

<i><b>PRINCIPLES OF MICROBIOLOGY</b></i> TOPIC	S	A	B	C	K	D
<u><i><b>AN OVERVIEW OF MICROBIOLOGY</b></i></u>						
Microorganisms as CELLS						
Life is a Rare Event						
Cells as CHEMICAL Machines						
Cells as CODING Devices						
Evolutionary Relationships						
Populations, Communities, and Ecosystems						
Impact of microorganisms on humans						
Overview of prokaryotic and eukaryotic cell structure, viruses						
Evolutionary relationships among living organisms						
Physiological diversity of microorganisms						
Prokaryotic Diversity - <i><b>Bacteria</b></i> - <i>Proteobacteria</i>						
- Gram-positive Bacteria						
- Cyanobacteria						
- Planctomyces & Spirochetes						
- Green Sulfur & Green Nonsulfur bacteria						
- Chlamydia & Deinococcus						
- <i>Aquifex</i> & <i>Thermatoga</i>						
Prokaryotic Diversity - <i><b>Archaea</b></i> - hyperthermophiles						
- methanogens, extreme halophiles, acidophiles						
- physiological diversity						
Eukaryotic Microorganisms - algae, fungi, protozoa, lichens						

<i><b>PRINCIPLES OF MICROBIOLOGY TOPIC</b></i>	S	A	B	C	K	D
<i><b><u>ORGANIZATION &amp; STRUCTURE OF MICROORGANISMS</u></b></i>						
Prokaryotes / Eukaryotes						
Size and Shape of Bacteria						
Staining						
Cytoplasmic Membrane of Bacteria - phospholipid bilayer						
Cytoplasmic Membrane of Archaea - phytanyl monolayer						
Membrane Proteins						
Lipoteichoic Acids, Wall Teichoic Acids						
Diffusion and Osmosis						
Solute Transport						
Transport Proteins						
Facilitated diffusion						
Group Translocation						
Active Transport: Lac Permease and "ABC" systems						
Other Membrane Functions - biosynthesis, secretion (protein export), energy						
<b>CELL WALL - Gram Positive</b>						
Peptidoglycan <u>Structure</u>						
Cell walls of <i>Archaea</i>						
<b>CELL WALL - Gram Negative</b>						
Lipopolysaccharide						
Wall-less Bacteria						
Flagella - structure and arrangement						
Flagella and locomotion						
Axial filaments						
Swarming						
Gliding Motility						
chemotaxis, general features						



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<u><i><b>NUTRITION AND METABOLISM</b></i></u>						
Catabolism / Anabolism						
Modes of obtaining <b>Energy</b>						
Modes of obtaining <b>Carbon</b>						
Microbial NUTRITION						
MACRONutrients						
MICRONutrients						
Laboratory Cultivation of Microorganisms - culture media						
Laboratory Cultivation of Microorganisms - environmental factors						
Sterilization, Aseptic Technique						
Pure Culture Concept						
bioenergetics: laws of thermodynamics						
catalysis in biological systems: enzymes						
prosthetic groups and coenzymes						
oxidation/reduction reactions; reduction potentials						
electron tower						
electron carriers						
high energy compounds; ATP						
energy release in biological systems						
fermentation: glycolysis						
allostery						
recovery of NAD						
fermentation: Entner-Doudoroff pathway						
fermentation: pentose phosphate pathway						
fermentation: phosphoketolase pathway						
products of pyruvate metabolism: ethanolic fermentation						
products of pyruvate metabolism: homolactic fermentation						
products of pyruvate metabolism: heterolactic fermentation						
products of pyruvate metabolism: propionic acid fermentation						

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<i><b>NUTRITION AND METABOLISM</b></i> (continued)						
products of pyruvate metabolism: mixed acid fermentation						
products of pyruvate metabolism: butanediol fermentation						
products of pyruvate metabolism: butanol fermentation						
mixed amino acid fermentation						
methanogens and biological production of methane gas						
respiration: TCA cycle						
respiration: electron transport chain						
respiration: generation of proton motive force						
respiration: ATP generation						
uncouplers of electron-transport phosphorylation						
anaerobic respiration						
dissimilative metabolism and denitrification						
assimilative metabolism						
<b>grouping</b> organisms based on interaction with molecular oxygen						
oxygen and <b>aerobic</b> bacteria; <u>divalent reduction</u> of oxygen						
oxygen and <b>aerobic</b> bacteria; <u>univalent reduction</u> of oxygen						
distribution of catalase and superoxide dismutase						
facultative aerobes						
oxygen and <b>anaerobic</b> bacteria						
chemolithotrophy: generation of <b>reducing</b> power						
chemolithotrophy: obtaining <b>energy</b>						
hydrogen oxidizing bacteria						
sulfur, iron, and nitrogen oxidations						
iron-oxidizing bacteria						
nitrification						
photosynthesis: light and dark reactions						
chlorophylls						
photosynthetic membranes in eukaryotes and prokaryotes						



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<b><i><u>MICROBIAL GROWTH</u></i></b>						
Regulation of DNA synthesis and Cell Division in bacteria						
Fts Proteins and the Cell Division Plane						
Cell Shape and Actin in Prokaryotes						
Modes of bacterial reproduction / binary fission, budding, hyphae						
Peptidoglycan <u>Synthesis</u>						
Population Growth / growth rate, generation time						
Exponential growth						
balanced growth						
mathematics of exponential growth						
growth curve / phases						
Enumeration of bacteria / direct counts, viable counts, cell mass, plating, cell mass, turbidimetric, MPN						
batch culture / growth yields / nutrient concentration						
continuous culture / chemostat						
cardinal temperatures						
classification based on temperature / habitats						
psychrophiles / facultative psychrophiles / freezing						
thermophiles /hyperthermophiles						
molecular adaptations to thermophilia / biotechnology						
ecology of thermophiles						
acidity and alkalinity (pH) / buffering, acidophiles						
water availability / activity of water / movement in biological sys.						
halophiles / osmophiles / xerophiles						
compatible solutes						
Oxygen: categories						
Oxygen: growth methods						
Oxygen: toxic forms of						

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<b><u>CONTROL OF MICROBIAL GROWTH</u></b>						
<b>Heat</b> Control of Microorganisms: characterization of heat inactivation						
<b>Heat</b> Control of Microorganisms: methods						
<b>Irradiation</b> Control of Microorganisms						
<b>Filtration</b> Control of Microorganisms						
<b>Chemical</b> Control of Microorganisms						
Measuring Antimicrobial Activity						
Disinfectants / Antiseptics						
Food Spoilage						
Food Preservation - <b>Reduced Temperature</b>						
Food Preservation - pH						
Food Preservation - <b>Reduced Water Activity</b>						
Food Preservation - <b>Canning</b>						
Food Preservation - <b>Chemical</b>						
Chemotherapeutic Agents - <b>Growth Factor Analogues</b>						
Chemotherapeutic Agents - <b>Antibiotics</b>						
Chemotherapeutic Agents - <b>β-Lactam Antibiotics</b>						
Chemotherapeutic Agents - <b>Antibiotics from Prokaryotes</b>						
Antibiotic Resistance						

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<b><i>MICROBIAL MOLECULAR BIOLOGY</i></b>						
Information flow: gene to protein						
Overview: replication, transcription, translation, regulation						
gene structure in prokaryotes and eukaryotes						
DNA structure						
base pairing						
secondary structure of DNA						
melting of double-stranded DNA						
hybridization of nucleic acids						
supercoiling of DNA - topoisomerases						
genetic elements: prokaryotic and eukaryotic chromosomes						
nonchromosomal genetic elements: viruses, plasmids, mito/chloro						
transposable genetic elements						
DNA replication: origin and replication forks						
DNA replication: leading and lagging strands						
DNA replication: proofreading						
termination of replication						
<b>DNA replication:</b> replicating <u>linear</u> genetic elements						
RNA structure: ribosomal RNA						
<b>Transcription:</b> enzyme structure ( <u>RNA polymerase</u> )						
<b>Transcription:</b> <u>initiation</u> (promoters)						
<b>Transcription:</b> <u>termination</u>						
mRNA: polygenic messages (operons)						
RNA <u>polymerases</u> of <b>Eukarya</b> and <b>Archaea</b>						
<b>RNA processing:</b> <u>prokaryotes</u>						
the unit of transcription						
<b>RNA processing:</b> <u>eukaryotes</u> (splicosomes, ribozymes)						
Transcription: enzymes (Bacteria, Archaea, Eukarya)						



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<b><u>REGULATION OF GENE EXPRESSION</u></b>						
Posttranslational Regulation of enzyme activity - allostery						
feedback inhibition						
regulation of pathways by <i>isozymes</i>						
regulation by covalent modification of enzymes						
DNA binding proteins						
negative regulation of transcription: <b>repression</b>						
negative regulation of transcription: <b>induction</b>						
<b>mechanism</b> of induction and repression						
<b>positive control</b> of transcription: maltose regulon						
Global Regulation / catabolite repression / lac operon						
Attenuation / trp operon						
Attenuation / other mechanisms						
Global Regulation / alternative sigma factors / heat shock proteins						
Global Regulation / quorum sensing						
Signal Transduction / two-component systems						
Signal Transduction / two-component systems / <b>EXAMPLES</b>						
mechanism of chemotaxis - the issues						
mechanism of chemotaxis, signaling molecules						
mechanism of chemotaxis, phosphorylation relay system						
mechanism of chemotaxis, adaptation						
Regulatory RNA / antisense nucleic acids						
contrast of gene expression in prokaryotes and eukaryotes						

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<b><u>VIRUSES</u></b>						
Viruses / obligate intracellular parasites / kinds of viruses						
Nature of virion / basic structure						
Nature of virion / virus symmetry						
Enveloped viruses						
Complex viruses						
Virus genome						
Virus enzymes						
Host cells / bacteria / eukaryotic						
Cancer						
Quantifying of viruses / plaque assays / plating efficiency						
Quantifying of viruses / animal infectivity assays						
Steps in virus reproduction						
Virus restriction and modification by host						
Viral Genome and Production of viral messenger RNAs						
Viral proteins / early / late / lytic						
Bacterial Viruses / T4						
Bacterial Viruses / MS2						
Life cycles of Temperate bacteriophages						
Bacterial Viruses / lambda / lytic cycle						
Bacterial Viruses / lambda / lysogenic cycle						
Animal Viruses / lytic, persistent, latent, transformation						
Animal Viruses / picornaviruses						
Animal Viruses / herpesviruses						
Animal Viruses / retroviruses						
Retroviruses and oncogenesis						
Viroids						
Prions						

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<b><u>MICROBIAL EVOLUTION AND SYSTEMATICS</u></b>						
Origin of the Earth and Microbial Life						
Primitive Life and Molecular Coding - RNA Life						
Primitive Life and Early Metabolic Strategies						
Early Life and Evolution of Photosynthesis						
Development of the Ozone Shield						
Primitive Eukaryotes - Origin of Nucleus						
Primitive Eukaryotes - Endosymbiosis/Mitochondria/Chloroplasts						
Evolutionary Chronometers - Characteristics						
Evolutionary Chronometers - Ribosomal RNA						
Ribosomal RNA Sequences and Evolution						
Ribosomal RNA Sequences & Evolution - Sequence Methodology						
Phylogenetic Trees from RNA Sequences - Distance Matrix Method						
Phylogenetic Trees from RNA Sequences - Parsimony Analysis						
Signature Sequences						
Signature Sequences: Fluorescent in-situ hybridization (FISH)						
Molecular Community Analysis						
Microbial Phylogeny - Universal Tree of Life						
Microbial Phylogeny - Organelles						
Microbial Phylogeny - Brief Description of Domain <b>Bacteria</b>						
Microbial Phylogeny - Brief Description of Domain <b>Archaea</b>						
Microbial Phylogeny - Brief Description of Domain <b>Eukarya</b>						
Characteristics of the Primary Domains: <b>Cell Walls</b>						
Characteristics of the Primary Domains: <b>Lipids</b>						
Characteristics of the Primary Domains: <b>RNA Polymerase</b>						
Characteristics of the Primary Domains: <b>Protein Synthesis</b>						
Taxonomy, Nomenclature, <i>Bergey's Manual</i> : Conventional Bacterial Taxonomy						

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<b><i>MICROBIAL EVOLUTION AND SYSTEMATICS</i></b> (continued)						
Taxonomy, Nomenclature, <i>Bergey's Manual</i> : Molecular Taxonomy, G+C Ratios						
Taxonomy, Nomenclature, <i>Bergey's Manual</i> : Molecular Taxonomy, DNA:DNA hybridization						
Taxonomy, Nomenclature, <i>Bergey's Manual</i> : <b>Ribotyping</b>						
Taxonomy, Nomenclature, <i>Bergey's Manual</i> : <b>Fatty Acid Analysis</b>						
Taxonomy, Nomenclature, <i>Bergey's Manual</i> : Species Concept						
Taxonomy, Nomenclature, <i>Bergey's Manual</i> : Nomenclature and Formal Taxonomic Standing						
<i>Bergey's Manual</i> and <i>The Prokaryotes</i>						
Diversity of the Bacteria: Introduction						
Diversity of the Bacteria: <u>Phylum 1</u> , <b><i>Proteobacteria</i></b>						
Diversity of the Bacteria: <u>Phylum 2</u> , <b>Gram-Positive Bacteria</b>						
Diversity of the Bacteria: <u>Phylum 3</u> , <b><i>Cyanobacteria</i>, <i>Prochlorophytes</i>, chloroplasts</b>						
Diversity of the Bacteria: <u>Phylum 4</u> , <b><i>Chlamydia</i></b>						
Diversity of the Bacteria: <u>Phylum 5</u> , <b><i>Planctomyces / Pirella</i></b>						
Diversity of the Bacteria: <u>Phylum 6</u> , <b><i>Verrucomicrobia</i></b>						
Diversity of the Bacteria: <u>Phylum 7</u> , <b><i>Bacteroides / Flavobacteria</i></b>						
Diversity of the Bacteria: <u>Phylum 8</u> , <b><i>Cytophaga</i> group</b>						
Diversity of the Bacteria: <u>Phylum 9</u> , <b>Green Sulfur Bacteria</b>						
Diversity of the Bacteria: <u>Phylum 10</u> , <b><i>Spirochetes</i></b>						
Diversity of the Bacteria: <u>Phylum 11</u> , <b><i>Deinococci</i></b>						
Diversity of the Bacteria: <u>Phylum 12</u> , <b>Green <u>Nonsulfur</u> Bacteria</b>						
Diversity of the Bacteria: <u>Phyla 13 and 14</u> , <b>Deeply Branching Hyperthermophiles</b>						
Diversity of the Bacteria: <u>Phyla 15 and 16</u> , <b><i>Nitrospira</i> and <i>Defferibacter</i></b>						