



Microbiology

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INTRODUCTION

Microbiology is the study of organisms that are visible only with a microscope.

HISTORY OF MICROBIOLOGY

- Robert Hooke:** first describing cells in 1665 when he used a microscope to observe a block of cork.
- Anton van Leeuwenhoek:** discovered microscopes, the terms in objects of pond water and animal teeth. In 1683, he dubbed these organisms "animalcules."
- Louis Pasteur:**
 - identified microorganisms as the cause of alcohol fermentation and lactic acid products.
 - disproved the theory of spontaneous generation—the idea that organisms may arise from inanimate matter, such as beef broth.
 - proposed the **germ theory of disease**, which states that microorganisms cause infectious diseases.

- Developed germ theory and vaccines.
- Robert Koch:** proved Pasteur's germ theory of disease through experimentation with anthrax in its incubator and growth in Koch's postulates.

- The same microorganisms are observed in every case of the disease.
- The microorganisms are isolated and cultured outside the body of the sick animal.
- The microorganism is injected into a healthy animal of the same species, causing the same disease.
- An identical microorganism is isolated from the newly sick animal.

KOCH'S POSTULATES



THE CELL THEORY

Every living organism is made up of cells, which are the lowest level of structural capacity of performing all the activities of life. All cells arise from preexisting cells.

PROKARYOTIC VS. EUKARYOTIC MICROORGANISMS

Several cell components exist in all types of cells.

- Cell membrane:** serves as an external barrier and encloses organelles.
- The basic unit is a **phospholipid molecule**, with a polar phosphate group as its hydrophilic head and two non-polar fatty acid chains as hydrophobic tails.
- Individual phospholipids form a fluid **phospholipid bilayer**, with hydrophilic heads facing out, and hydrophobic tails facing in to form a aqueous zone that separates the watery cell interior from the extracellular environment.
- Cell membranes** are **semipermeable**, allowing passage of gases, liquids, and small polar molecules. Cell membranes are not permeable to charged molecules ions and proteins and large polar molecules.
- Membrane proteins:** protein molecules embedded in the bilayer transport molecules unable to cross the membrane independently, assist in biologically important reactions, and interact with molecules of neighboring cells.
- Cytoplasm:** a semifluid medium (called **cytosol**) and all the organelles inside the plasma membrane but outside the nucleus.
- Cytoskeleton:** system of protein filaments in the cytoplasm

including **microtubules** and **microfilaments** that gives the cell shape and helps direct movement.

- Ribosomes:** proteins that work with RNA to synthesize polypeptides.

PROKARYOTES

The simplest unicellular organisms and the earliest cells to evolve. **Characteristics** that make differences from eukaryotes include:

- Genetic material floats in the cytoplasm in a concentrated but unenclosed region called the **nucleoid**.
- No membrane-bound organelles.



EUKARYOTES

Found in multicellular organisms and multicellular plants and animals, contain membrane-bound organelles, each of which performs a specific function and increases efficiency.



CELL MEMBRANE



PLANT CELL



ANIMAL CELL

METABOLISM

CELLULAR RESPIRATION

Cellular process of oxidizing glucose or food molecules to obtain energy in the form of **adenosine triphosphate (ATP)**.

GLYCOLYSIS

The oldest metabolic pathway, used by all cells, and a precursor to both the aerobic and anaerobic respiratory pathways. Glycolysis occurs in the cytoplasm. The six-carbon sugar glucose is degraded to form two molecules of three-carbon pyruvate, resulting in two NADH and two net ATP.

FERMENTATION

In the absence of oxygen, respiration relies on glucose to produce ATP. This **anaerobic** process uses an organic molecule to accept the electrons from NADH and reform NADH for glycolysis to run again. Much energy is released in by-products, such as ethanol or lactic acid. Three types of fermentation exist:

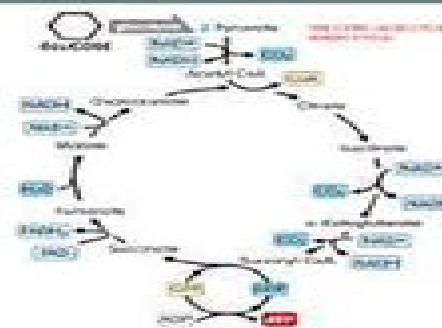
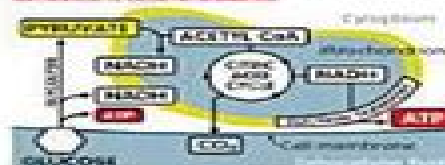
- Homolactic:** bacteria convert pyruvate to lactic acid.
- Alcoholic:** yeast and bacteria convert pyruvate into ethanol and CO₂.
- Heterolactic:** organisms produce lactic acid as well as other acids and alcohols.

OXIDATIVE RESPIRATION

If oxygen is present, glycolysis leads to **aerobic** respiration, which produces a net total of 38 ATP per molecule of glucose.

- Collection of pyruvate:** carbon dioxide enters cell from pyruvate to produce acetyl-CoA and NADH.
- Citric acid cycle (Krebs cycle):** begins with acetyl-CoA joining oxaloacetic acid to form citric acid, which is oxidized to CO₂, yielding ATP, NADH, and FADH. Oxaloacetic acid is regenerated for another cycle. Occurs in the mitochondria of eukaryotes and the cytoplasm of aerobic prokaryotes.

AN OVERVIEW OF CELLULAR RESPIRATION



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Lingjun Ying

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Bonazzoli,2010-01-21 **Brief Lessons in Microbiology** Mario Juhas,2023-04-29 Recent discoveries in microbiology are hard to grasp for those unfamiliar with scientific jargon and the research data can be overwhelming even for those working in other scientific fields This book aims to remedy this situation by presenting the most interesting findings and current trends in microbiology in an easy to read and understandable format The first part tells the story of the beginnings of microbiology itself and introduces the reader to the founders of this fascinating research discipline The second part focuses on communication between microorganisms and how they organize themselves into fascinating microbial cities called biofilms The reader also learns how bacteria exchange genetic material mechanisms that are the root of the emergence of multidrug resistant superbugs pathogens that pose a major burden to human health and our healthcare systems The third part is devoted to the latest techniques being used by scientists to study control and manipulate microorganisms for our benefit The final part links the first three parts together and highlights how infectious diseases including coronaviruses can be transmitted from animals to humans how global warming is affecting emerging diseases and provides information on the actions that need to be taken to get ahead of pathogenic microbes and future pandemics This comprehensive state of the art book is intended for anyone interested in microbiology and epidemiology from biology and biomedical students in schools and colleges to patients suffering from infectious diseases who want to learn more about their condition The concepts covered in this book contribute to UN Sustainable Development Goal 3 Health and Well Being **Microbiology** BarCharts, Inc,2016-11 This reference answers the most important questions that form the foundation of Microbiology within 6 laminated pages Carry this core material in a handy format to use beyond the course and into higher level and career courses then even further into your working life as a refresher With many diagrams in a small package you will not need to crack the textbook to review Suggested uses o Students especially relevant for those majoring in science or a health care related field o Quick Reference instead of digging into the textbook to find a core answer you need while studying use the guide to reinforce quickly and repeatedly o Memory refreshing your memory repeatedly is a foundation of studying have the core answers handy so you can focus on understanding the concepts o Test Prep no student should be cramming but if you are there is no better tool for that final review **Microbiology with Diseases by Taxonomy, Books a la Carte Edition** Robert W. Bauman,2016-01-05 NOTE This edition features the same content as the traditional text in a convenient three hole punched loose leaf version Books a la Carte also offer a great value this format costs significantly less than a new textbook Before purchasing check with your instructor or review your course syllabus to ensure that you select the correct ISBN Several versions of Pearson's MyLab Mastering products exist for each title including customized versions for individual schools and registrations are not transferable In addition you may need a Course ID provided by your instructor to register for and use Pearson's MyLab Mastering products For courses in introductory microbiology Invest in your future Microbiology Matters Known for its unique and effective art program conversational writing style and author created Video Tutors the Fifth Edition

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Table of Contents Microbiology Sparkcharts

1. Understanding the eBook Microbiology Sparkcharts
 - The Rise of Digital Reading Microbiology Sparkcharts
 - Advantages of eBooks Over Traditional Books
2. Identifying Microbiology Sparkcharts
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Microbiology Sparkcharts
 - User-Friendly Interface
4. Exploring eBook Recommendations from Microbiology Sparkcharts
 - Personalized Recommendations
 - Microbiology Sparkcharts User Reviews and Ratings
 - Microbiology Sparkcharts and Bestseller Lists
5. Accessing Microbiology Sparkcharts Free and Paid eBooks
 - Microbiology Sparkcharts Public Domain eBooks
 - Microbiology Sparkcharts eBook Subscription Services
 - Microbiology Sparkcharts Budget-Friendly Options

6. Navigating Microbiology Sparkcharts eBook Formats
 - ePub, PDF, MOBI, and More
 - Microbiology Sparkcharts Compatibility with Devices
 - Microbiology Sparkcharts Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Microbiology Sparkcharts
 - Highlighting and Note-Taking Microbiology Sparkcharts
 - Interactive Elements Microbiology Sparkcharts
8. Staying Engaged with Microbiology Sparkcharts
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Microbiology Sparkcharts
9. Balancing eBooks and Physical Books Microbiology Sparkcharts
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Microbiology Sparkcharts
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Microbiology Sparkcharts
 - Setting Reading Goals Microbiology Sparkcharts
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Microbiology Sparkcharts
 - Fact-Checking eBook Content of Microbiology Sparkcharts
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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