

# The Microorganism

## Lecture #2 – Dr. Gary Mumaugh

### Subjects Covered

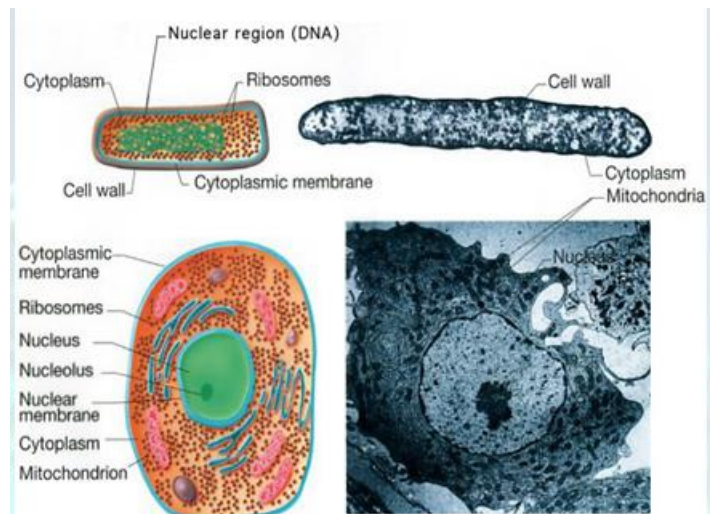
- Properties of Life
- Microorganism Classifications
- Prokaryotic & Eukaryotic Cells
- Five Kinds of Microbes
- Microorganism Worldview

### Characteristics of Living Organism

- Cellular organization
- Ability to produce energy and to transform chemicals into cell material
- Ability to reproduce, and in doing so, pass their genes (DNA) to their progeny
- Ability to respond to external and internal stimuli
- Ability to grow, and in the case of some unicellular and all multicellular organisms, to develop or differentiate into various types of cells
- The term organism implies cellular life.
- Micro-organisms are a type of cellular life that is microscopic in size.
- Viruses are not considered microorganisms because they are not cells.
  - Viruses consist of nucleic acid (DNA or RNA) enclosed in a protein coat.
  - They lack many essential properties of cells, including membranes, ribosomes and metabolic enzymes.
  - Viruses are considered microbes, but not microorganisms, and arguably are not "alive".

### Two Types of Microbial Cells

- **Prokaryotic** – does not have a nucleus
  - Prokaryotic cells are said to have a "primitive" nucleus because their DNA is not enclosed within a nuclear membrane.
  - The nuclear region of a prokaryotic cell is sometimes referred to as a nucleoid, but never as a nucleus.
- **Eukaryotic** – has a nucleus enclosed in a nuclear membrane with DNA



## Microorganism Definitions

- Bacteria, bacterium - (microbiology) single-celled spherical or spiral or rod-shaped organisms
  - They serve important functions as pathogens and have dominant biochemical properties.
- Intestinal flora - harmless microorganisms (as Escherichia coli) that inhabit the intestinal tract and are essential to its normal functioning
- Microbe, germ, “bug” - a minute life form (especially a disease-causing bacterium)
- Moneran, moneron - organisms that typically reproduce by asexual budding or fission
- Pathogen - any disease-producing agent (virus or bacterium or other microorganism)
- Protist, protistan - free-living or colonial organisms with diverse nutritional and reproductive modes
- Viruses, virus - (virology) ultramicroscopic infectious agents that only replicate within cells of living hosts

## Major Microorganism Classifications

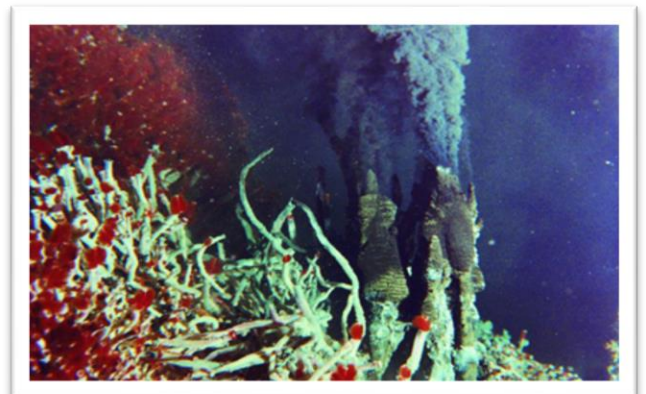
- **Effective Microorganisms (EMs)**
  - Effective microorganisms (EM) technology is now viewed to be a major science
  - Agriculture, farming practices, animal husbandry (livestock), environmental, human health and hygiene, industrial applications, waste composting, foods and supplements
- **Harmful Microorganisms (HMs)**
  - Natural and manufactured bacterial agents
  - Impact of harmful microorganisms (known technically as either pathogenicity or virulence) is measured by the microorganism's ability to cause disease
- **Primary pathogens** have the ability to transmit disease
- **Secondary opportunistic pathogens** have the ability to cause disease only in those individuals afflicted with immune deficiencies

## 5 Major Groups of Microorganisms

- Archaea Prokaryotic
- Bacteria Prokaryotic
- Algae Eukaryotic
- Protozoa Eukaryotic  
Protozoa are called Protista
- Fungi Eukaryotic

### Archaea

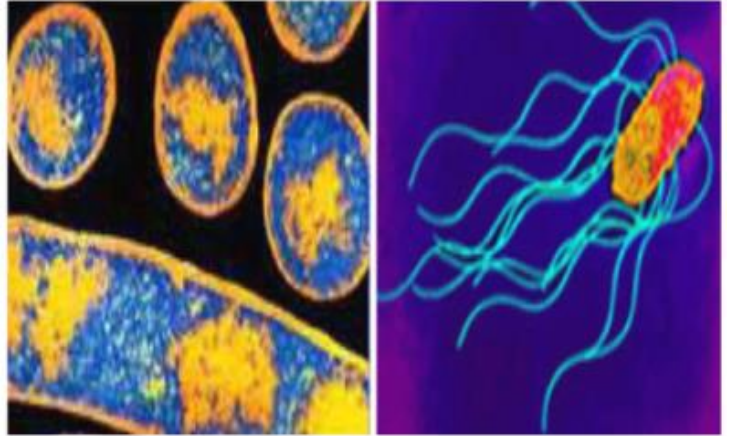
- Unicellular prokaryotic cells
- Sometimes produce methane (CH<sub>4</sub>) during their metabolism
- Often live in extreme environments



- High temperature, low pH or high salt concentrations
- They are specifically adapted to these conditions by means of special types of membranes and metabolism
- Archaea are found near such thermal vents growing at temperatures as high as 120°C.

### Bacteria

- Unicellular prokaryotic organisms
- Bacteria live everywhere that life exists on earth except the most extreme environments
  - Archaea live in the extremes
- Lives in animals, plants and humans
- Most are beneficial or harmless
- Some cause disease.
- (L) *Clostridium botulinum*, the bacterium that causes botulism is also the source of BOTOX
- (R) *Salmonella enterica* the most common cause of salmonella food poisoning



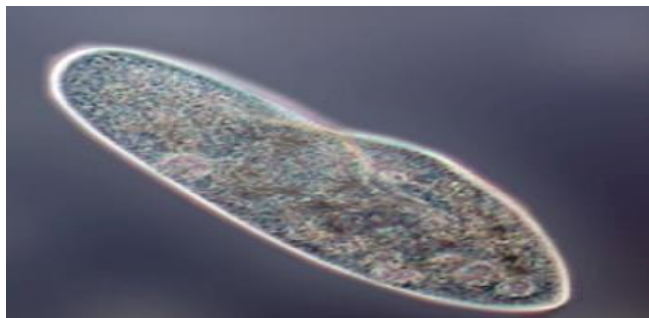
### Algae

- Plant-like, photosynthetic, eukaryotic organisms
- Live wherever there is light and moisture
- They convert carbon dioxide (CO<sub>2</sub>) to organic material and produce oxygen (O<sub>2</sub>) during photosynthesis, the same as plants



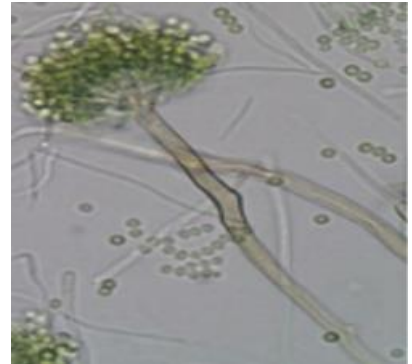
### Protozoa

- Animal-like, non-photosynthetic eukaryotes
- Common in moist environments, including the intestinal tracts of animals
- Most are motile because they are predatory on other microbes and have to catch and ingest their food
- A few of them cause some important diseases, such as malaria and sleeping sickness
- *Paramecium*



## Fungi

- Non-photosynthetic eukaryotes
- Generally non-motile, that absorb their nutrients directly from the environment
- Includes mushrooms, molds and yeast
  - Yeast are truly unicellular
  - Molds and mushrooms have a vegetative multicellular stage and produce unicellular spores
  - Molds live mainly in the soil and are responsible for biodegradation
  - Yeast live in environments high in sugar
- *Aspergillus nidulans*, which contains the microscopic spores of the fungus

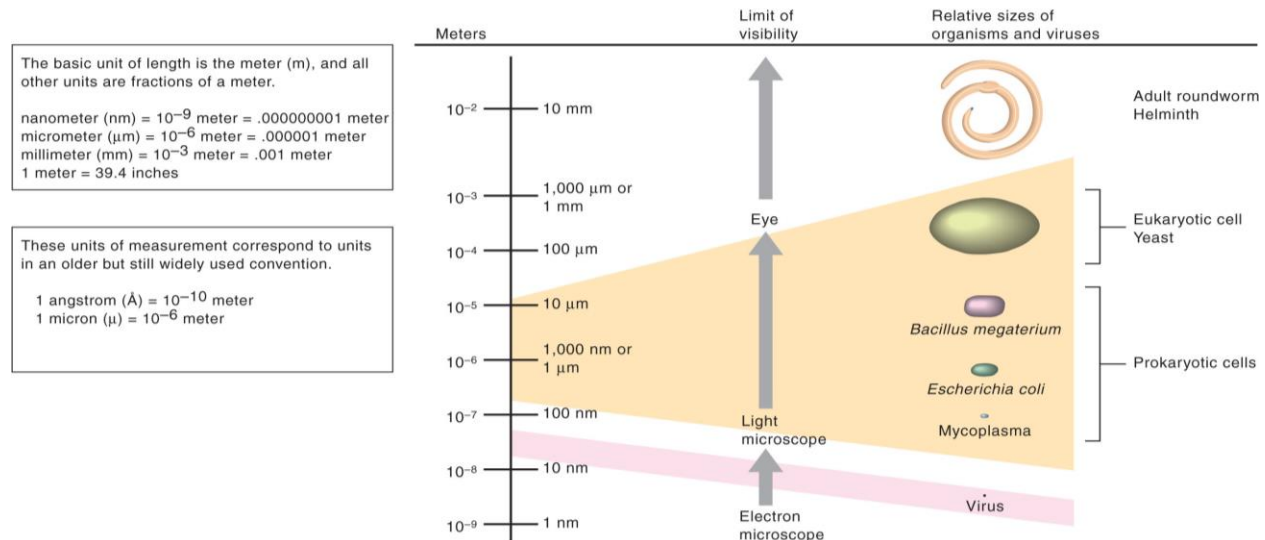


## Viruses

- Made of nucleic acid (DNA or RNA) and protein and have some of the characteristics of life
- Lack ribosomes, membranes, and means to generate energy, which are properties of cells
- Considered microbes, but they are not microorganisms since they are non-cellular
- Viruses are considered obligate intracellular parasites because they can only replicate in association with a host cell which they infect

## Size in the Microbial World

- Tremendous range in size
  - Smallest virus approximately 1/1,000,000<sup>th</sup> size of largest eukaryotic cell





## Microorganisms Worldview

- Majority of microorganisms are harmless and many (though not all) possess beneficial qualities
- Harmful microorganisms represent only a minute portion of the overall microbes
- The threat they pose to humans, animals, or agriculture can be quite devastating

