

MICROBIOLOGY

Introduction

What is Microbiology?

Microbiology is the study of living creatures too small to see with the naked eye. This division of biology includes the study of bacteria, fungi, protozoa, algae, viruses and other important minute organisms.

Why Study Microbiology?

No living creature can separate itself from interaction with microbes. We use them to help create pharmaceuticals, clean up hazardous waste, and make food products. They can also wreak havoc on all creatures by invading them and causing disturbance and infection. Understanding the way they function is vital to life on earth.

History of Microbiology

1820 Deodorants used to reduce putrefaction. Sodium hypochlorite used in Parisian morgues to reduce decay.

1840 Ignaz Semmelweis, a Viennese physician, was supervising medical students in the maternity wards when he noticed a correlation between putrefaction in autopsy and puerperal fever in pregnant women. He also noticed that some physicians found higher rates of puerperal fever in their patients. He, along with Oliver Wendell Holmes in the US, requested that all physicians wash their hands between patients. Few complied and many more women died in childbirth.

1850 Louis Pasteur, a very bright brewer trying to make the best beer, noticed that it was microorganisms that fermented sugar to alcohol. When incorrect microbes were in the mixture, undesirable products resulted. He proceeded to culture *Bacillus anthracis* and proved it to be a causative agent of the disease anthrax.

1860 Joseph Lister, an English surgeon, using data gathered in operating rooms and from old bandages he picked up in the trash outside hospitals, proposed that infections were due to "miasmas" found around patients. He began to use carbolic acid (phenol) to wrap wounds and to spray the air around the patient, which killed what he called "septic germs." His work went unappreciated for years.

1890 Robert Koch, a German physician, continued Louis Pasteur's work. He established that anthrax bacteria was always present in infected blood, that the infected blood could transmit anthrax, and the bacteria was isolatable outside the animal.

1940 Alexander Fleming discovered penicillin and used it to cure various diseases. Along with Ernst Chain and Howard Florey, he developed a production process.

1950 Joshua Lederberg, Edward Tatum, and George Beadle discovered and worked on genetic recombination in bacteria.

1960 Francois Jacob and Jacques Monod discovered and elucidated control of enzyme synthesis. They are credited with the Lac Operon model of genetic control of enzyme synthesis.

1980 Michael Bishop and Harold Varmus discovered that virus encoded oncogenes originate in eukaryotic cells.

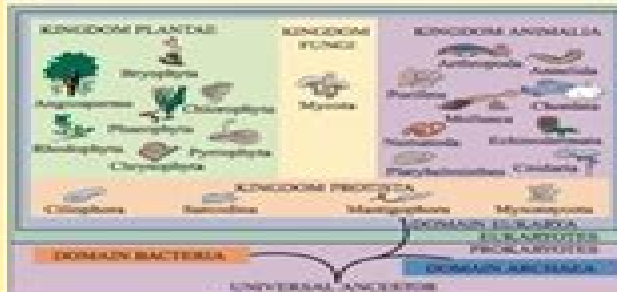
1985 Kary Mullis invents PCR, polymerase chain reaction, a technique to amplify any DNA sequence.

1997 Stanley Prusiner is awarded the Nobel Prize for work on prions, "infectious proteins."

Types of Infective Agents

Bacteria	Mycoplasmas	L. Form
Fungi	Rickettsias	Viroids
Viruses	Sporebates	Prions
Protozoa	Chlamydiae	DNA/RNA

Organismal Evolution



How Prokaryotes and Eukaryotes Differ

PROKARYOTES

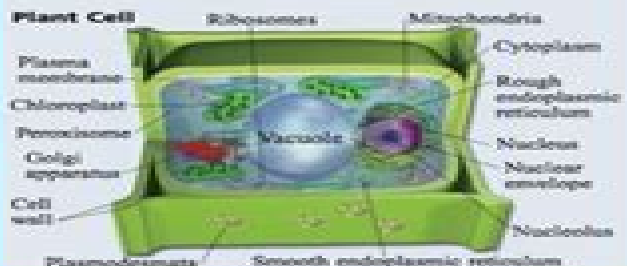
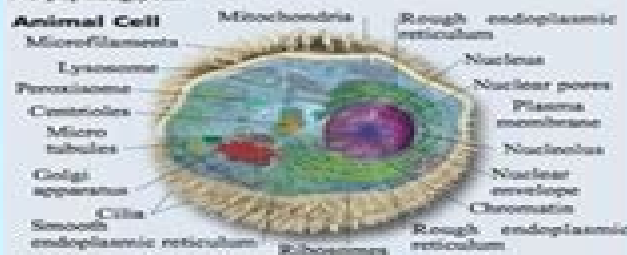
No nucleus
Simple membrane
One chromosome
Bacteria / Mycoplasma / Algae
Small diameter / 1-5um
No organelles
Ribosomes are 70S
Simple flagella
Conjugation, transduction, transformation peptidoglycan in cell wall

Prokaryotic Cell



EUKARYOTES

True nucleus
Complex, invaginated membrane
Multiple chromosomes
Algae / fungi / protozoa
Large diameter / 10-100um
Organelles
Ribosomes are 70S and 80S
8 x 2 microtubular flagella conjugation
No peptidoglycan



The Cell Theory

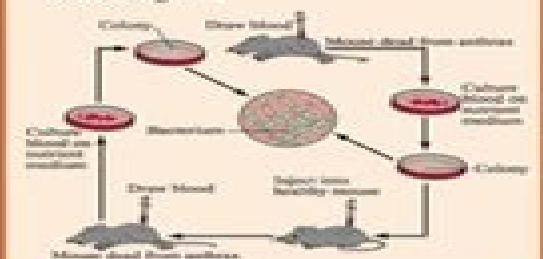
The cell theory, first put forth in the 1800's, has three main premises and states:

- All living things are made up of one or more cells.
- The cell is the basic unit of life.
- All cells come from pre-existing cells. A microbe can be one cell or a cluster or colony of cells that work together. Some pathogens are just infective pieces of RNA or DNA.

Koch's Postulates

To prove a microorganism causes disease:

- Identical microbe must be present in all individuals with the same disease.
- Microbe must be cultured outside the body.
- Microbe must induce disease when given to same species.
- Identical microbe must be isolated from newly diseased organism.



Food Borne Pathogens

VIROSES

Norwalk
Polio
Coxsackie
Echovirus
Hepatitis A

FUNGI

Aspergillus

PROTOZOA

Giardia
Toxoplasma
Cryptosporidium
Salmonella

HELMINTHES

Trichina
Pinworm
Tricostema
Nematodes

BACTERIA

Gram Positive Genera

Bacillus
Clostridia
Listeria

Gram Negative Genera

Erwinia
Salmonella
Shigella
Escherichia
Pseudomonas
Campylobacter
Yersinia
Bacteroides
Brucella

GRAM NEGATIVE VS GRAM POSITIVE

Food Borne Bacterial Symptoms:

Gram Positive (Usually Produce Toxins)

Headache, dizziness, uncoordinated movements, numbness and excessive incoherent

Gram Negative (Usually Result in Infection)

Abdominal cramps, malaise, tenesmus, diarrhea, hemorrhagic stool, vomiting and nausea

Microbiology Study Guide

Roman Wölfel



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