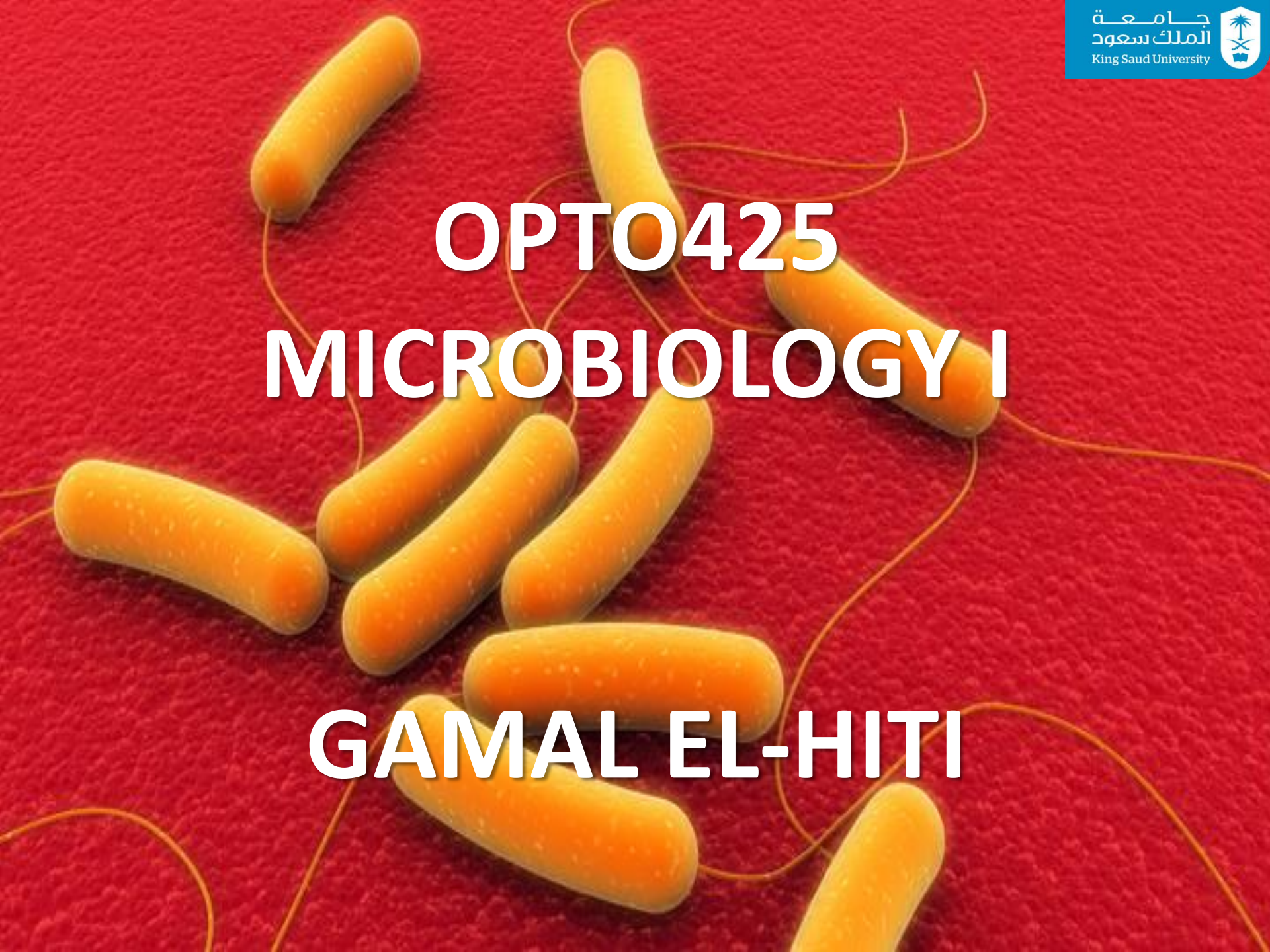


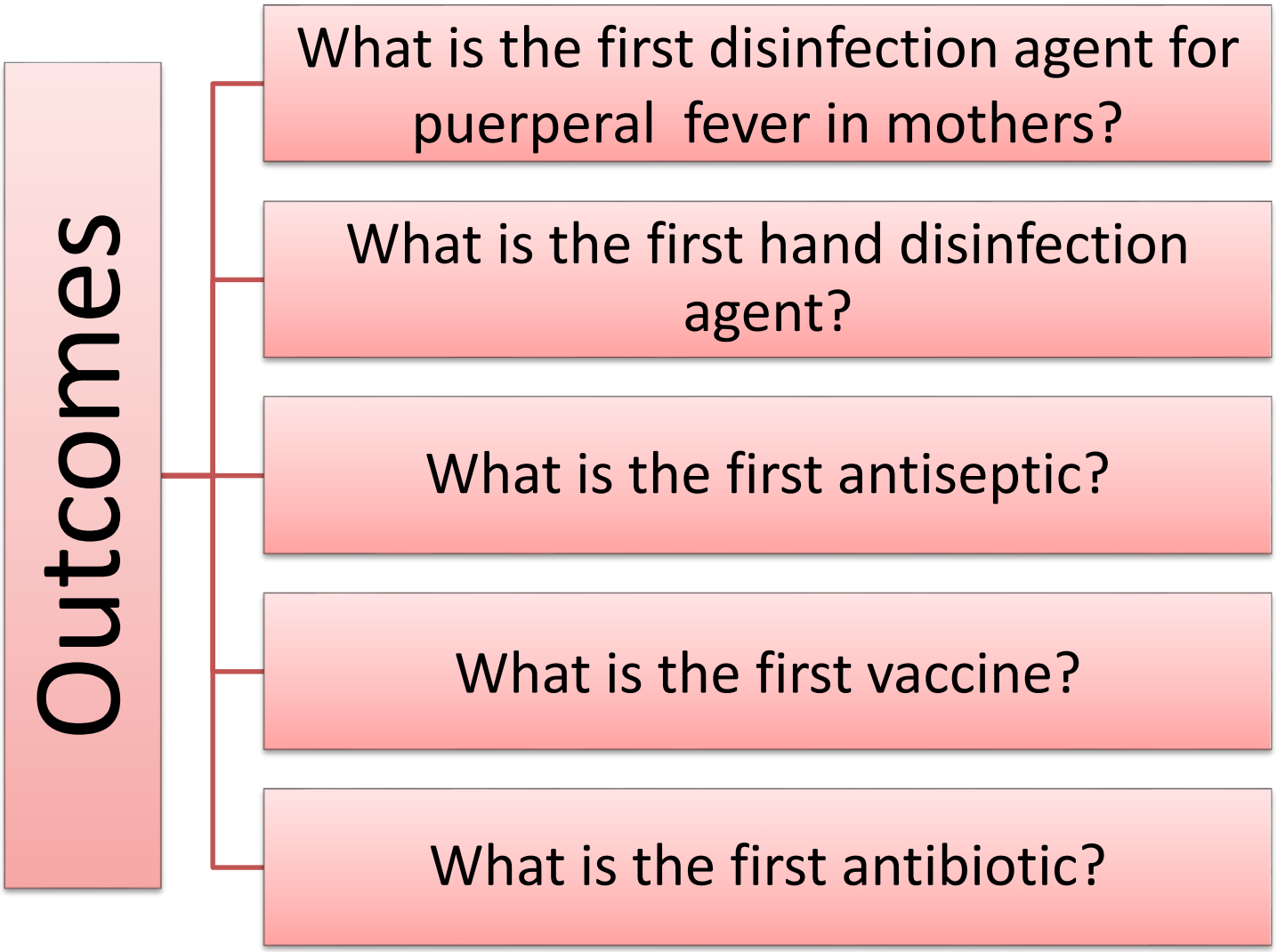
OPTO425
MICROBIOLOGY I

GAMAL EL-HITI

History of Microbiology

OPTO425
Lecture Three

Learning Outcomes



History of Microbiology

- Ignaz Semmelweis (Hungarian; 1818 – 1865)
- Known for hand disinfection for puerperal fever in mothers.
- In 1847, he proved that puerperal fever could be drastically cut by the use of hand wash for doctors and nurses in obstetrical clinic.

- Ignaz called the savior of mothers.

History of Microbiology

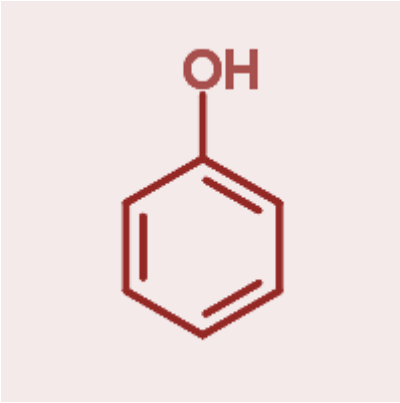
History of Microbiology

- Joseph Lister (British; 1827 – 1912)

- Joseph Lister is the surgeon who introduced new principles of cleanliness which transformed surgical practice in the late 1800s.
- He used phenol as antiseptic in surgery, based on Pasteur and Semmelweis findings.
- He read Pasteur's work on microorganisms and decided to expose the wounds to chemicals.

History of Microbiology

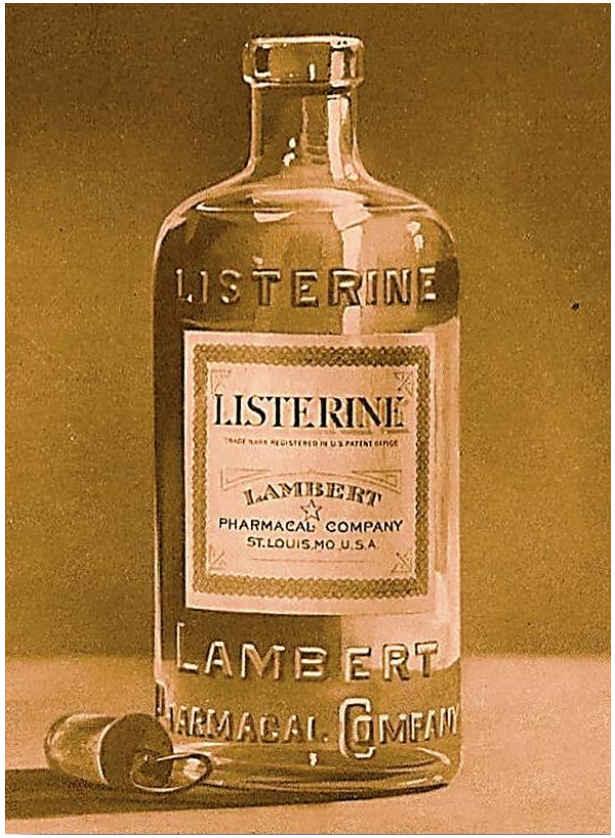
- Lister covered the wounds with dressings soaked with carbolic acid (phenol).



- The rate of infection was vastly reduced.
- In order to limit infection in the theatre while operating, Lister experimented with:
- Hand-washing

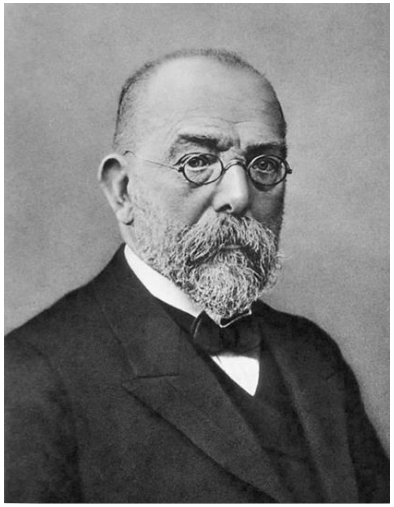
History of Microbiology

- Sterilising instruments
- Spraying carbolic acid
- The Listerian principles were adopted throughout many countries by a number of surgeons.
- Lister was known as the father of antiseptic surgery in which antiseptic was used for the first time in surgery.



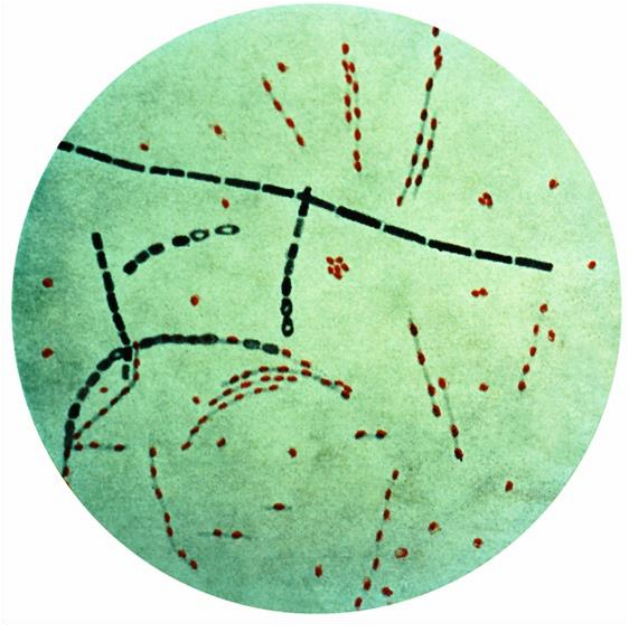
History of Microbiology

- Robert Koch (German; 1843 – 1910)
- The founder of modern Bacteriology.
- Widely known for his work with anthrax.

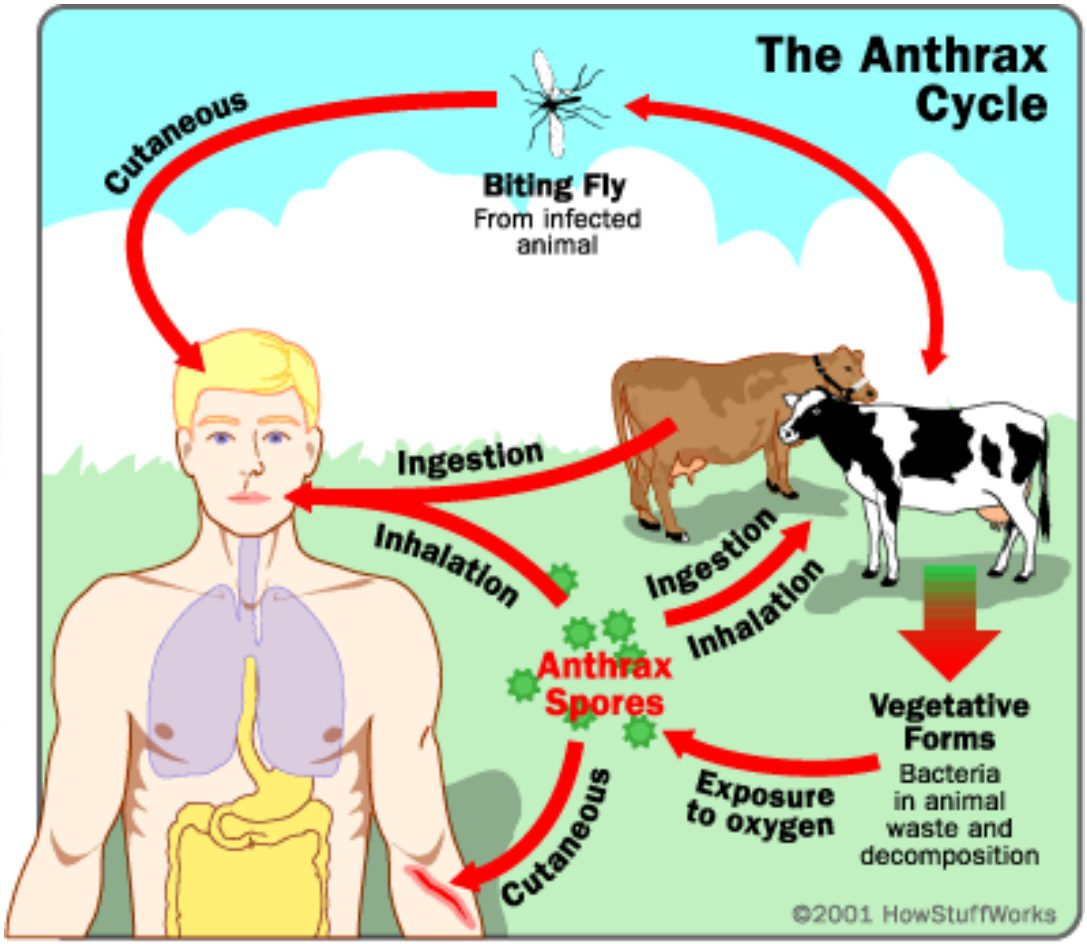


- Discovered that the causative agent of the fatal disease to be *Bacillus anthracis*.
- Development of pure culture technique.
- Conducted research in Egypt on cholera.
- Won Nobel Prize in 1905.

History of Microbiology



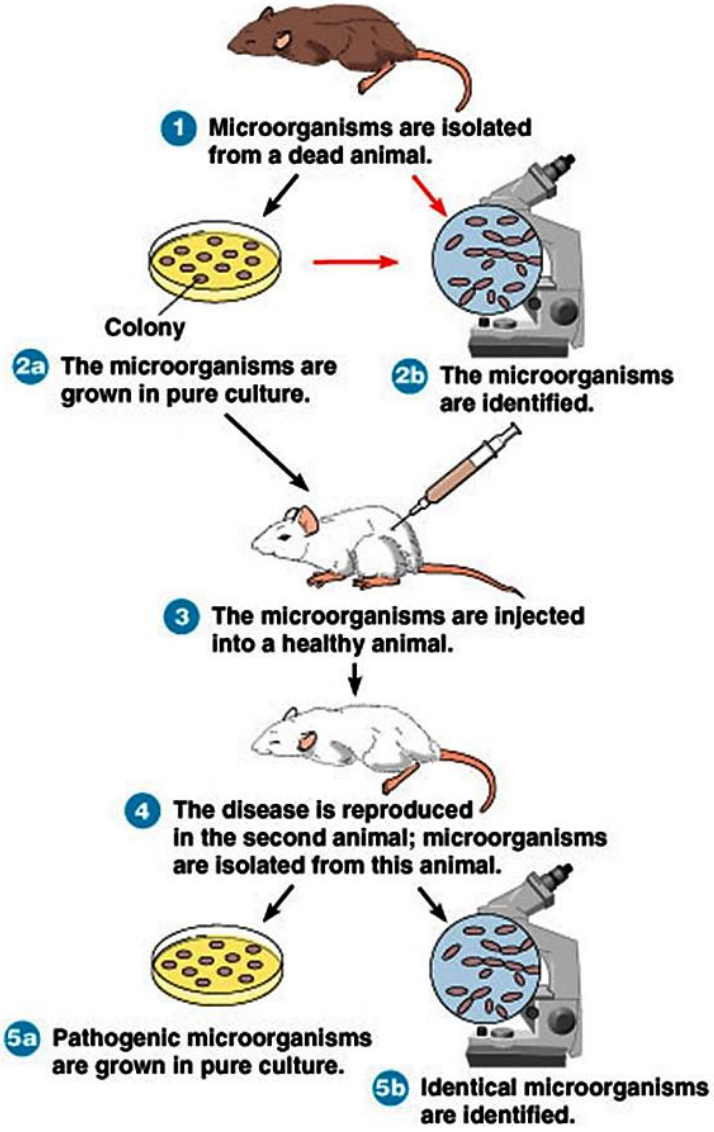
Bacillus anthracis from an agar culture



Koch's Postulates

- Proof of Etiology of Infectious Diseases
- The same pathogen must be present in every case of the disease.
- The pathogen must be isolated from the diseased host and grown in pure culture.
- The pathogen from the pure culture must cause the disease when it is inoculated into a healthy and susceptible lab animal.
- Pathogen isolated from inoculated animal must be as original microbe.

Koch's Postulates

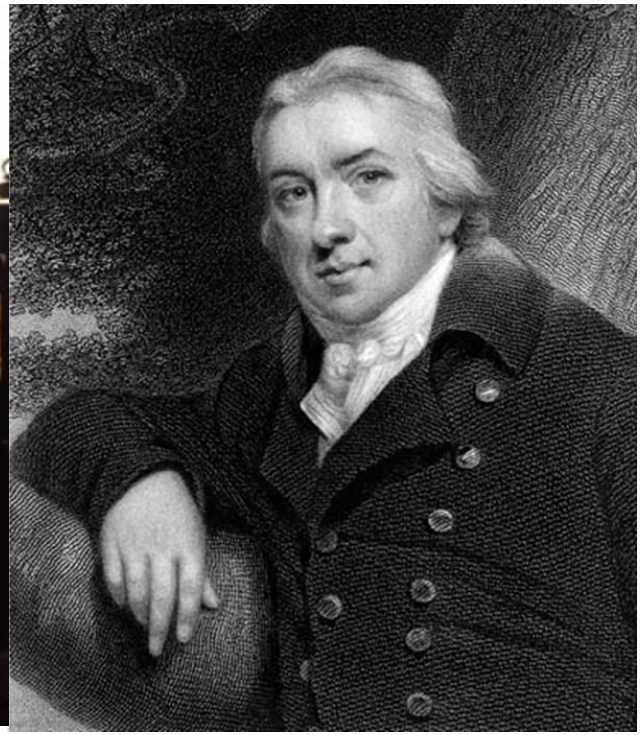


Exceptions to Koch's Postulates

- Why the modification of Koch's postulates was necessary?
- To establish disease etiology for organisms that cannot be grown on artificial media.
- Some diseases, *e.g.* *pneumonia* may be caused by various microbes.
- Some pathogens, such as *Streptococcus pyogenes*, cause several different diseases.
- Certain pathogens, such as HIV, cause disease in humans only.

History of Microbiology

- Edward Jenner (British; 1749 – 1823)
- The birth of vaccination (1796) before the golden age period (smallpox vaccination).



History of Microbiology

- In May 1796 a dairymaid (Sarah) consulted Jenner about a rash on her hand.
- He diagnosed her with cowpox rather than smallpox.
- She confirmed that one of her cows (Blossom) had recently cowpox.

- Cowpox is a mild viral infection of cows that causes a few weeping spots on their udders.

History of Microbiology

- Jenner tested the protective properties of cowpox.
- He gave it to someone who had not yet suffered smallpox.
- He made a few scratches on a boy's arm (James, 8 years, son of his gardener).
- He rubbed into them some material from one of the pocks on lady's hand.
- A few days later the boy became mildly ill with cowpox but recovered a week later.

History of Microbiology

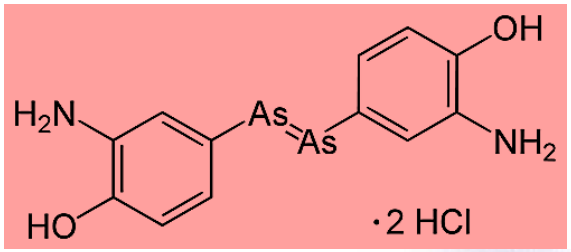
- Jenner recognized that cowpox could pass from person to person as well as from cow to person.
- Cowpox is a skin disease caused by a virus known as the *cowpox virus*.
- The next step was to test whether the cowpox would now protect the boy from smallpox.

History of Microbiology

- As Jenner anticipated, and undoubtedly to his great relief, James did not develop smallpox, either on this occasion or on the many subsequent ones when his immunity was tested again.
- Jenner followed up this experiment with many others.
- Around 100 years later, Pasteur showed how vaccinations work.
- Children are now vaccinated nationwide.

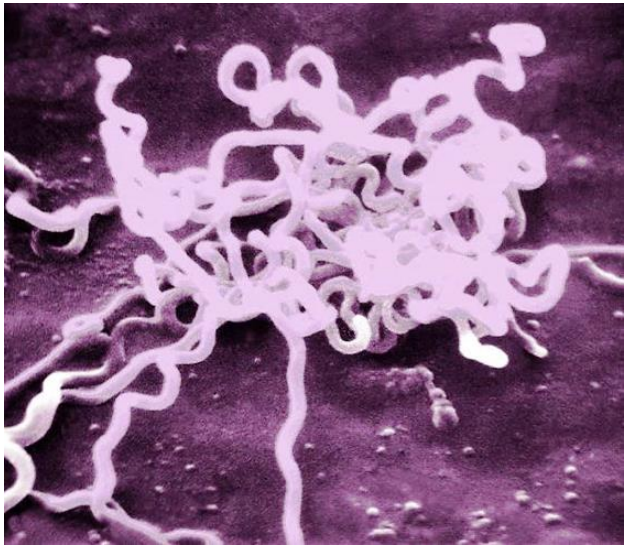
History of Microbiology

- Paul Ehrlich (German; 1854 – 1915)
- The Birth of Modern Chemotherapy.
- In 1910, he developed a synthetic arsenic drug, salvarsan or arsphenamine, to treat syphilis.



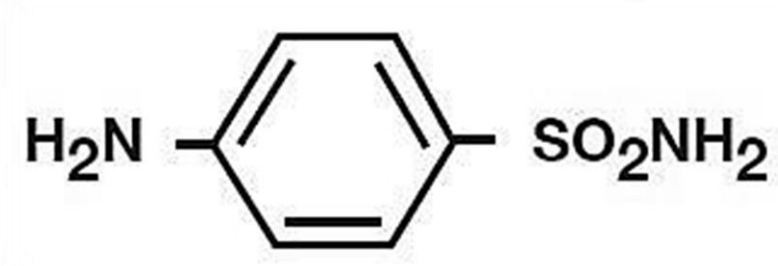
History of Microbiology

- Syphilis is a sexually transmitted infection.
- Caused by the spirochete bacterium *Treponema pallidum*.
- The primary route of transmission is through sexual contact.
- Also, it could be transmitted from mother to fetus during pregnancy or at birth, resulting in congenital syphilis.



History of Microbiology

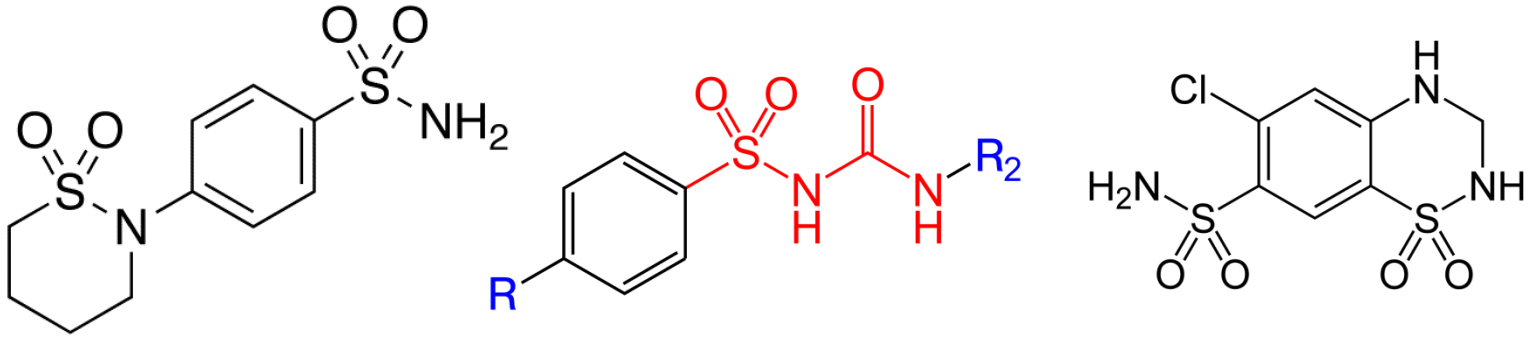
- Gerhard Domagk (German; 1895 – 1964)
- He introduced sulfa drugs (sulfonamides) in 1935.



- Sulpha drugs are synthetic antimicrobial agents that contain the sulfonamide group.
- It is first commercially available antibiotic that provided the first successful therapies for many bacterial diseases.

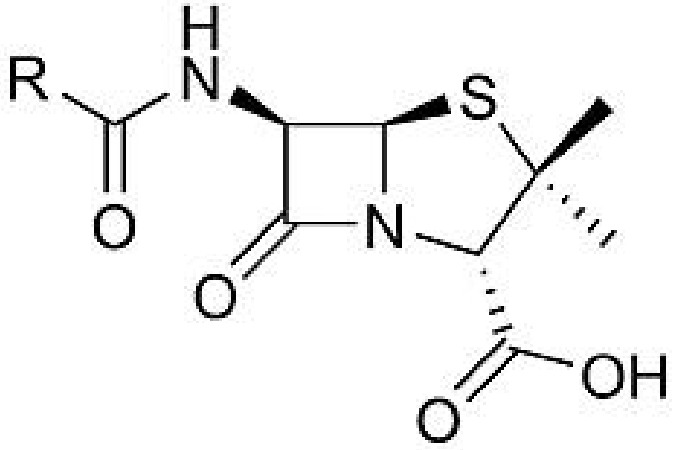
History of Microbiology

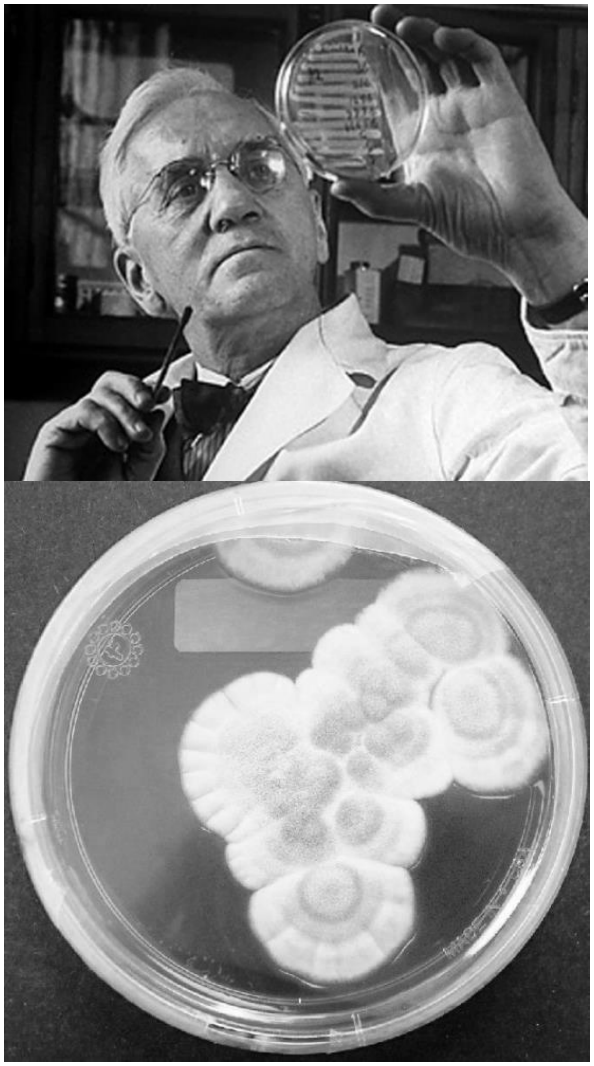
- Some sulfonamides are also devoid of antibacterial activity.
- Examples of sulfonamides:
- The anticonvulsant sultiame.
- The sulfonylureas.
- Thiazide diuretics are newer drug groups based on the antibacterial sulfonamides.



History of Microbiology

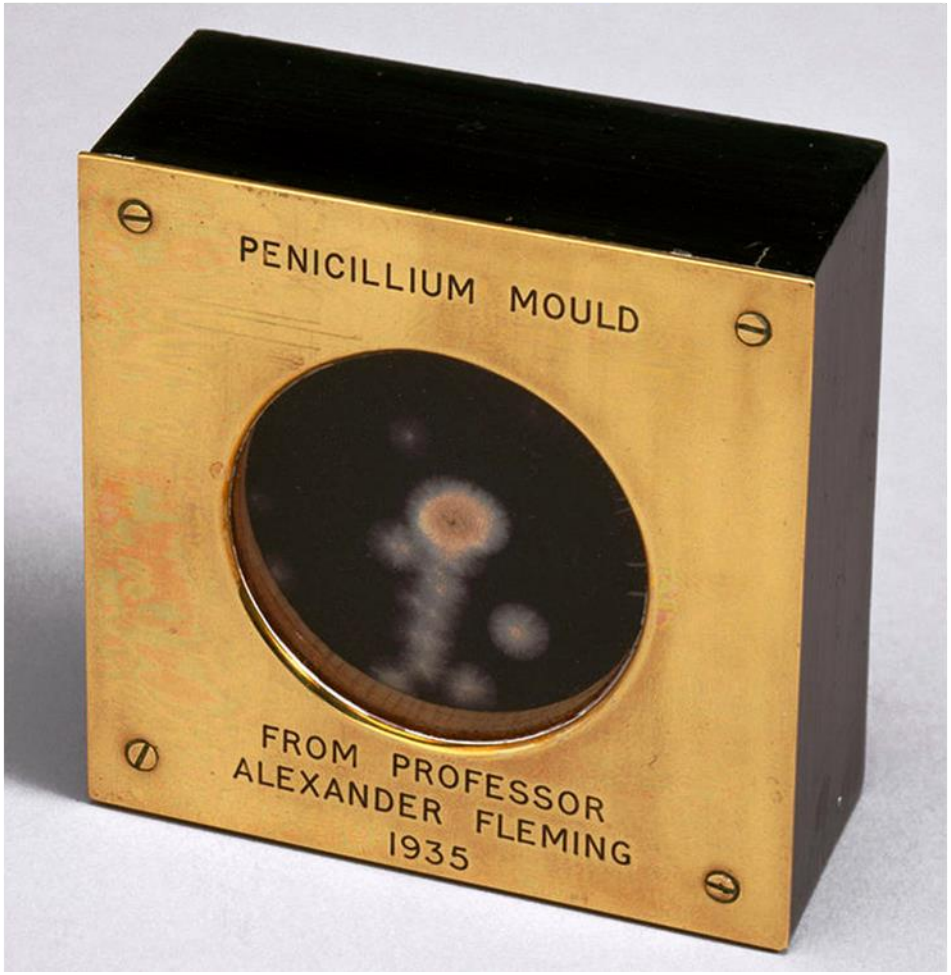
- Alexander Fleming (Scottish; 1881 – 1955)
- The discovery of the first antibiotic (Penicillin, fungus) by accident in 1928.





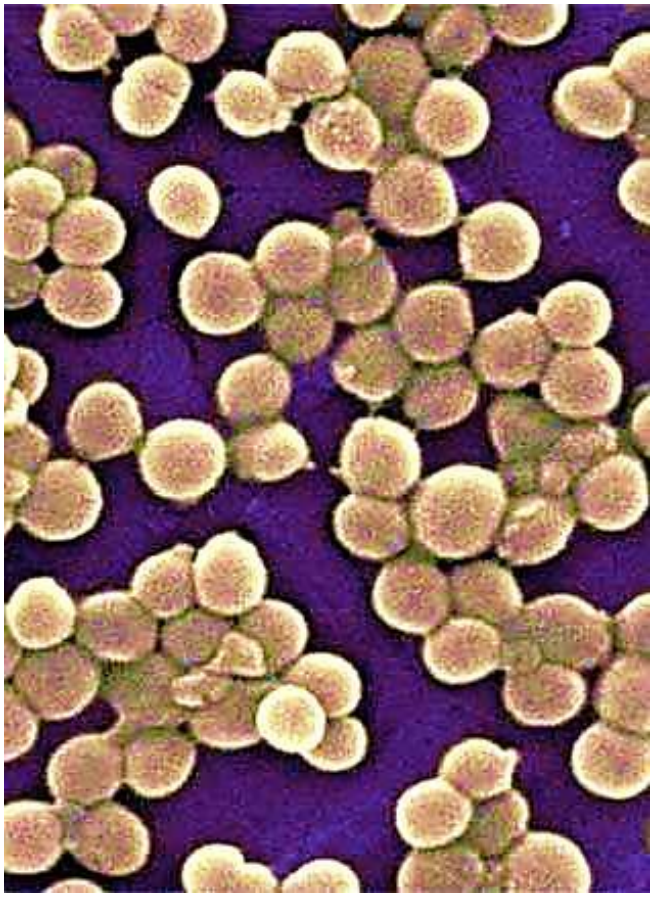
History of Microbiology

Sample of penicillium mould presented by Alexander Fleming, 1935



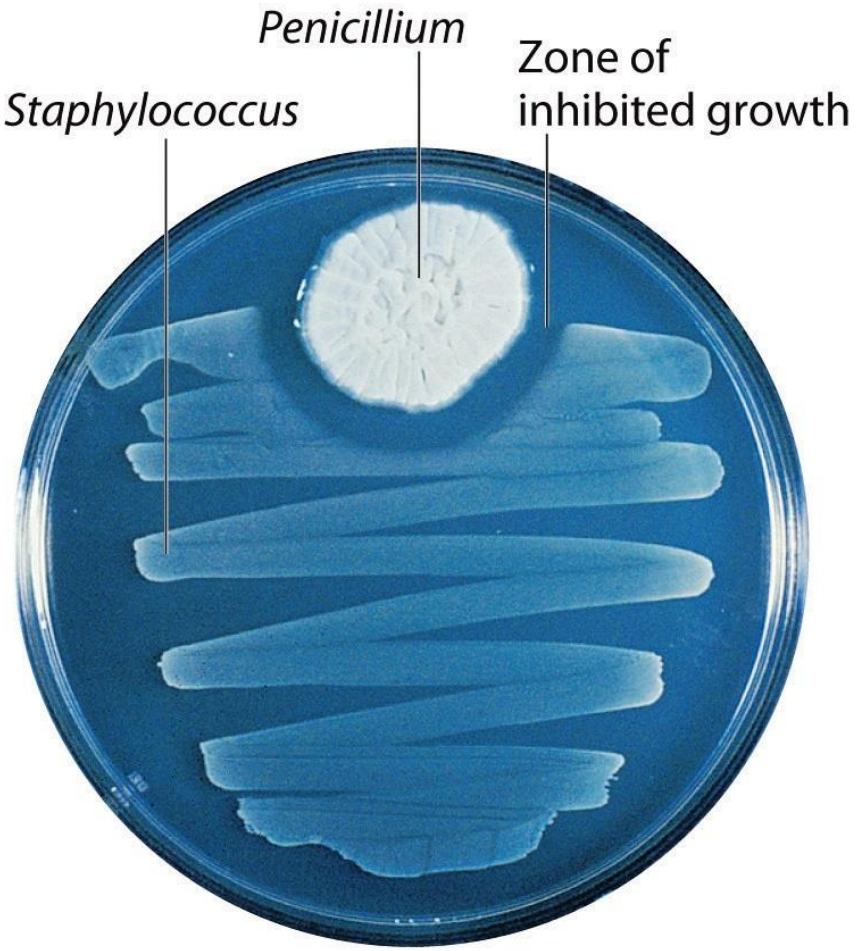
History of Microbiology

- Fleming was convinced that nasal mucus had antibacterial effects.
- Left his *Staphylococcus* (a genus of Gram-positive bacteria) culture on an agar plate for 2 weeks.
- He found mold on his plate which prevented bacterial growth.



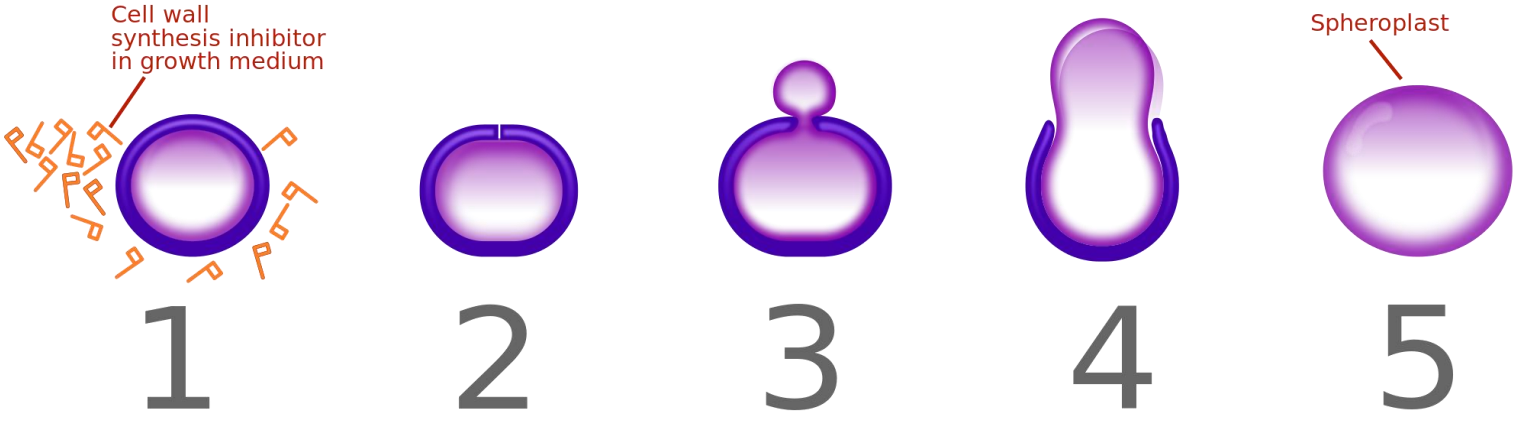
History of Microbiology

- Penicillin is widely used antibiotic agents, derived from the Penicillium mould.
- Penicillin purification and clinical trials were not known until 1940s.



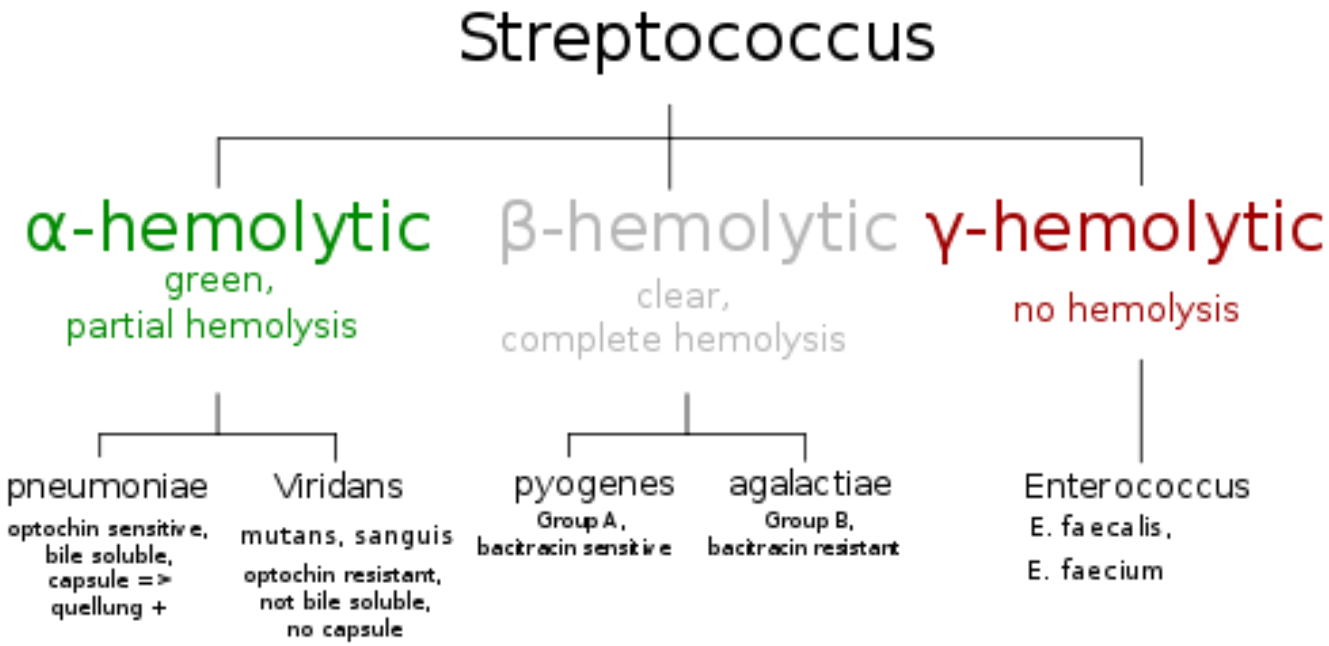
History of Microbiology

- Bacteria that attempt to grow and divide in the presence of penicillin fail to do so (*i.e.* inhibition of bacterial growth).
- The bacteria end up shedding their cell walls.



History of Microbiology

- Rebecca Lancefield (American; 1895 – 1981)
- She developed a system to classify the bacteria *Streptococcus.*



History of Microbiology

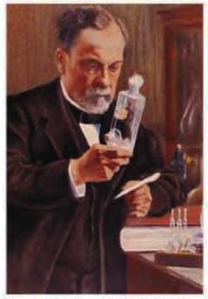
1665 Hooke—First observation of cells
1673 van Leeuwenhoek—First observation of live microorganisms
1735 Linnaeus—Nomenclature for organisms
1798 Jenner—First vaccine
1835 Bassi—Silkworm fungus
1840 Semmelweis—Childbirth fever
1853 DeBary—Fungal plant disease

1857 Pasteur—Fermentation
1861 Pasteur—Disproved spontaneous generation
1864 Pasteur—Pasteurization
1867 Lister—Aseptic surgery
1876 *Koch—Germ theory of disease
1879 Neisser—*Neisseria gonorrhoeae*
1881 *Koch—Pure cultures
Finley—Yellow fever
1882 *Koch—*Mycobacterium tuberculosis*
Hess—Agar (solid) media
1883 *Koch—*Vibrio cholerae*
1884 *Metchnikoff—Phagocytosis
Gram—Gram-staining procedure
Escherich—*Escherichia coli*
1887 Petri—Petri dish
1889 Kitasato—*Clostridium tetani*
1890 *von Behring—Diphtheria antitoxin
*Ehrlich—Theory of immunity
1892 Winogradsky—Sulfur cycle
1898 Shiga—*Shigella dysenteriae*
1908 *Ehrlich—Syphilis
1910 Chagas—*Trypanosoma cruzi*
1911 * Rous—Tumor-causing virus (1966 Nobel Prize)

GOLDEN AGE OF MICROBIOLOGY

1928 *Fleming, Chain, Florey—Penicillin
Griffith—Transformation in bacteria
1934 Lancefield—Streptococcal antigens
1935 *Stanley, Northrup, Sumner—Crystallized virus
1941 Beadle and Tatum—Relationship between genes and enzymes
1943 *Delbrück and Luria—Viral infection of bacteria
1944 Avery, MacLeod, McCarty—Genetic material is DNA
1946 Lederberg and Tatum—Bacterial conjugation
1953 *Watson and Crick—DNA structure
1957 *Jacob and Monod—Protein synthesis regulation
1959 Stewart—Viral cause of human cancer
1962 *Edelman and Porter—Antibodies
1964 Epstein, Achong, Barr—Epstein-Barr virus as cause of human cancer
1971 *Nathans, Smith, Arber—Restriction enzymes (used for recombinant DNA technology)
1973 Berg, Boyer, Cohen—Genetic engineering
1975 Dulbecco, Temin, Baltimore—Reverse transcriptase
1978 Woese—Archaea
*Mitchell—Chemiosmotic mechanism
1981 Margulis—Origin of eukaryotic cells
1982 *Klug—Structure of tobacco mosaic virus
1983 *McClintock—Transposons

1988 *Deisenhofer, Huber, Michel—Bacterial photosynthesis pigments
1994 Cano—Reported to have cultured 40-million-year-old bacteria
1997 *Prusiner—Prions



Louis Pasteur (1822–1895)
Demonstrated that life did not arise spontaneously from nonliving matter.

Robert Koch (1843–1910)
Established experimental steps for directly linking a specific microbe to a specific disease.

Rebecca C. Lancefield (1895–1981)
Classified streptococci according to serotypes (variants within a species)