# UNIT 2.1

## The Microbe and the Microbial World We Inhabit

*Presented by:*
*Dr. Jonathan Trent*

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## The Microbe and the Microbial World We Inhabit

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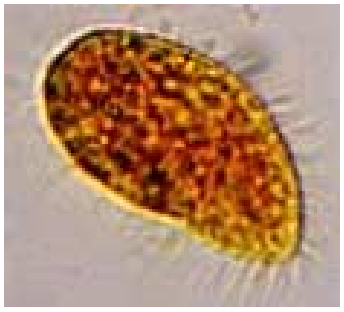


## Vocabulary:

- DNA
- Metabolism
- Protein
- RNA

## Purpose:

The overall purpose is to present to students of engineering the form and function of microbes as molecular "machines." The fundamental working components will be discussed indicating how 'DNA makes RNA make proteins' (the central dogma of molecular biology) and how proteins are the builders and building blocks of cells. The adaptability and versatility of the microbial design will be presented by discussions of extreme environments.

## Objectives:

To understand:

a) The Earth as a Habitable Planet

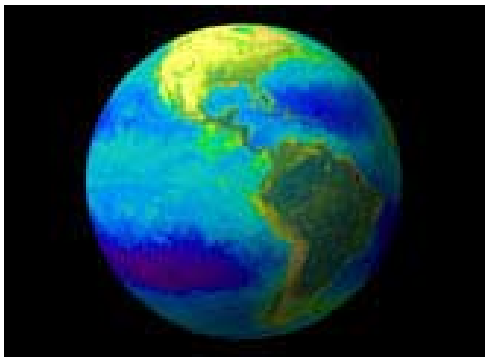
b) Classifications of Life

c) The Architecture of the Microbial Cell

d) Metabolism

e) Molecular Adaptation

## The Earth as a Habitable Planet



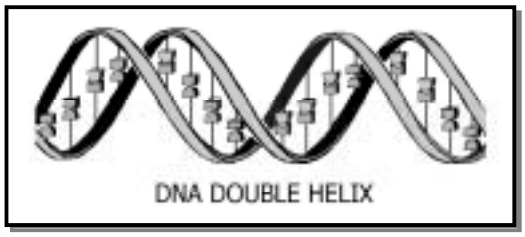
- In the beginning…
- Uniformity and catastrophe
- Current range and variability
    - Ocean depths
    - Geothermal areas
    - Ice
    - Saturated salt

## Classification of Life: What's in a Name?

- An audacious perspective on life
- Plants vs. animals
- The invention of the microscope and the discovery of "animolecules"
- The five kingdoms of life
- The cell: prokaryotes vs. eukaryotes
- System vs. phylogeny: Linnaeus vs. Darwin
- Molecular classifications systems (phylogeny?)
- Classification by temperature

<table>
<tr><th>Two Kingdoms</th><th>Five Kingdoms</th><th colspan="2">Three domains and who knows how many "Kingdoms"</th></tr>
<tr><td>Animalia</td><td>Animalia</td><td rowspan="11">Eukarya</td><td>Animalia</td></tr>
<tr><td rowspan="2">Plantae</td><td>Fungi</td><td>Fungi</td></tr>
<tr><td>Plantae</td><td>Plantae</td></tr>
<tr><td rowspan="9">Either Protozoa (=Animal) or Algae (=Plant)</td><td rowspan="9">Protoctista</td><td>Alveolata</td></tr>
<tr><td>Stramenopiles</td></tr>
<tr><td>etc...</td></tr>
<tr><td>Sporozoa</td></tr>
<tr><td>Mycetozoa</td></tr>
<tr><td>Euglenozoa</td></tr>
<tr><td>etc...</td></tr>
<tr><td>Archezoa</td></tr>
<tr><td rowspan="2">Plant (bacteria and blue-green algae)</td><td rowspan="2">Monera</td><td>Eubacteria</td><td>(kingdoms not specified)</td></tr>
<tr><td>Archaea</td><td>Euryarchaeota<br>Korarchaeota<br>Crenarchaeota</td></tr>
</table>

## The Architecture of the Microbial Cell




- Size and shape
- The sum of the parts
- The functional whole
    - DNA replication
    - Protein synthesis or transcription and translation

## Metabolism/Building the Building Blocks of Life

- Turning 'lead into gold'
- The gradients of energy

## Microbes Go to the Extremes

- Life's position in the temperature range in the universe
- A word about words
- Still living on the Earth of 3 billion years ago

## Molecular Adaptations to Life at High Temperatures

- The concept of acquired thermotolerance
- Proteins as thermo-protectants
- The mystery of how protein-thermo-protectants work

## What Does This All Mean for the Engineers of the Future?

- Building on nature: Biology and Nanotechnology
    - Genetic engineering
    - Self-assembling proteins
    - The nature of small things to come…

**Notes:**