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A Brief History of Microbiology

The First Observations

1. Robert Hooke observed that cork was composed of (little boxes) he introduced the term cell (1665).
2. Hooke's observations laid the groundwork for development of the cell theory, the concept that all living things are composed of cells.
3. Anton van Leeuwenhoek, using a simple microscope, was the first to observe microorganisms (1673).

The Debate over Spontaneous Generation

4. Until the mid-1880s, many people believed in spontaneous generation, the idea that living organisms could arise from nonliving matter.
5. Francesco Redi demonstrated that maggots appear on decaying meat only when flies are able to lay eggs on the meat (1668).
6. John Needham claimed that microorganisms could arise spontaneously from heated nutrient broth (1745).
7. Lazzaro Spallanzani repeated Needham's experiments and suggested that Needham's results were due to microorganisms in the air entering his broth (1765).
8. Rudolf Virchow introduced the concept of biogenesis: living cells can arise only from preexisting cells (1858).
9. Louis Pasteur demonstrated that microorganisms are in the air everywhere and offered proof of biogenesis (1861).
10. Pasteur's discoveries led to the development of aseptic techniques used in laboratory and medical procedures to prevent contamination by microorganisms.

The Golden Age of Microbiology

- II. The science of microbiology advanced rapidly between 1857 and 1914.

Fermentation and Pasteurization

12. Pasteur found that yeast ferment sugars to alcohol and that bacteria can oxidize the alcohol to acetic acid.

13. A heating process called pasteurization is used to kill bacteria in some alcoholic beverages and milk.

The Germ Theory of Disease

14. Agostino Bassi (1835) and Pasteur (1865) showed a causal relationship between microorganisms and disease.

15. Joseph Lister introduced the use of a disinfectant to decontaminate surgical wounds in order to control infections in humans (1860s).

16. Robert Koch proved that microorganisms cause disease. He used a sequence of procedures, now called Koch's postulates (1876), that are used today to prove that a particular microorganism causes a particular disease.

Vaccination

17. In a vaccination, immunity (resistance to a particular disease) is conferred by inoculation with a vaccine.

18. In 1798, Edward Jenner demonstrated that inoculation with cowpox material provides humans with immunity to smallpox.

19. About 1880, Pasteur discovered that avirulent bacteria could be used as a vaccine for fowl cholera; he coined the word *vaccine*.

20. Modern vaccines are prepared from living avirulent microorganisms or killed pathogens, from isolated components of pathogens, and by recombinant DNA techniques.

The Birth of Modern Chemotherapy: Dreams of a "Magic Bullet"

21. Chemotherapy is the chemical treatment of a disease.

22. Two types of chemotherapeutic agents are synthetic drugs (chemically prepared in the laboratory) and antibiotics (substances produced naturally by bacteria and fungi to inhibit the growth of other microorganisms).

23. Paul Ehrlich introduced an arsenic-containing chemical called salvarsan to treat syphilis (1910).

24. Alexander Fleming observed that the *Penicillium* fungus inhibited the growth of a bacterial culture. He named the active ingredient penicillin (1928).

25. Penicillin has been used clinically as an antibiotic since the 1940s.

26. Researchers are tackling the problem of drug-resistant microbes.

Modern Developments in Microbiology

27. Bacteriology is the study of bacteria, mycology is the study of fungi, and parasitology is the study of parasitic protozoa and worms.
28. Microbiologists are using genomics, the study of all of an organism's genes, to classify bacteria, fungi, and protozoa.
29. The study of AIDS, analysis of the action of interferons, and the development of new vaccines are among the current research interests in immunology.
30. New techniques in molecular biology and electron microscopy have provided tools for advancing our knowledge of virology.
31. The development of recombinant DNA technology has helped advance all areas of microbiology.

Microbes and Human Welfare

1. Microorganisms degrade dead plants and animals and recycle chemical elements to be used by living plants and animals.
2. Bacteria are used to decompose organic matter in sewage.
3. Bioremediation processes use bacteria to clean up toxic wastes.
4. Bacteria that cause diseases in insects are being used as biological controls of insect pests. Biological controls are specific for the pest and do not harm the environment.
5. Using microbes to make products such as foods and chemicals is called biotechnology.
6. Using recombinant DNA, bacteria can produce important substances such as proteins, vaccines, and enzymes.
7. In gene therapy, viruses are used to carry replacements for defective or missing genes into human cells.
8. Genetically modified bacteria are used in agriculture to protect plants from frost and insects and to improve the shelf life of produce.

Microbes and Human Disease

1. Everyone has microorganisms in and on the body; these make up the normal microbiota, or flora.
2. The disease-producing properties of a species of microbe and the host's resistance are important factors in determining whether a person will contract a disease.
3. Bacterial communities that form slimy layers on surfaces are called biofilms.
4. An infectious disease is one in which pathogens invade a susceptible host.
5. An emerging infectious disease (EID) is a new or changing disease showing an increase in incidence in the recent past or a potential to increase in the near future.

Q1/ How did the idea of spontaneous generation come about?

Q2/ Match the people in column A to their contribution toward the advancement of microbiology, in column B.

Column A

- a . Avery, Macleod, and McCarty
- b. Beadle and Ta tum
- c. Berg
- d. Ehrlich
- e. Fleming
- f. Hooke
- g. Iwanowski
- h. Jacob and Monod
- i. Jenner
- j. Koch , lancefield
- l. Lederberg and Tatum
- m. Lister
- n. Pasteur
- o. Stanley
- p.vanLeeuwenhoek
- q. Virchow
- r. Weizmann

Column B

- 1. Developed vaccine against smallpox
- 2. Discovered how DNA controls protein synthesis in a cell
- 3. Discovered penicillin
- 4. Discovered that DNA can be transferred from one bacterium to another
- 5. Disproved spontaneous generation
- 6. First to characterize a virus
- 7. First to use disinfectants in surgical procedures
- 8. First to observe bacteria
- 9. First to observe cells in plant material and name them
- 10. Observed that viruses are filterable
- 11. Proved that DNA is the hereditary materia l
- 12. Proved that microorganisms can cause disease
- 13. Said living cells arise from preexisting living cells
- 14. Showed that genes code for enzymes
- 15. Spliced animal DNA to bacterial DNA
- 16. Used bacteria to produce acetone
- 17. Used the first synthetic

chemotherapeutic agent

18. Proposed a classification system for streptococci based on antigens in their cell walls

References:1- Microbiology an introduction TWELFTH EDITION. Gerard. Tortora 2016.

2- Microbiology an introduction TENTH EDITION. Gerard. Tortora.2010.