**Introduction to Microbiology**

**The Microbial World and You**

Microorganisms / Microbes:

-typically unicellular

-too small to see with unaided eye

-include:

bacteria & archaea fungi

protozoa algae viruses

-located almost everywhere

-only a small % are pathogens

-most involved in environmental / ecosystem balance:

\*breakdown waste

\*ﬁx nitrogen

\*photosynthesis –foundation of food chain

\*digestion in animals

\*vitamin production

**Organism Nomenclature**

-Established by Carolus Linnaeus (1735)

-latinized

-each organism has unique two part **genus & species** name:

e.g. *Escherichia coli*

-written in italics or underlined

-genus with capital ﬁrst letter

-species/speciﬁc epithet all lowercase

-after ﬁrst use in documents can abbreviate genus: *E. coli*

-name often describes organism: shape, habitat, name of discoverer, etc.

Microbial Groups



**Brief History of Microbiology**

**1665 Robert Hooke**

-Developed ﬁrst microscope

-Observed smallest units of life, calls them cells

-Proposed cell theory:

All living things are composed of cells

Prevailing thoughts:

**Spontaneous Generation** Theory: some forms of life could arise spontaneously from nonliving matter

**1673-1723 van Leeuwenhoek**

-Enhanced microscope magniﬁcation

-Published observations of tiny live moving objects: called them “animalcules”

Scientists now interested in microbes: Where do they come from?

**1858 Virchow**

-Theory of **Biogenesis**: living cells can only arise from living cells

Great debates & Experiments to prove both sides continue

**1861 Louis Pasteur**

-Demonstrates microbes in air can contaminate sterile solutions but air cannot give rise to microbes: no spontaneous generation

-Microbes present on all non-living matter

-Microbes can be killed by heat

-Methods can block access of microbes to sterilized medium:

aseptic technique

-Establishes link between activity of a microbe and speciﬁc change in organic material.

-Invented Pasteurization: kill contamination

-Applied ‘microbes cause change in organics’ logic to disease

**Germ Theory of Disease: microbes cause disease**

(prevailing thought: disease = punishment for misdeeds

**1860s Joseph Lister**

-Knew physicians transmitted infections

-Knew phenol (carbonic acid) killed bacteria

-Treated surgical wounds and implements, reduced incidence of infection

**1876 Robert Koch**

-Proves Germ Theory of Disease:

\*Anthrax-kills livestock

\*isolated *Bacillus anthracis* from sick animals

\*grows *B. anthracis* in culture

\*injects culture into healthy animal

\*animal sick with Anthrax, dies, same *B. anthracis* in blood

-**Koch’s Postulates: experimental steps to prove a particular bacteria causes a particular disease.**

**1857-1914 Golden Age of Microbiology**

-Establishment of Microbiology as a science

-Discovery of disease agents

-Discovery of role of immunity

-Development of vaccines

-Development of Chemotherapy

 - Vaccination:

**1796 Jenner lister**

-Observed milkmaids who got cowpox never got smallpox

-Injected cowpox into child, child mildly ill

-Child never contracted cowpox or smallpox

 **1880 Pasteur**

-Observed bacteria grown in lab became avirulent but could produce immunity

-Coined the term vaccine (vacca is Latin for cow)

**Chemotherapy** = treatment of disease using chemicals

**Antibiotics** = chemicals produced by one microbe to kill another

**Synthetic drug** = chemicals synthesized in lab to treat infections and disease

**1910 Ehrlich**

-First chemotherapy for infection

-Salvarsan (arsenic) for syphilis 1928 **Flemming**

-First antibiotic

-Penicillin for *Staphylococcus* infections

Early microbiology topics now divided into speciﬁc ﬁelds:

**Bacteriology** : study of bacteria

**Mycology** : study of fungi

**Phycology**: study of algae

**Parasitology**: study of protozoa

and parasitic worms

**Virology**: study of viruses

**Immunology**: host immunity & vaccines

**Recombinant DNA Technology**: insertion of genes into microbes to produce therapeutics

Microbes and Human Welfare (Good)

-Recycling vital elements (decomposition, photosynthesis, & nitrogen ﬁxation return C, N, O, S, and P back to food chain)

 -Sewage treatment

-Bioremediation

-Insect pest control

-Food production

 -Commercial applications

-Biotechnology & Genetic Engineering:

\*vaccines, \*therapeutics, \*gene therapy and \*agriculture

**Microbes and Human Disease**

-Normal Microbiota = microbes that live in or on you always

sometimes good, sometimes bad

\*prevent pathogen colonization

\*produce vitamins in gut

\*can cause disease in new location or immuno-compromised host

-Resistance = ability to ward off disease

-Infectious Disease

Pathogens = microbes that have part of life cycle in human host causing illness

\*reemerging and increasing

\*increasing drug resistance Emerging Infectious Diseases (EIDs) =

diseases that are new or changing and increasing

\*genetic changes in organisms

\*spread to new regions

Of all known bacteria, less than 10% cause any illness in humans