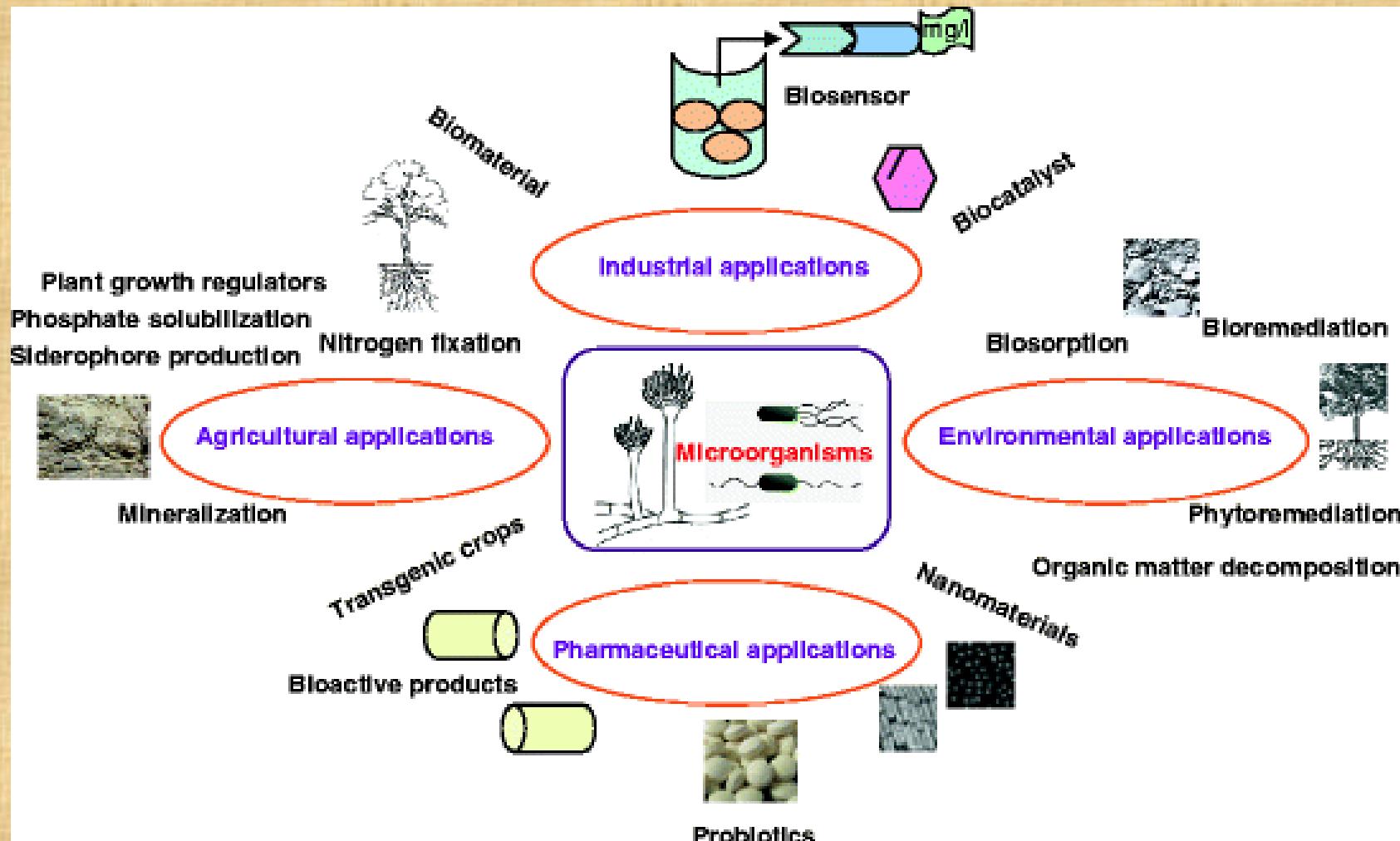


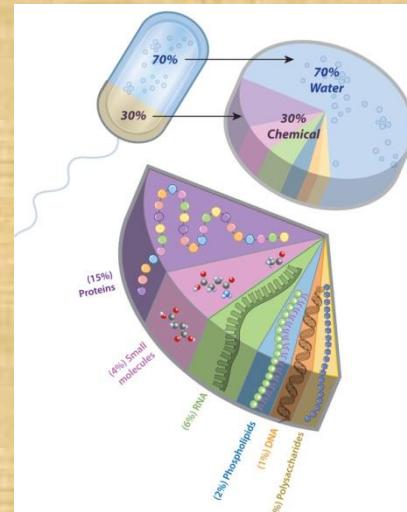
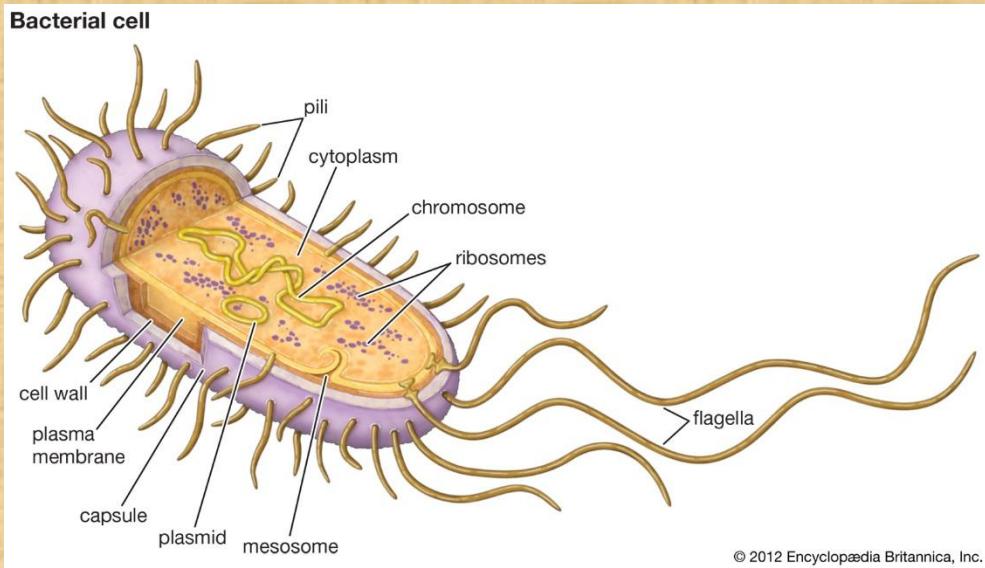
Structure of blue green algae (*Spirulina*), Fungi (*Saccharomyces cerevisiae*), Protozoa (*Amoeba*), Bacteria (*Escherichia coli*) and Viruses (*Caronavirus*).



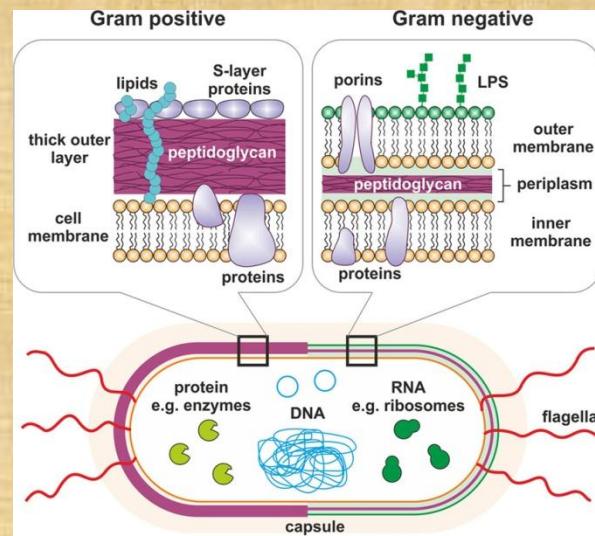
# Salient features of bacteria

- 1. They're prokaryotes
  2. They're unicellular (0.1 to 10  $\mu\text{M}$  in size)
  3. They lack well developed nucleus. Instead there is a nucleoid at that place.
  4. Nuclear membrane is absent.
  5. They contain 70S ribosome
  6. Their cell wall is generally made up of peptidoglycan
  7. They don't have 9+2 array in their flagella (if present)
  8. Genetic material is double stranded circular DNA

# Structure of Bacteria (*Escherichia coli*)



Chemical composition



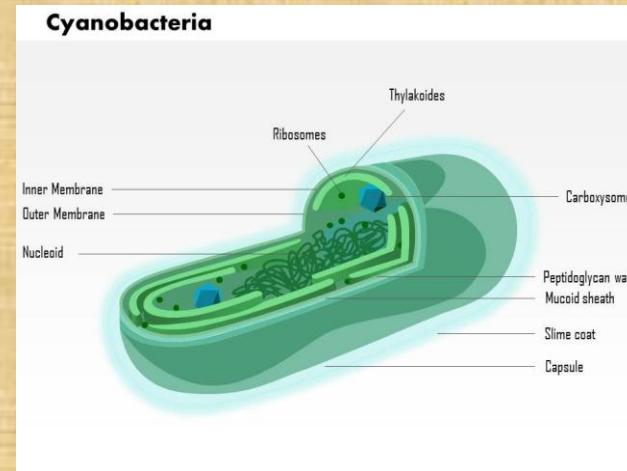
# Spirulina

- Spirulina is a photosynthetic, spiral-shaped, multicellular and blue-green alga. Cell division occurs by binary fission. As it contains chlorophyll a, like higher plants botanist classify it as micro alga belonging to Cyanophceae class; but according to bacteriologists it is a bacterium due to its prokaryotic structure. Filaments are solitary and free floating and display gliding motility. Spirulina is characterized by its regularly coiled trichomes.
- Spirulina has photosynthetic system, plucri-stratified cell wall, capsule, ribosome and numerous inclusions. Cell wall is made of four membered layers: L1, L2, L3, and L4.
- Mexicans started using this microorganism as human food. Its chemical composition contains proteins (55%-70%), carbohydrates (15%-25%) and essential fatty acids (18%) vitamins, minerals and pigments like carotenes, chlorophyll and phycocyanin, pigments are used in food and cosmetic industries.
- Spirulina is considered as excellent food, lacking toxicity and have anticancer, antiviral, immunological properties and it also acts as a potent antioxidant.

# Spirulina



Spirulina morphology

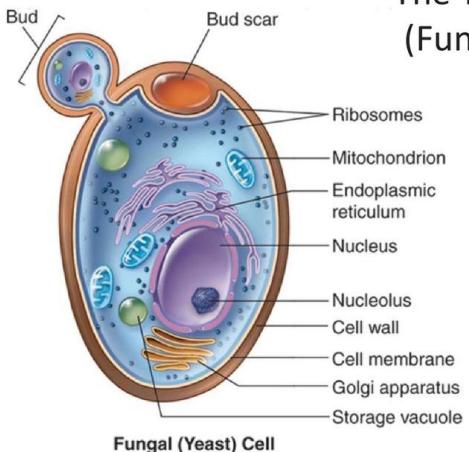


Spirulina tablets and powder

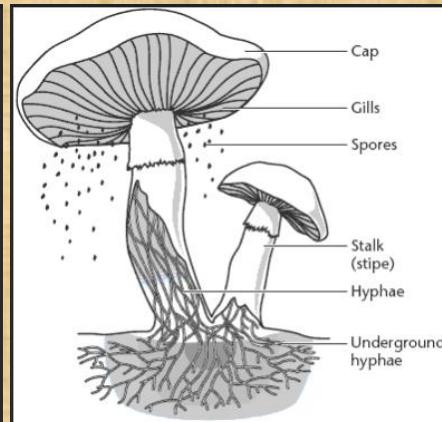
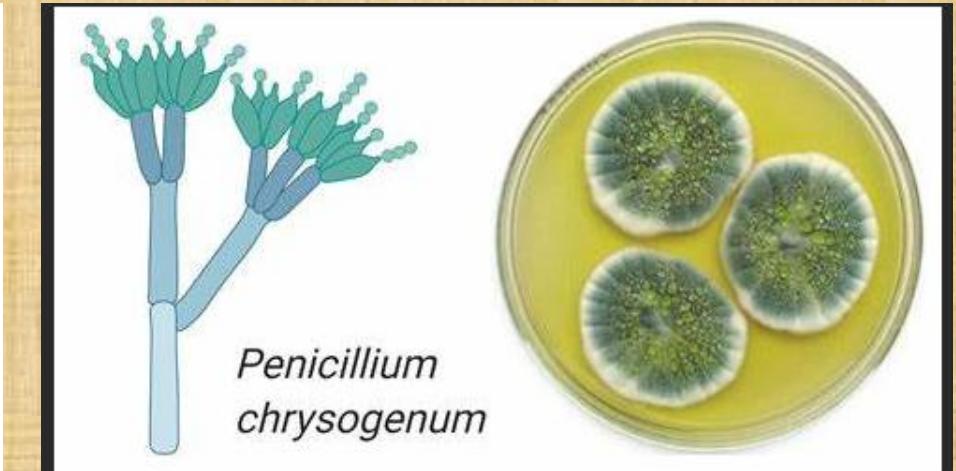
## General Characteristics of Fungi:

- Eukaryotic.
- Decomposers – the best recyclers around.
- No chlorophyll – non photosynthetic.
- Most multicellular (hyphae) – some unicellular (yeast)
- Non-motile.
- Cell walls made of chitin (kite-in) instead of cellulose like that of a plant.
- Are more related to animals than plant kingdom.

# Fungi

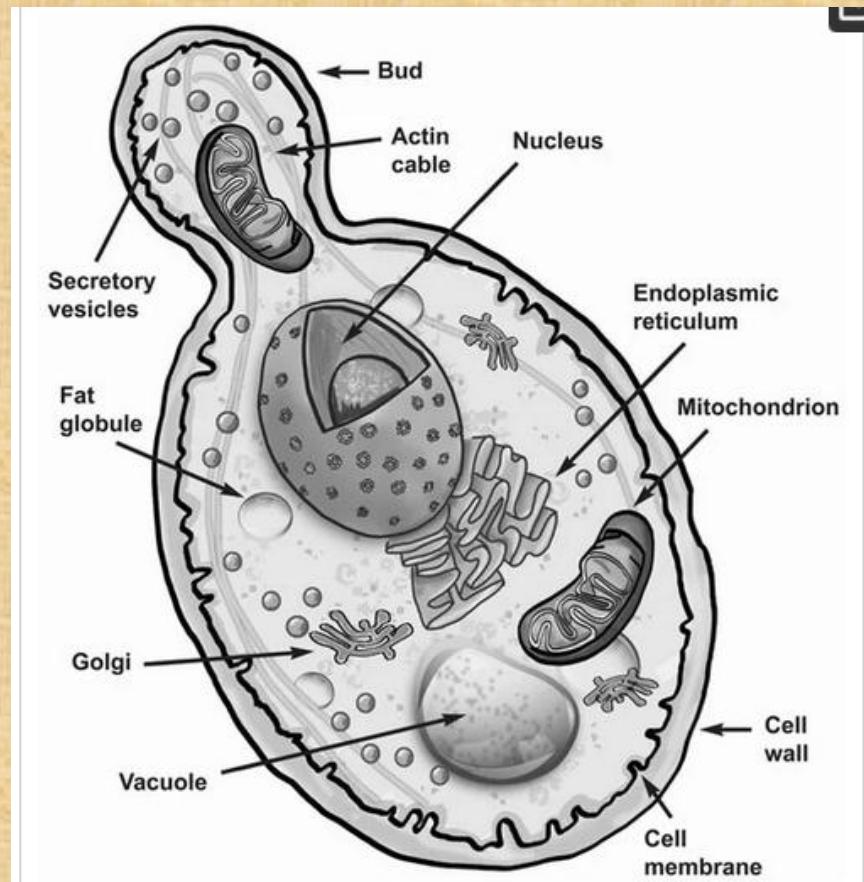


The Yeast Cell  
(Fungal Cell)



Mushroom

# *Saccharomyces cerevisiae*

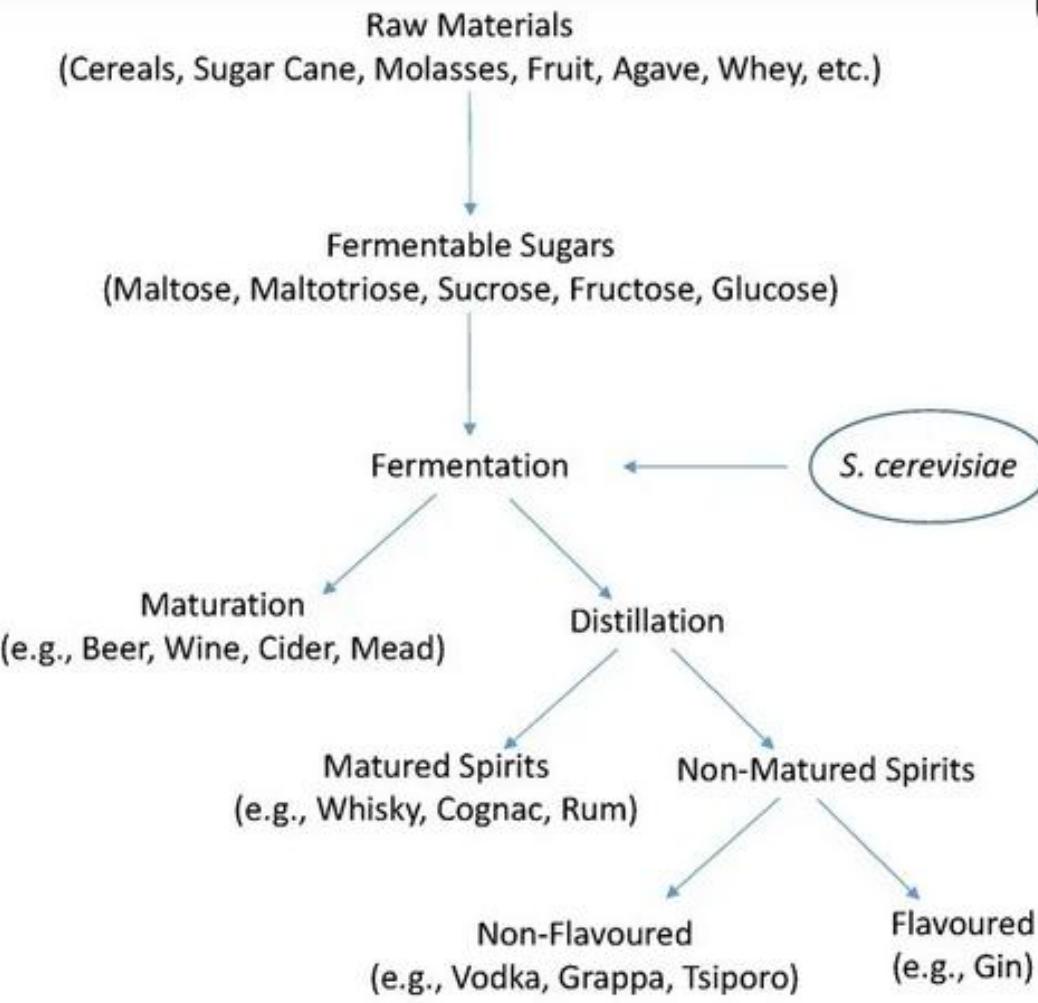


# *Saccharomyces cerevisiae*

- *Saccharomyces cerevisiae* (*S. cerevisiae*) is a unicellular fungus, possessing a nuclear genomic DNA of 12068 kilobases (kb) organized in 16 chromosomes.
- Its genome has been completely sequenced by Goffeau et al. 1996 and was found to contain approximately 6000 genes, of which, 5570 are predicted to be protein-encoding genes.
- *S. cerevisiae* is a model organism, a valuable tool for all aspects of basic research.
- *S. cerevisiae* naturally grows on fruits- such as grapes and dates- as well as grains- such as wheat and barley. Its primary form of reproduction is budding, where daughter cells sprout directly off of mother cell.

# *Saccharomyces cerevisiae*

- Alcoholic beverages are produced following the fermentation of sugars by yeasts, mainly (but not exclusively) strains of the species, *Saccharomyces cerevisiae*.
- The sugary starting materials may emanate from cereal starches (which require enzymatic pre-hydrolysis) in the case of beers and whiskies, sucrose-rich plants (molasses or sugar juice from sugarcane) in the case of rums, or from fruits (which do not require pre-hydrolysis) in the case of wines and brandies.
- In the presence of sugars, together with other essential nutrients such as amino acids, minerals and vitamins, *S. cerevisiae* will conduct fermentative metabolism to ethanol and carbon dioxide (as the primary fermentation metabolites) as the cells strive to make energy and regenerate the coenzyme NAD<sup>+</sup> under anaerobic conditions.
- Yeasts will also produce numerous secondary metabolites which act as important beverage flavour congeners, including higher alcohols, esters, carbonyls and sulphur compounds. These are very important in dictating the final flavour and aroma characteristics of beverages such as beer and wine, but also in distilled beverages such as whisky, rum and brandy.

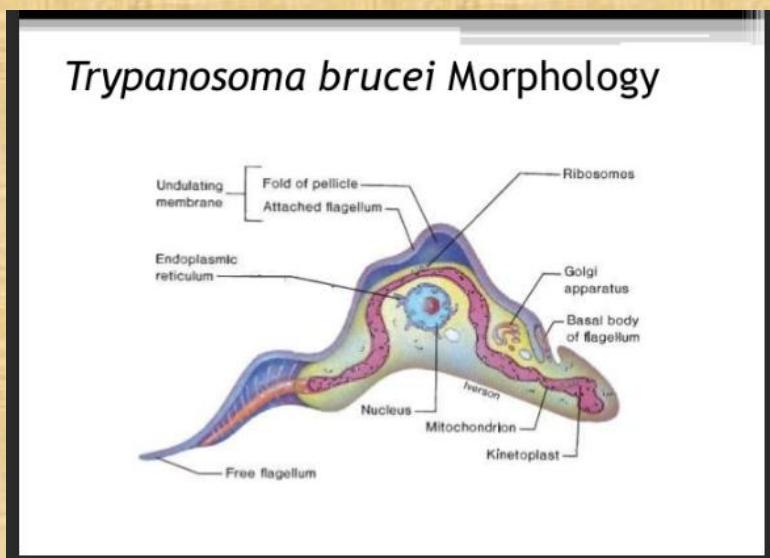
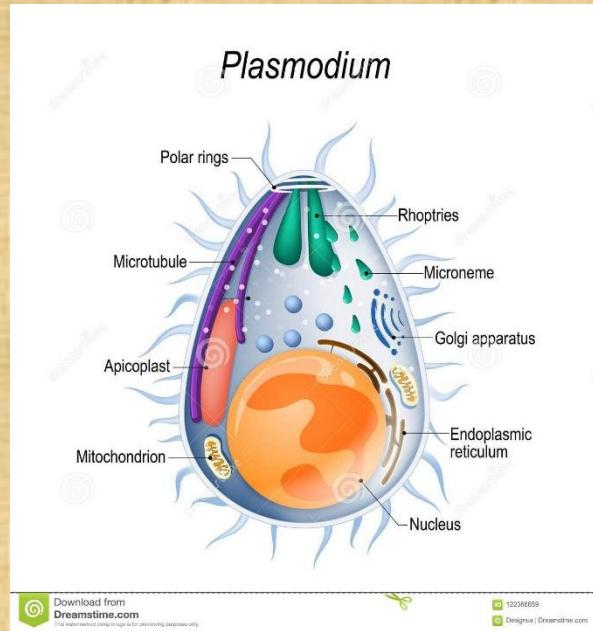
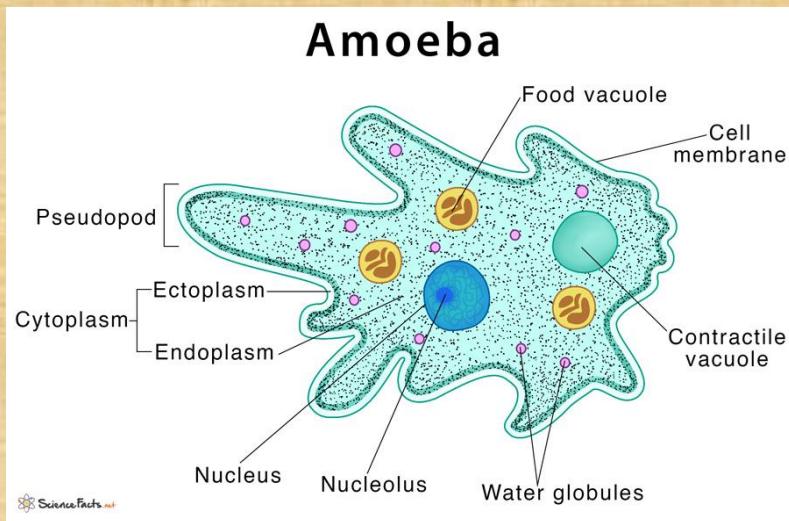


The key roles of *Saccharomyces cerevisiae* in production of fermented beverages.

# Protozoa

- Protozoa are unicellular eukaryotic microorganisms lacking a cell wall and belonging to the Kingdom Protista.
- Protozoa reproduce asexually by fission, schizogony, or budding. Some protozoa can also reproduce sexually.
- Relatively few protozoa cause disease.
- The vegetative, reproducing, feeding form of a protozoan is called a trophozoite.
- Under certain conditions, some protozoa produce a protective form called a cyst.

# Protozoa



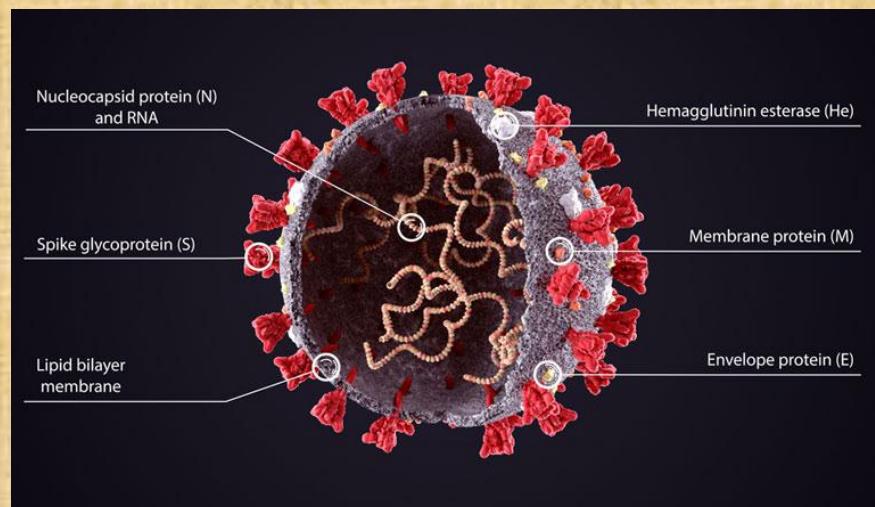
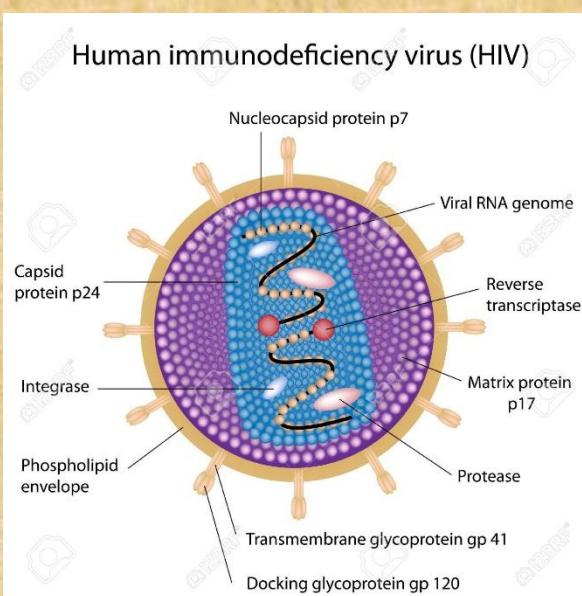
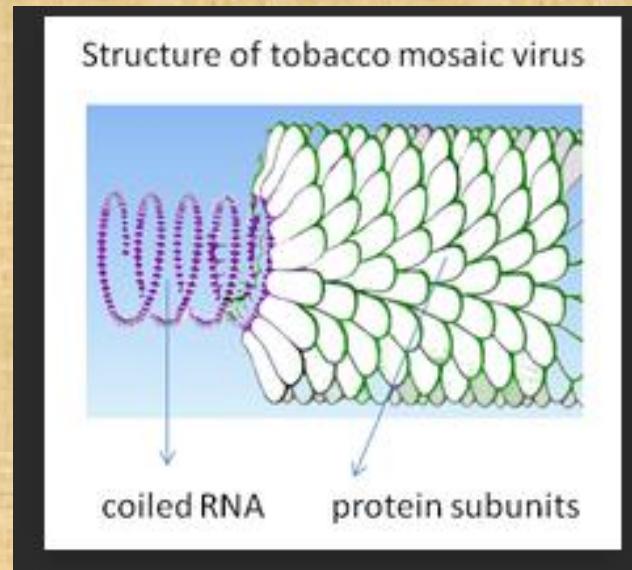
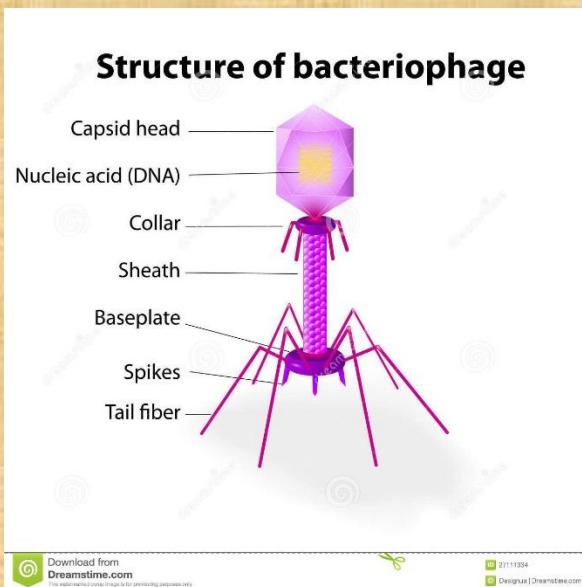
# Amoeba

- Amoebas are identified by their ability to form temporary cytoplasmic extensions called pseudopodia, or false feet, by means of which they move about. This type of movement, called amoeboid movement, is considered to be the most primitive form of animal locomotion.
- Amoebas are used extensively in cell research for determining the relative functions and interactions of the nucleus and the cytoplasm. Each amoeba contains a small mass of jellylike cytoplasm, which is differentiated into a thin outer plasma membrane, a layer of stiff, clear ectoplasm just within the plasma membrane, and a central granular endoplasm.
- The endoplasm contains food vacuoles, a granular nucleus, and a clear contractile vacuole. During feeding, extensions of cytoplasm flow around food particles, surrounding them and forming a vacuole into which enzymes are secreted to digest the particles. Oxygen diffuses into the cell from the surrounding water, and metabolic wastes diffuse from the amoeba into the surrounding water. A contractile vacuole, which removes excess water from the amoeba, is absent in most marine and parasitic species. Reproduction is asexual (binary fission).
- There are numerous parasitic amoebas. Of six species found in the human alimentary tract, *Entamoeba histolytica* causes amebic dysentery.

## Characteristics of virus

- ✓ Viruses have an inner core of nucleic acid surrounded by protein coat known as an envelope
- ✓ Most viruses range in sizes from 20 – 250 nm
- ✓ Viruses are inert (nucleoprotein ) **filterable Agents**
- ✓ Viruses are **obligate intracellular parasites**
- ✓ Virus occupy a space in between living and non-living, because they are *crystallisable* and *non-living outside the body of host.*
- ✓ Viruses depend fully on the host's cell machinery to continue their life – *metabolically inefficient.*
- ✓ They are responsible for a number of dreadful diseases in human and plants.

# Viruses



**Coronavirus**

# Coronaviruses

- **Coronaviruses** are a group of related RNA viruses that can cause illnesses such as the common cold, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS).
- In 2019, a new coronavirus was identified as the cause of a disease outbreak that originated in China.
- The virus is known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).
- The disease it causes is called coronavirus disease 2019 (COVID-19). In March 2020,
- the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic. The genome size of coronaviruses ranges from approximately 26 to 32 kilobases, one of the largest among RNA viruses. They have characteristic club-shaped spikes that project from their surface, which in electron micrographs create an image reminiscent of the stellar corona, from which their name derives.

# References

- [https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A\\_Microbiology\\_\(Kaiser\)/Unit\\_4%3A\\_Eukaryotic\\_Microorganisms\\_and\\_Viruses/09%3A\\_Protozoa/9.1%3A\\_Characteristics\\_of\\_Protozoa](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Kaiser)/Unit_4%3A_Eukaryotic_Microorganisms_and_Viruses/09%3A_Protozoa/9.1%3A_Characteristics_of_Protozoa)
- <https://www.britannica.com/science/antibiotic-resistance>
- <https://www.dreamstime.com/stock-images-structure-virus-bacteriophage-image27111334>