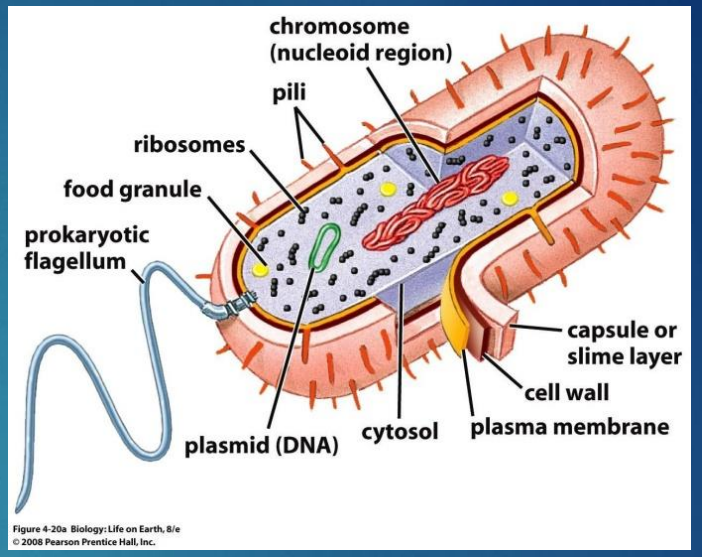
Types of microbial cells:

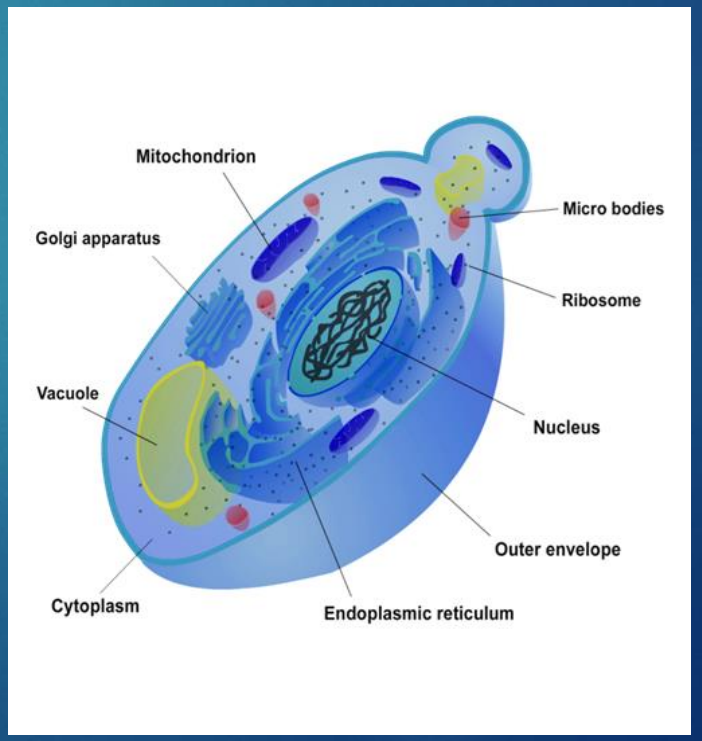
Prokaryotes – small cells with simple composition

- domain **Bacteria** (bacteria and cyanobacteria)
- domain **Archea** (archeons)

Eukaryotes– bigger cell, complex structure

- domain **Eukarya**
  - kingdom **Fungi** – microscopic fungi - yeasts, moulds
  - kingdom **Plantae** – microscopic algae
  - rkingdom **Protista** – protozoa

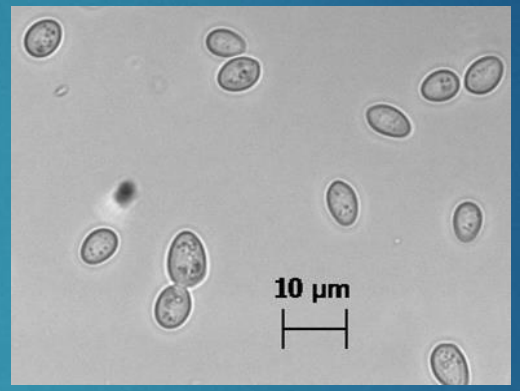




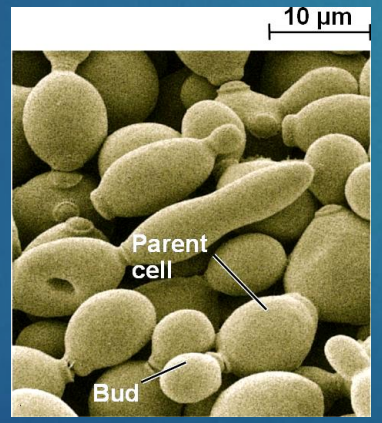
Comparison of size of bacterial and yeast cells:

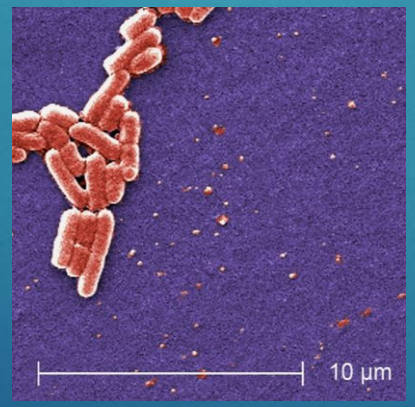
Prokaryotic cell – bacteria *Escherichia coli* (1 x 2 μm) (bacillus)

Eukaryotic cell – yeast *Saccharomyces cerevisiae* (3 -10 μm) (round shape)



Light microscopy (native section)

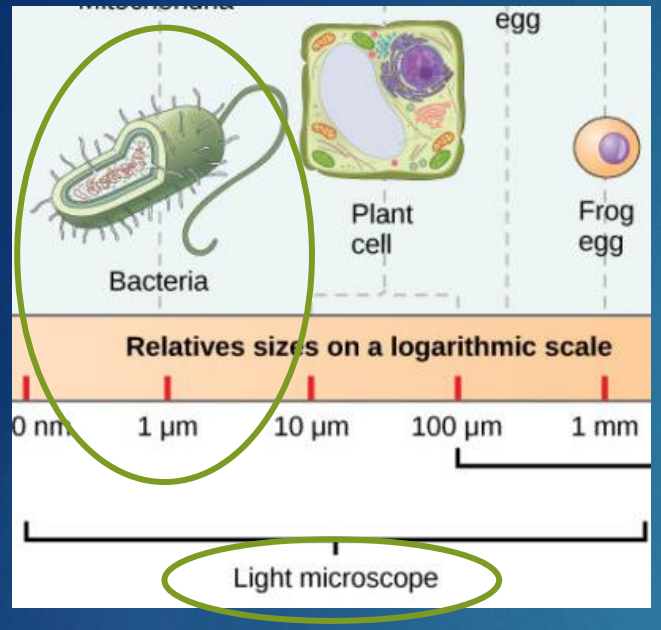




SEM

Theory of endosymbiosis - size of bacteria ➔ similar in size to mitochondria in eukaryotes

1. Bacteria (prokaryotic MO, 0,2-2µm)



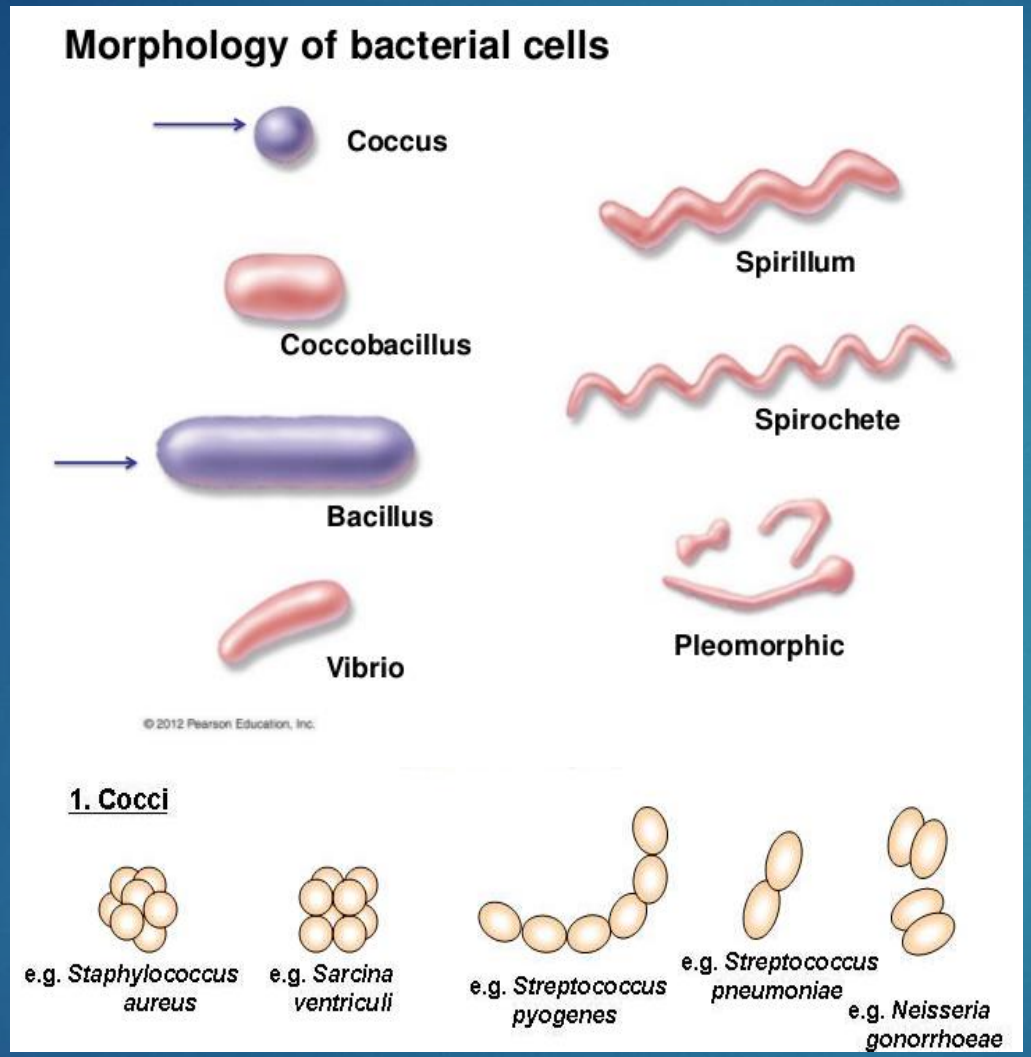
Light microscopy

- Increase of contrast leads to better visualization –
- For increase of contrast we use STAINING
  - dyes are organic:
    - Able to bind specific cell compartment
    - Methylene blue, crystal violet, carbolfuchsin...

Staining:

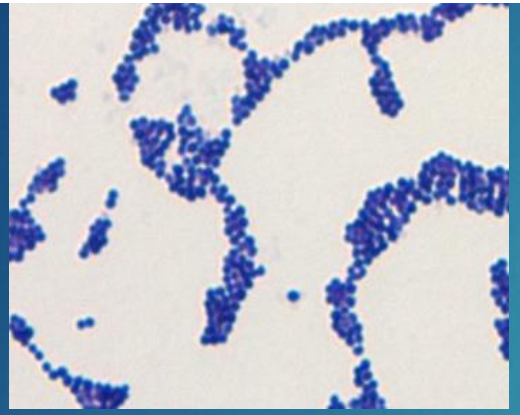
- **Monochromatic (one stain)**
- **Diagnostic - Gram staining**

Shapes of bacteria cells



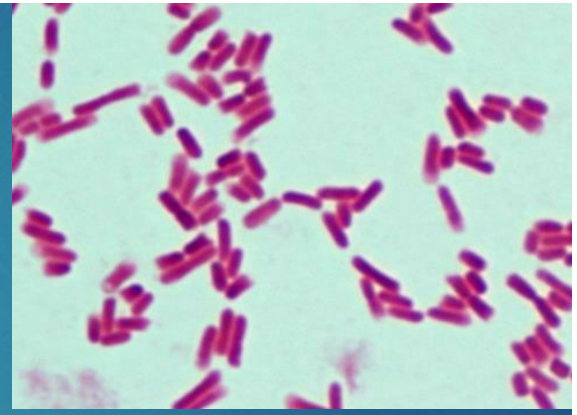
⇨Fixation before staining - For better staining and differentiation

Shapes of bacterial cells

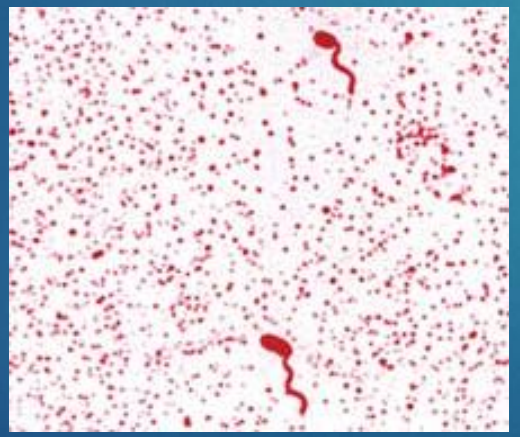


staphylococci
Staphylococcus aureus

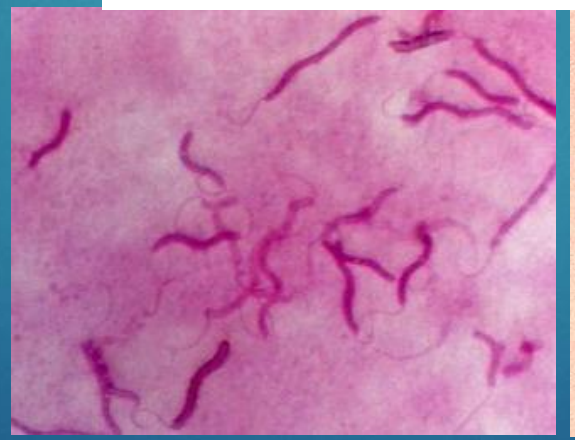
streptococci
Streprococcus equi



bacilli
Escherichia coli



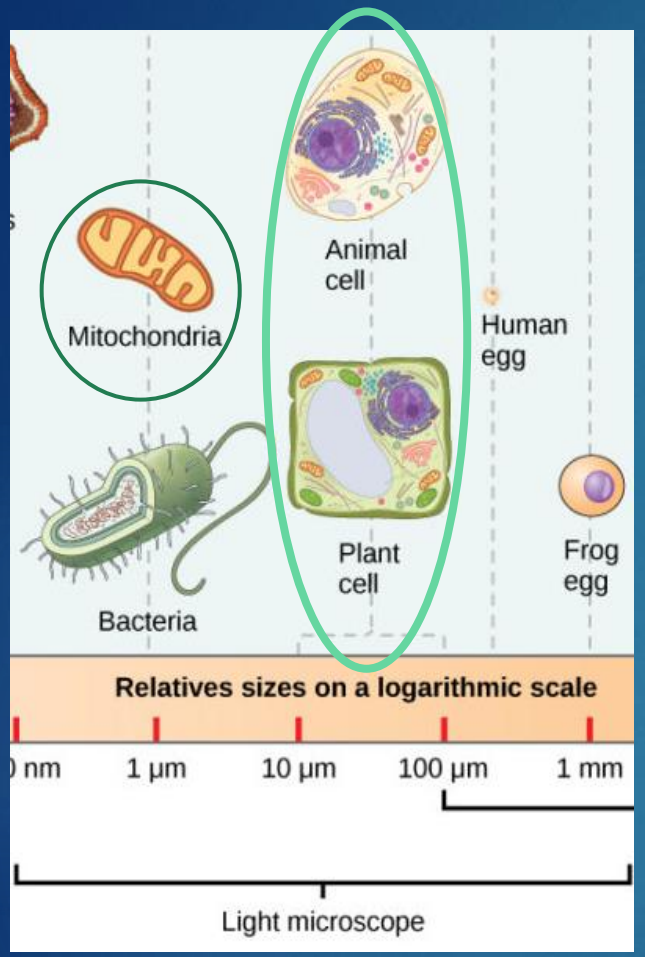
vibrio
Vibrio sp.



spirilla
Spirillum sp.

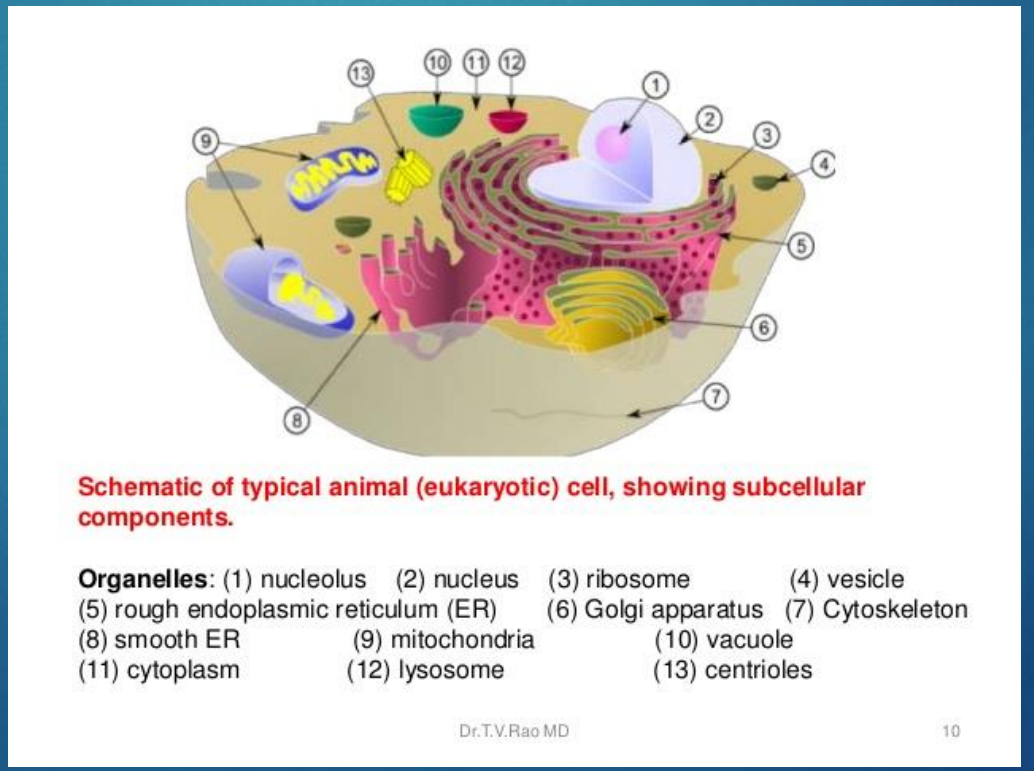
pleomorphic
Corynebacterium diphteriae

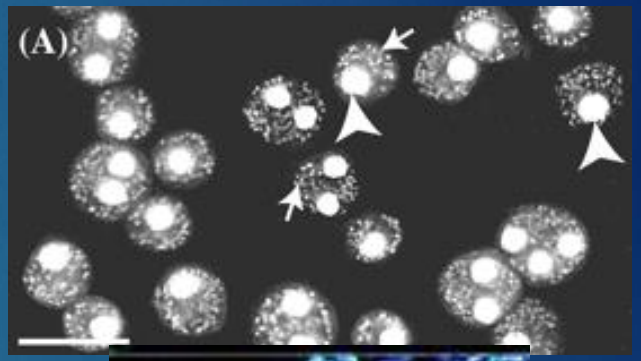
2. Yeasts and microscopic fungi (eukaryotic MO, 1 –more than 10 µm)

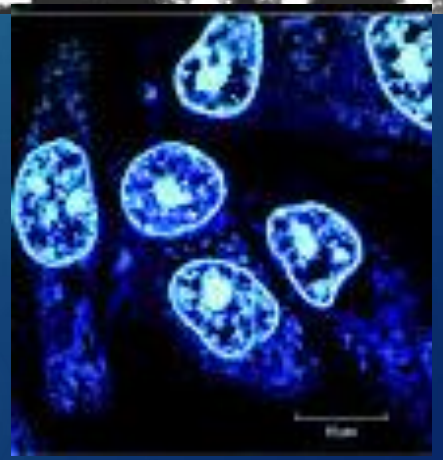


- Yeasts and microscopic fungi (molds)
  - Non-photosynthesis
  - Chitin in cell wall

Eukaryotic cell:

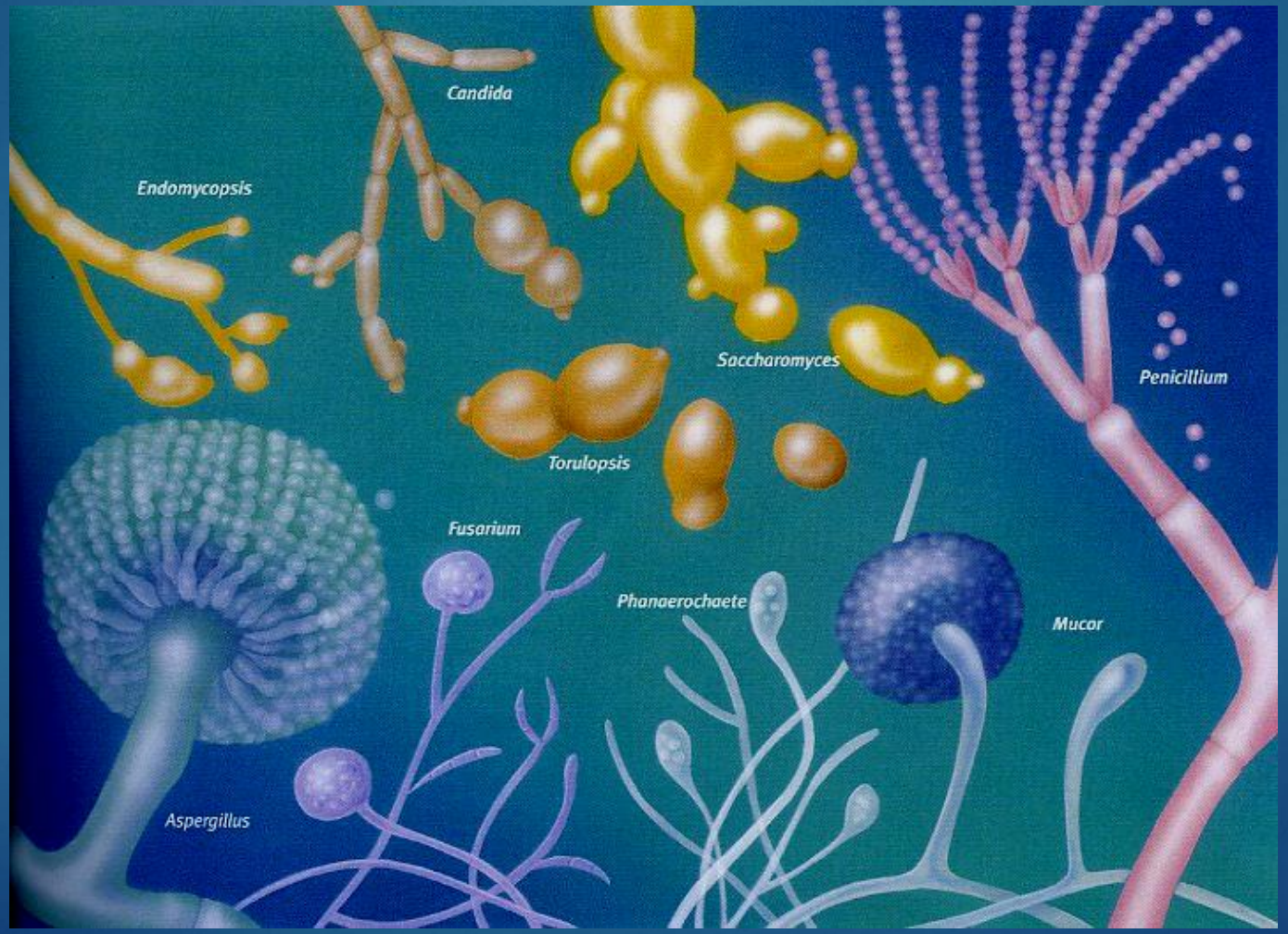






Types of cells and structres of microscopic fungi

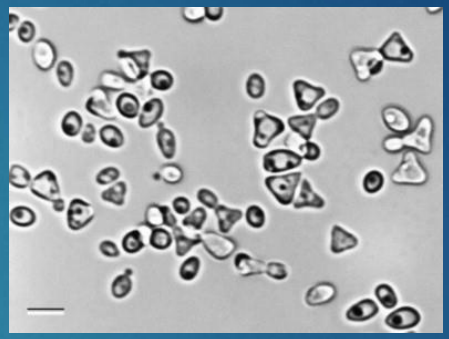
1. Yeast-like cells – various shapes (round, elongated, triangular)
2. Mycelial forms (hyphae, pseudohyphae)) – one cell, many cells, septae / non septae, special structures for reproduction



Shapes of yeasts

round
Saccharomyces cerevisiae

elongated
Schizosaccharomyces pombe



triangular
Trigonopsis variabilis

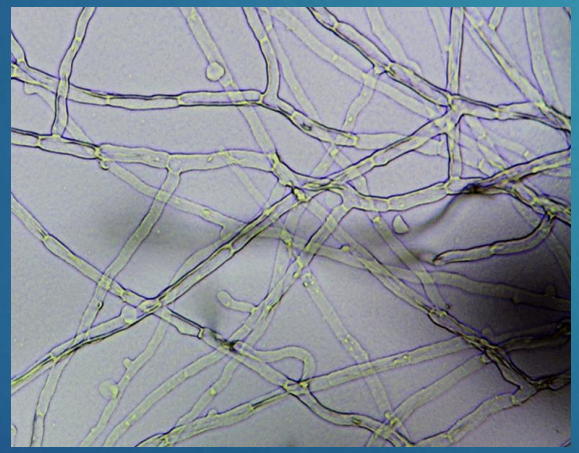
vytvárajúce pseudohýfy
Candida glabrata

vytvárajúce pravé hýfy
Canida albicans

Shapes of microscopic fungi

Penicillium sp.

Aspergillus niger



hyphae
Penicillium sp.

conidiophor
Penicillium sp.

conidiophor
Aspergillus niger