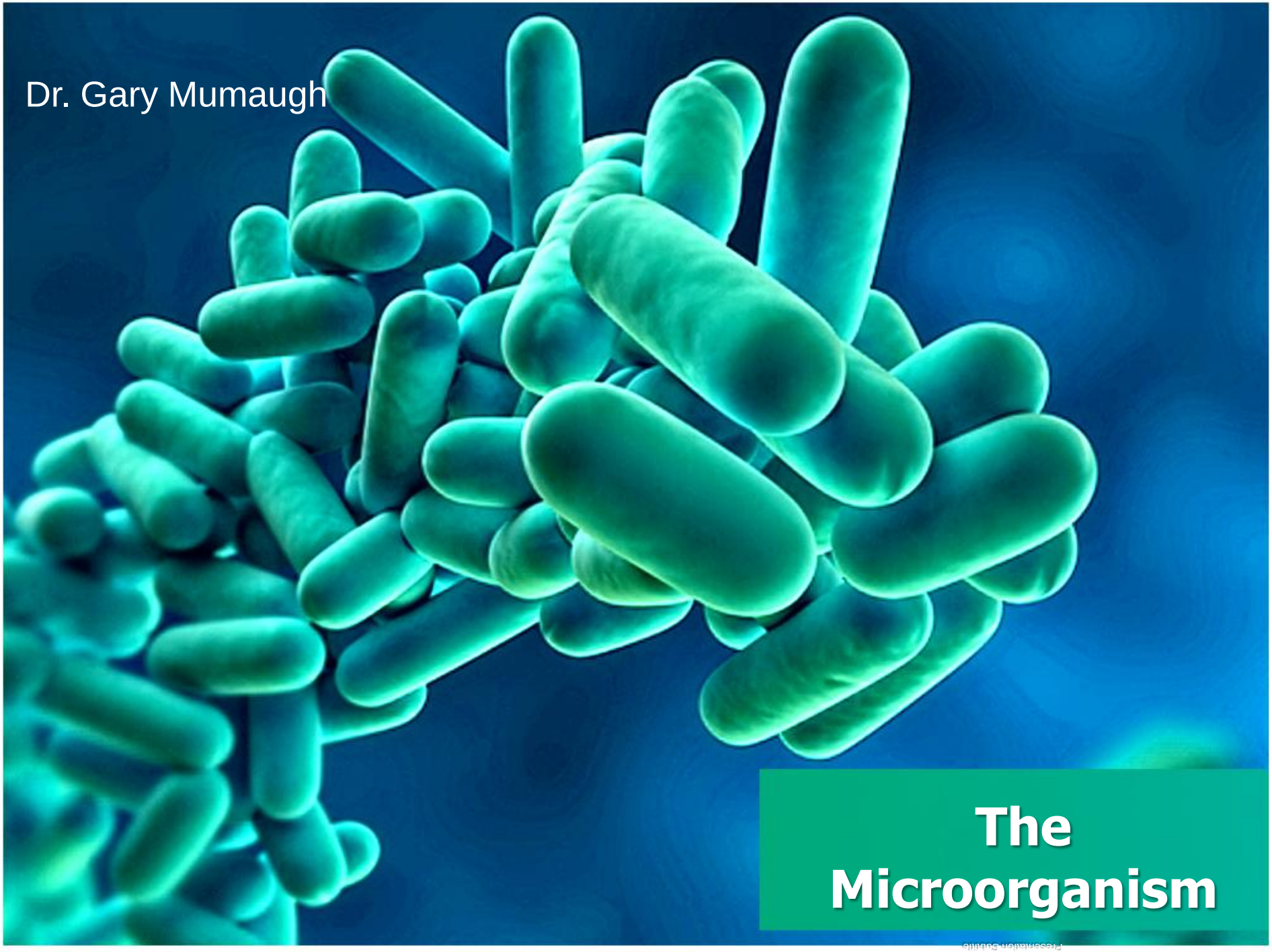

Dr. Gary Mumaugh
The Microorganism

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

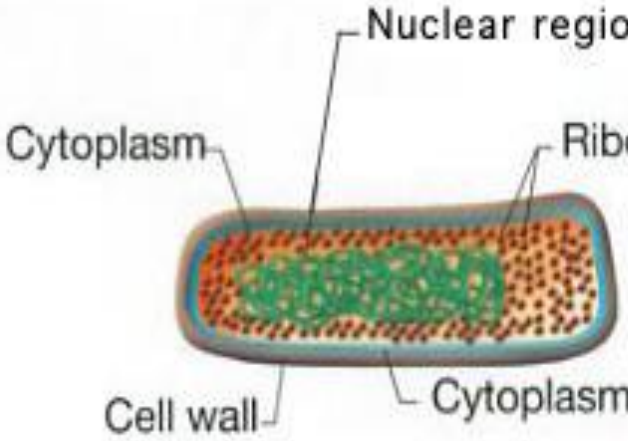
Characteristics of Living Organism

- 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 muticellular organisms, to develop or differentiate into various types of cells

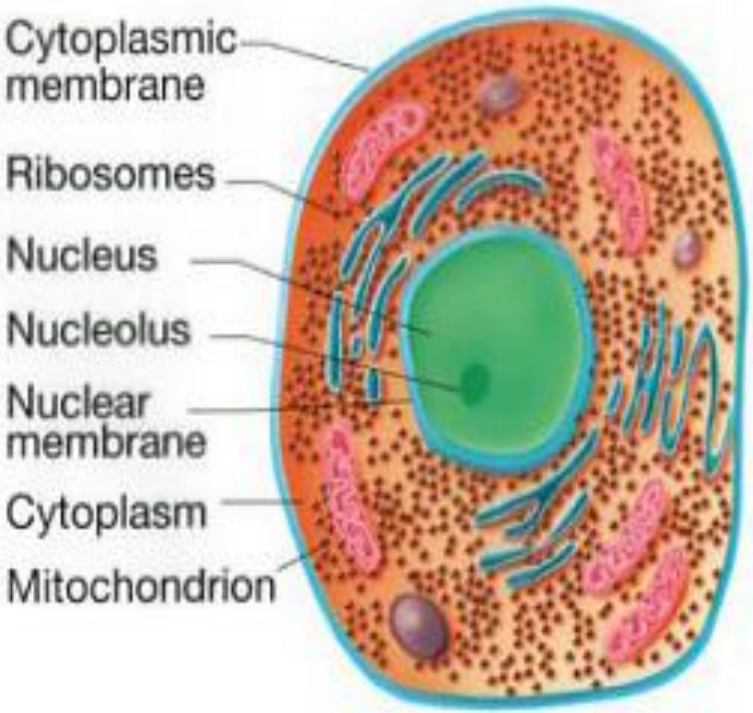
- The term **organism** implies cellular life.
- **Micro-organisms** are a type of cellular life that is microscopic in size.
- Viruses are not considered microorganisms because they are not cells.
  - Viruses consist of nucleic acid (DNA or RNA) enclosed in a protein coat.
  - They lack many essential properties of cells, including membranes, ribosomes and metabolic enzymes.
  - Viruses are considered microbes, but not microorganisms, and arguably are not "alive".

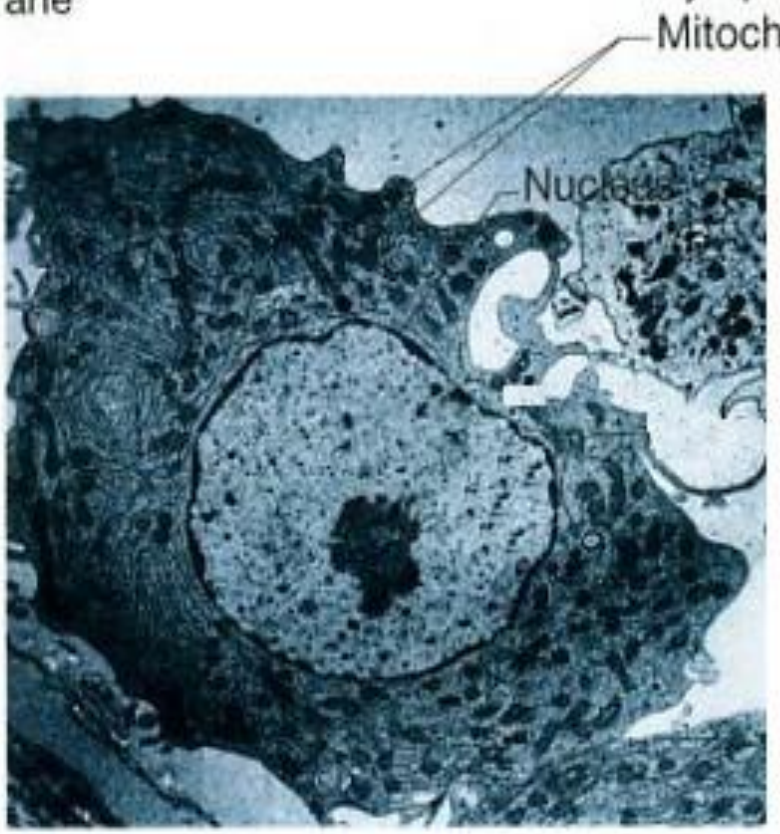
Two Type of Microbial Cells

- 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


Nuclear region (DNA)
Cytoplasm
Ribosomes
Cell wall
Cytoplasmic membrane


Cell wall
Cytoplasm


Cytoplasmic membrane
Ribosomes
Nucleus
Nucleolus
Nuclear membrane
Cytoplasm
Mitochondrion


Mitochondria
Nucleus

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 Microorgansims

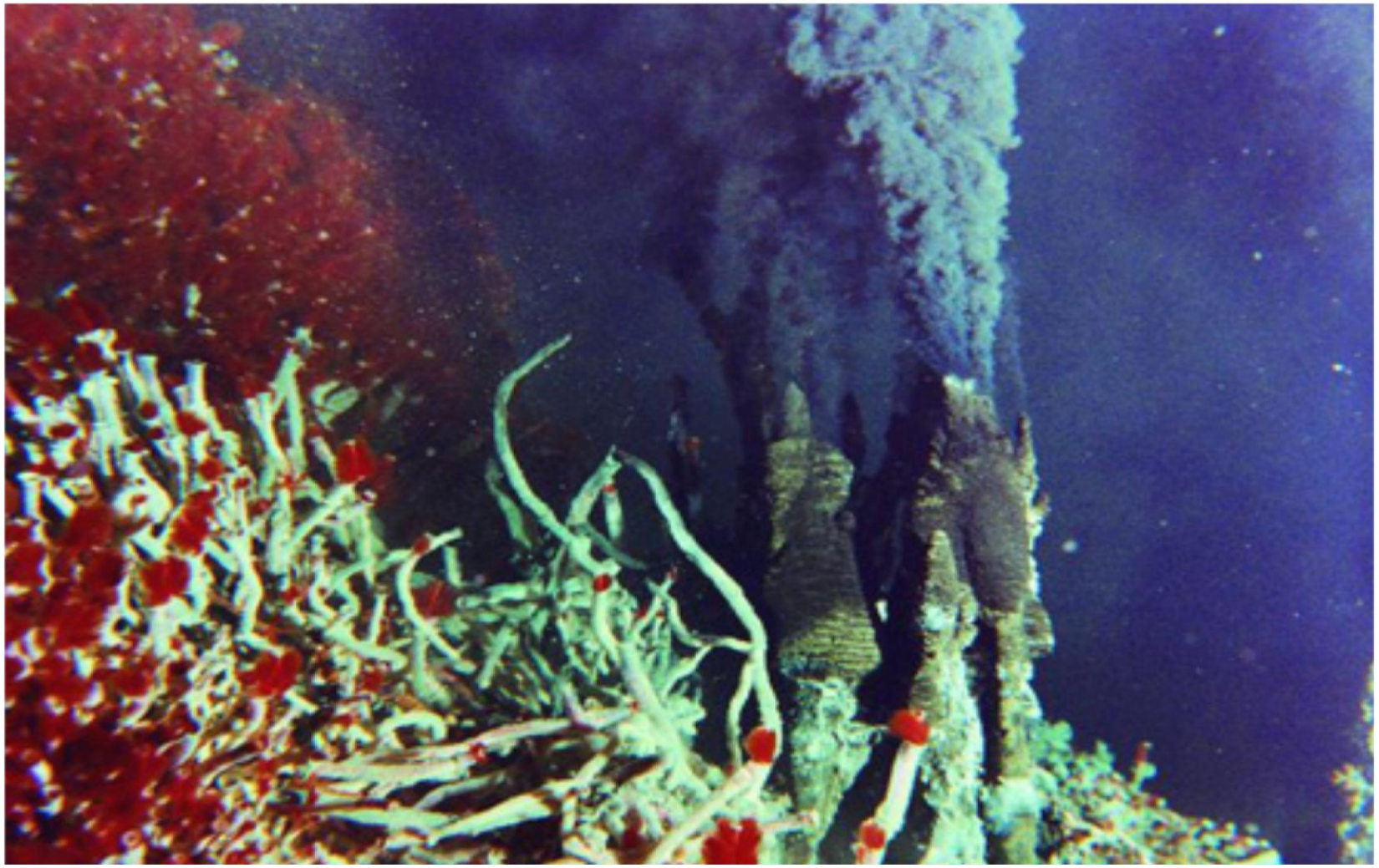
- **Archaea** Prokaryotic
- **Bacteria** Prokaryotic
- **Algae** Eukaryotic
- **Protozoa** Eukaryotic

  Algae and Protozoa are called Protista
- **Fungi** Eukaryotic

Archaea

- Unicellular prokaryotic cells
- Sometimes produce methane (CH_4) 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^{o}C.

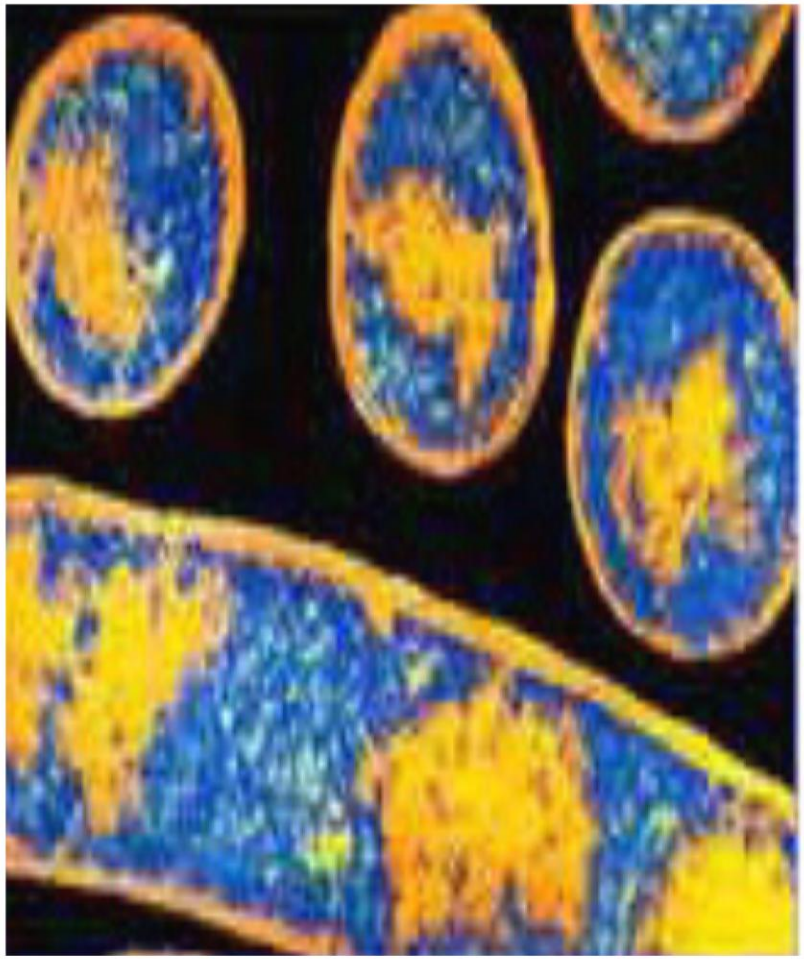


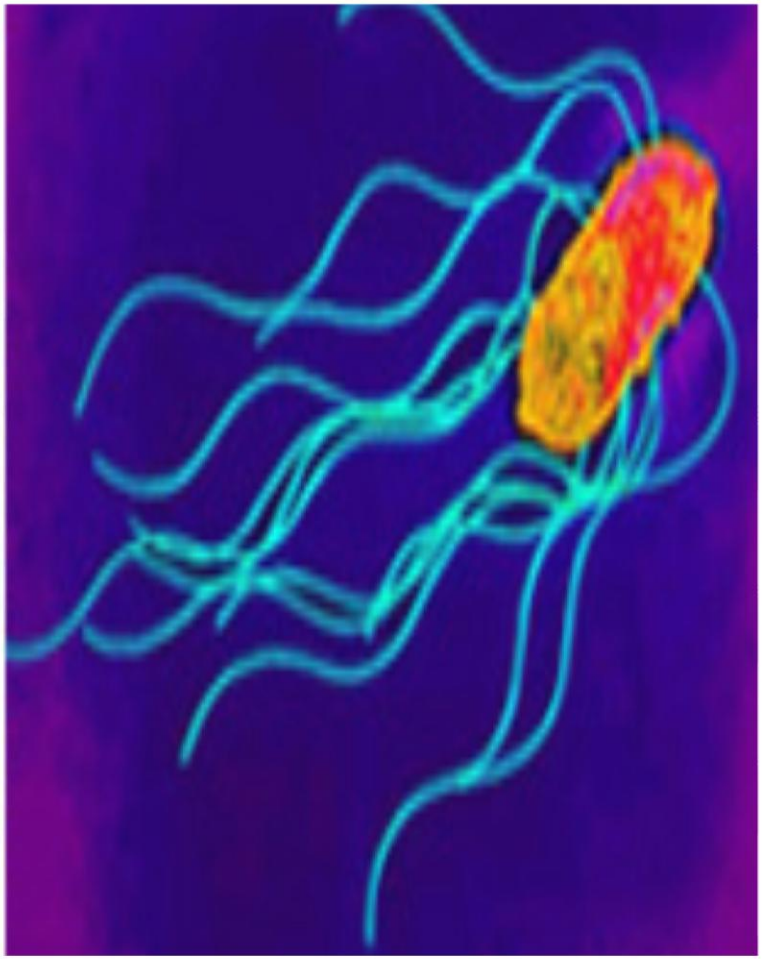
Bacteria

- 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

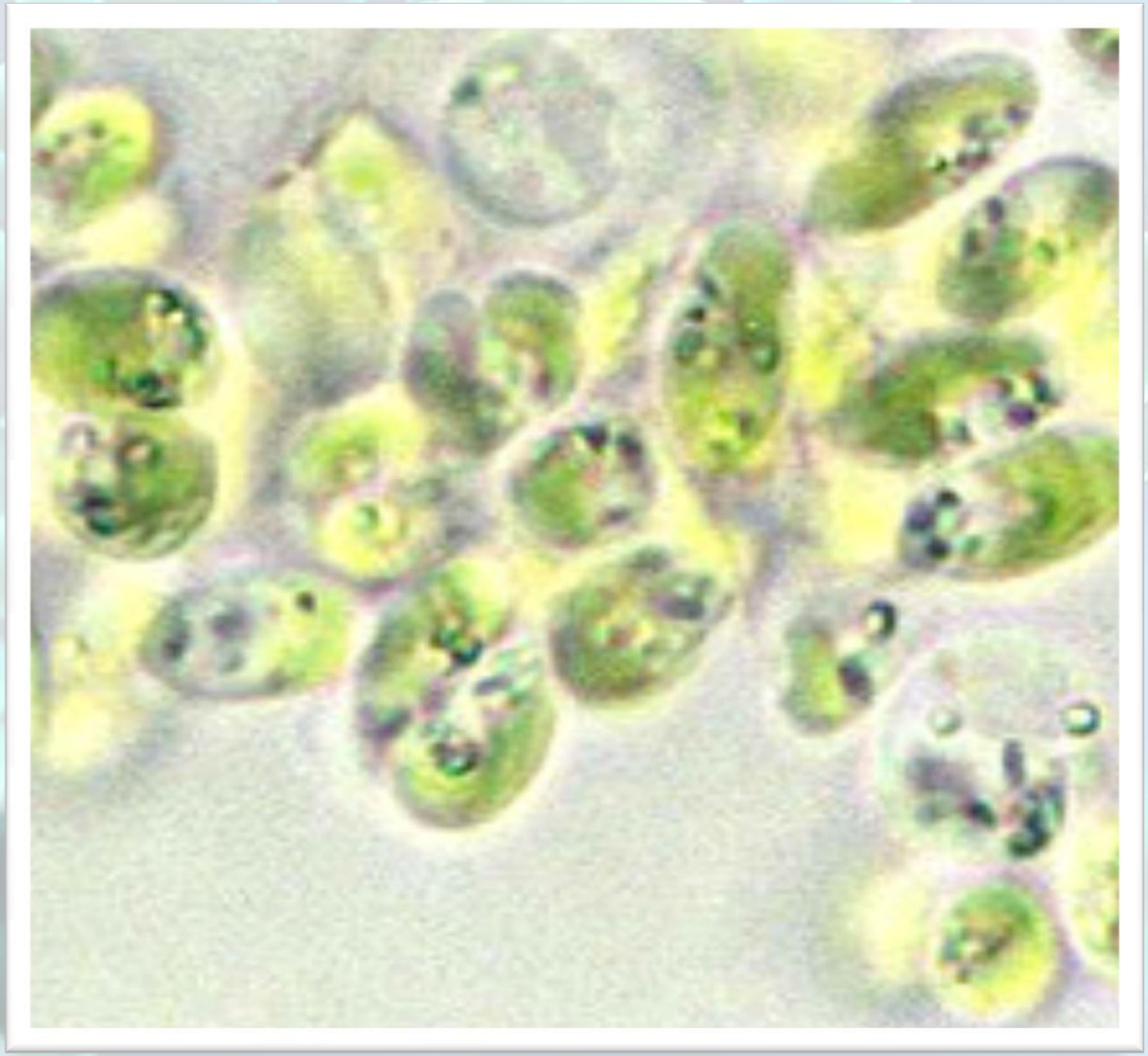




Algae

- Plant-like, photosynthetic, eukaryotic organisms
- Live wherever there is light and moisture
- They convert carbon dioxide (CO_2) to organic material and produce oxygen (O_2) during photosynthesis, the same as plants

Monadus subterraneous, a freshwater alga



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

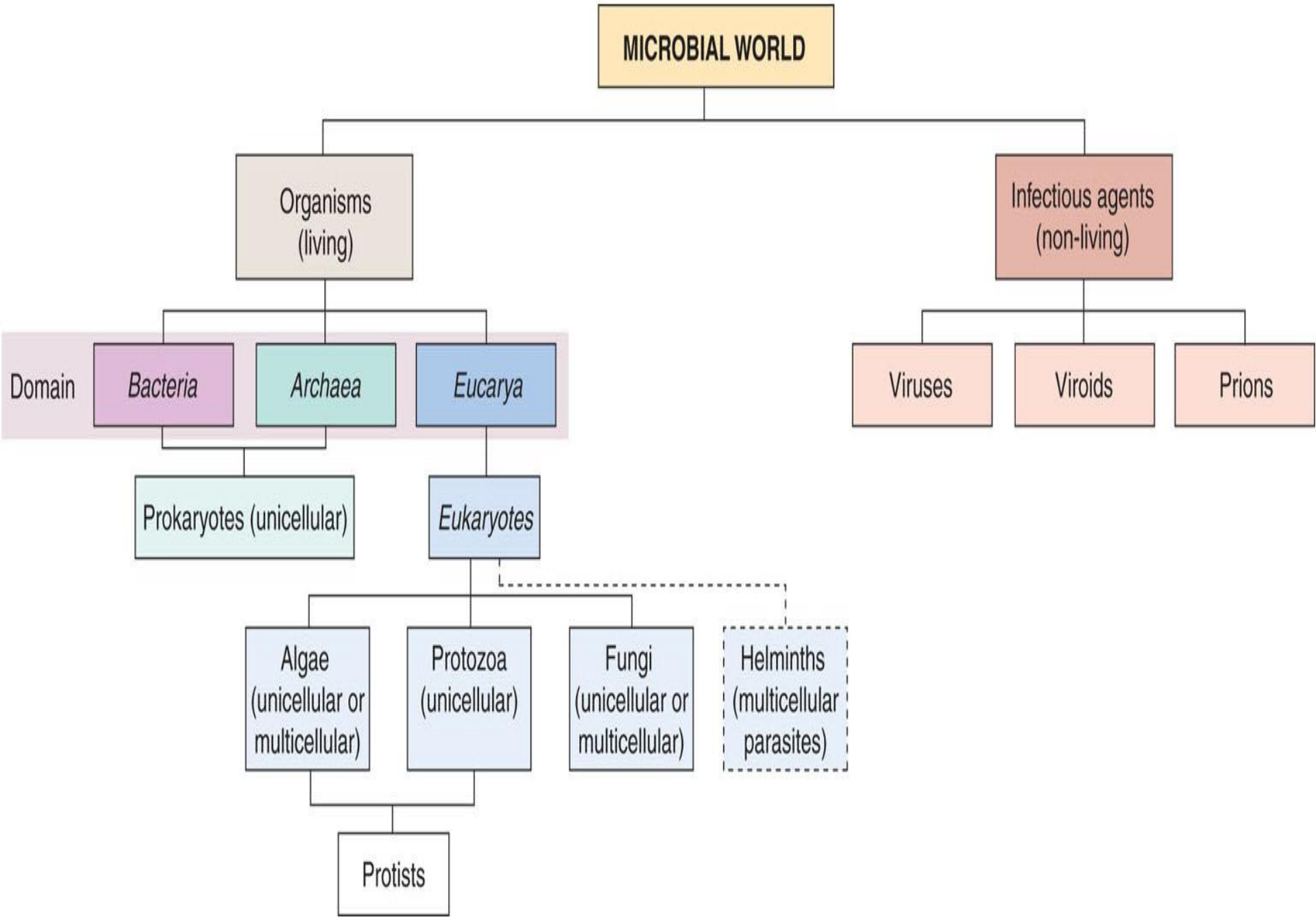
Fungi

- 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

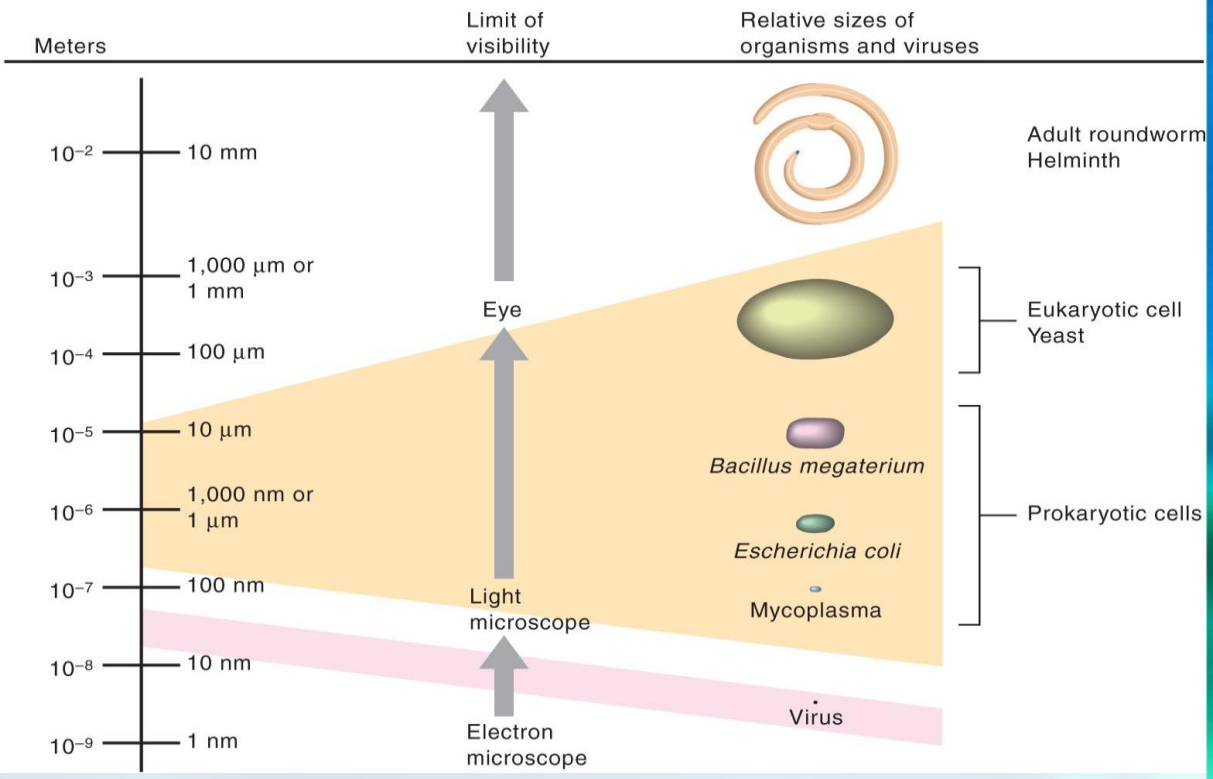
- Tremendous range in size
  - Smallest virus approximately 1/1,000,000th size of largest eukaryotic cell

The basic unit of length is the meter (m), and all other units are fractions of a meter.

nanometer (nm) = 10^{-9} meter = .000000001 meter
micrometer (μm) = 10^{-6} meter = .000001 meter
millimeter (mm) = 10^{-3} meter = .001 meter
1 meter = 39.4 inches

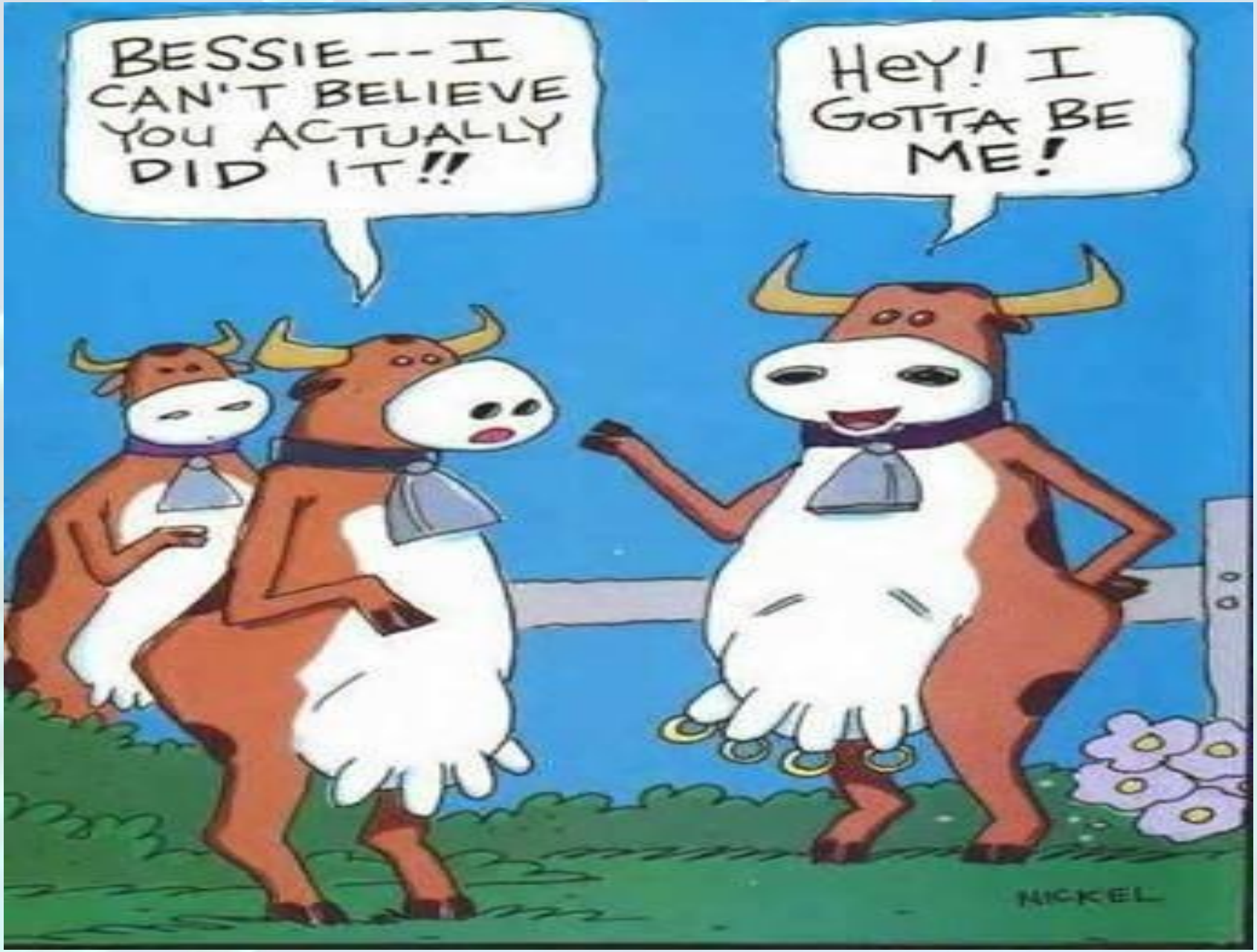
These units of measurement correspond to units in an older but still widely used convention.

1 angstrom (Å) = 10^{-10} meter
1 micron (μ) = 10^{-6} meter



Microorganisms Worldview

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


BESSIE--I CAN'T BELIEVE YOU ACTUALLY DID IT!!
Hey! I GOTTA BE ME!
NICKEL