**Lab 2: Size, Scale and General Features of Viruses, Fungi and Bacteria**

(15 points)

**Objectives:**

* To learn about the sizes of typical microorganisms.
* To become familiar with the units used to measure them.
* To learn about the Internet as a source of information useful to the study of microbes.
* To learn about cell structure.

**What you need:**

* *Alcamo’s Microbes and Society* textbook, both chapters 1 and 2
* Access to the websites listed below

**What to do:**

* Read Pages 30 – 31 and 37 – 38 in Chapter 2 of the textbook.
* Use the following websites to help you answer the questions:
  + <http://www.wisc-online.com/objects/ViewObject.aspx?ID=ABM4202>
  + <http://en.wikipedia.org/wiki/Bacteria>
  + <http://en.wikipedia.org/wiki/Eukaryote>
  + <http://www.sciencedaily.com/articles/p/protozoa.htm>
  + <http://en.wikipedia.org/wiki/Mold>
  + <http://www.news-medical.net/health/What-is-a-Virus.aspx>
  + <http://botany.si.edu/projects/algae/introduction.htm>
* **Remember – please answer the questions using a different color font**

**Answer the following questions:**

1. (0.5 point) What is microbiology?

***A branch of science that studies microorganisms and viruses, and their harmful and beneficial effects on the environment and mankind.***

1. (1.5 points) Who were Janssen, Hooke, and Leeuwenhoek, **why are they important to microbiology**, and in which centuries did they live?

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| ***Scientist*** | ***Life Span (Century)*** | ***Contribution*** |
| ***Zacharias Janssen*** | ***1585 – 1632 (16th & 17th)*** | ***Credited with the invention of the compound microscope*** |
| ***Robert Hooke*** | ***1635 – 1703 (17th & 18th)*** | ***Using a microscope, observed minute slices of cork (cells). Published observations in “Micrographia”.*** |
| ***Anton von Leeuwenhoek*** | ***1632 – 1723 (17th & 18th)*** | ***Observed pond water through microscope. Saw microorganisms that behaved animal-like (protozoan & alga); named microorganisms “animalcules”.*** |

1. (2 point) Complete the following table:

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| **Prefix** | **Multiple / fraction of a meter** | **What might be measured using this unit?** |
| kilo | ***1000 X*** | ***long distances, as in from Lane Community College to your home*** |
| centi | ***1/100 (1 hundredth)*** | ***Dimensions of tangible objects; i.e. human height, width of computer screen.*** |
| milli | ***1/1000 (1 thousandth)*** | ***measurement of tools; socket set*** |
| micro | ***1/1000000 (1 millionth)*** | ***Most often used in cellular measurement; microorganisms*** |
| nano | ***1/1000000000 (1 billionth)*** | ***Used to measure particles; viruses*** |

1. (1.5 points) Describe what a prokaryote is and include a) a description of the genetic material and location, b) what type of organelles they have (if any), and c) if they have a cell wall, cell membrane, or both.

***Prokaryotic cells have a cellular organization; however, lack a cell nucleus. Prokaryotes have chromosomes – located in the cell’s cytoplasm – that carry the cell’s genetic material (DNA).***

***Prokaryotes do not have organelles.***

1. (1 point) Briefly list the functions or provide a description of each of the following in prokaryotic cells and if every prokaryote has the particular structure.

a) Cell membrane - ***barrier that surrounds the cell that separates the environment from cytoplasm; present in all prokaryotes.***

b) Cell wall -  ***cell structure and water balance; present in most prokaryotes.***

c) Chromosomes - ***carry the genetic information (DNA); present in all prokaryotes.***

d) Cytoplasm – ***semi-fluid inside of the cell; present in all prokaryotes.***

e) Flagella – ***cell mobiitly; present in some prokaryotes.***

f) Ribosomes -  ***tiny bodies where protein is constructed; present in all prokaryotes.***

1. (1.5 points) Describe what a eukaryote is and include a description of a) the genetic material and packaging/location, b) organelles, and c) whether they have a cell wall, cell membrane or both.

***Eukaryotic cells have a cellular organization and a cell nucleus. The nucleus contains chromosomes that carry the cell’s genetic material (DNA). Eukaryotes have organelles – membrane enclosed cellular components. All eukaryotes have a nucleus and a cell membrane. Most eukaryotes contain mitochondria. Alga, plant, and fungi contain cell walls.***

1. (2 points) Briefly list the functions or a description of each of the following in eukaryotic cells and if every eukaryote has the particular structure..
2. Cell membrane - ***barrier that surrounds the cell that separates the environment from cytoplasm; present in all eukaryotes.***
3. Chromatin (Chromosomes) - ***carry the genetic information (DNA); present in all eukaryotes.***
4. Endoplasmic reticulum - ***organelle that modifies proteins and synthesizes*** [***lipids***](https://www.boundless.com/biology/definition/lipid/)***;*** ***present in most eukaryotes.***
5. Golgi apparatus - ***organelle where the sorting of lipids and proteins takes place; present in most eukaryotes.***
6. Lysosome - ***take care of the cell's digestive process; present in animal cells***
7. Mitochondria - ***responsible for the conversion of chemical energy to cellular energy (ATP); present in most eukaryotes***
8. Nucleolus - ***condensed region of chromatin where ribosome synthesis occurs.***
9. Nucleus – ***houses the genetic information needed for growth and metabolism; present in all eukaryotes***
10. Perioxisomes - ***carry out reactions oxidation that break down fatty acids and amino acids and detoxify poisons; present in eukaryotes.***
11. Ribosomes - ***tiny bodies where protein is constructed; present in all eukaryotes.***
12. (0.5 points) What things do prokaryotes and eukaryotes have in common – name at least **two** things?
    * ***Cell membrane***
    * ***ATP production***
13. (2.5 points) Describe six different examples of the spectrum of microorganisms. For each, include the size scale, written descriptions of their structure, and a few facts describing their importance.

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| Organism | Size scale  (i.e. 1 – 5 m)  m = micrometers | Brief description of their structure | Example organism (**be specific**) and a few facts describing the organism’s significance |
| **1. Bacterium** | **2 – 4 m (length) 0.2 – 0.5 m (width)** | **Rod-shaped – sort of like a capsule** | ***Mycobacterium tuberculosis-* an extremely dangerous pathogen that is one of the leading causes of death among bacterial diseases** |
| **2. Protozoan** | **2 – 50m (diameter)** | **Change shape (Amoeba)**  **fixed shape (Paramecium)** | ***Amoeba proteus-* fresh water single celled organisms that feed on bacteria and smaller protozoa.** |
| **3. Molds (Fungi)** | **7– 12 m (length) 4 – 5 m (width)** | **Great variation in morphology** | ***Stachybotrys chartarum* – black mold – linked to leprosy and sick building syndrome** |
| **4. Yeast (Fungi)** | **Size varies greatly**  **3 – 4 m(diameter)** | **Spherical** | ***Candida albicans*- pathogen that can cause**[**infections**](https://en.wikipedia.org/wiki/Yeast_infection)**in humans** |
| **5. Alga** | **10 m(diameter)** | **Round 2 tail-like flagella** | ***Chlamydomonas reinhardtii* -**  **used in the production of biopharmaceuticals and hydrogen** |
| **6. Virus** | **120 nm (diameter)** | **Spherical** | ***Human immunodeficiency virus* - causes AIDS** |

1. (2 point) Complete the following table. List three organisms with different **shapes** (round, square, etc.), the name of an example of an organism with that shape (*Legionella pneumophila)*, and disease the organism can cause (Legionnaire’s disease – a type of pneumonia). Note the correct manner in which scientific names are written – the Genus is capitalized while the species name is not capitalized and both names are italicized!

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| Basic bacterial forms/shapes | Name of an example organism of that form | Disease caused by that organism |
| **Example: rod-shaped (bacilli)** | ***Legionella pneumophila*** | **Legionnaire’s disease (a type of pneumonia)** |
| **Round (cocci)** | ***Streptococcus pneumoniae*** | **Pneumonia ()** |
| **Spiral (Spirillum)** | ***Treponema pallidum*** | **Syphilis** |
| **Square (Haloquadratum – Archae)** | ***Haloquadratum walsbyi*** | **N/A** |