

MIDDLESEX COUNTY COLLEGE
EDISON, NEW JERSEY

Course Title: **Microbiology**

Catalog: **BIO-221**

Class Hours: 3

Laboratory Hours: 3

Credit Hours: 4

Department Chair: _____ Division Dean: _____ Date: 2008 - 2009

Prerequisite: Biology 118 or equivalent: Chemistry 118 or equivalent

Textbook for Course:

<u>Author</u>	<u>Title</u>	<u>Publisher</u>	<u>Copyright</u>
M. Madigan Martinko, Dunlap & Clark	Biology of Microorganisms, 12th Edition	Benjamin Cummings	2009
Johnson & Case	Laboratory Experiments in Microbiology; 8th Edition	Benjamin Cummings	2007

Approved Safety Glasses-mandatory for all laboratory exercises

Supplementary Materials:

Films, film loops, color slides, overhead transparencies and supplements.

Catalog Description:

A comprehensive study of microorganisms, with detailed coverage of the Bacteria, Fungi, Protozoans, Helminthic parasites, and viruses. Topics include: cellular and viral structure and function, taxonomy, microbial metabolism and genetics, physical and chemical methods of controlling microorganisms and concepts of pathogenicity and immunology. The laboratory exercises emphasize practical skills in manipulating, observing, controlling and identifying microbes.

Course Goals:

This course parallels a university or college level course in introductory microbiology for biology or microbiology majors. It serves as preparation for higher level courses in microbiology - introducing the student to basic microbiological concepts of structure, physiology, genetics, immunology, pathogenicity and microbial population control.

Course Objectives:

The student shall learn:

1. The scope of microbiology and significant historical contributions to the science.
2. To compare and contrast basic structural functional metabolic, genetic and reproductive characteristics of procaryotic and eucaryotic organisms.
3. The general effects of physical and chemical agents on microbes and the fundamental role of these agents in microbial control.
4. The basic concepts of pathogenicity and immunology.

Course Requirements: (Any special requirements)

Students are expected to attend every lecture and laboratory session. Laboratory record books must be kept current.

Evaluation:

Evaluation in the lecture is based on quizzes and tests and in the laboratory on qualitative and quantitative appraisal of the student's achievement via practical examinations, and tests and evaluations of the student's laboratory record book. There is also a final comprehensive examination on the course content.

Course Outline

I. Introduction to Microbiology

- A. Survey of new and emerging diseases
 1. AIDS
 2. Legionnaires disease
 3. Lyme's disease
- B. Reemergence of "older" diseases
 1. Flu epidemics
 2. TSS
 3. Multi-drug resistant TB
 4. STDs
- C. Usefulness of microorganisms
 1. Aquatic organisms
 2. Photosynthetic organisms
 3. Food production
 4. Production of organics
 5. Medical applications

II. Brief History of Microbiology

- A. Leeuwenhoek and Microscopy
- B. Spontaneous Generation vs Biogenesis.
 1. Redi
 2. Needham
 3. Pasteur: goose-necked flasks
- C. Fermentation: wine industry
- D. Germ Theory of Disease
 1. Koch: Anthrax
 2. Koch's Postulates

E. Golden Age of Microbiology

III. Scope of Microbiology

- A. Immunization: Jenner and cow pox/small pox
- B. Chemotherapy
 - 1. Malarial treatment
 - 2. Alexander Fleming: penicillin
- C. Virology
- D. Recombinant DNA technology
- E. Taxonomy
 - 1. Linnaeus
 - 2. Whittaker
 - i) 5 Kingdom classification

IV. Benefits from microorganisms

- A. Recycling of dead matter: mineralization
- B. Sewage treatment
- C. Cleaning of toxic wastes
- D. Production of insecticides
- E. Production of proteins for human consumption
- F. Production of medically important substances, hormones, etc.

V. Microscopy

- A. Brightfield microscopy
 - 1. Limits of resolution
- B. Darkfield microscopy
 - 1. Advantages
 - 2. Disadvantages
- C. Fluorescent microscopy
 - 1. Immunofluorescence
- D. Phase Contrast microscopy
 - 1. Reinforcement and cancellation of waves
 - 2. Convert differences in density to differences in intensity
 - 3. Advantages and disadvantages
- E. Electron microscopy
 - 1. General construction
 - 2. TEM and SEM

VI. Differential Stains

- A. Gram Stain
- B. Acid Fast Stain
- C. Special Stains
 - 1. Spore stains
 - 2. Flagellar stains
 - 3. Capsular stains (negative stains)

VII. Prokaryotic cell structure

- A. Bacterial shapes
 - 1. Planes of division
- B. Cellular Matrix
 - 1. Nucleoid

2. Plasmids
3. Ribosomes: 30S + 50S
4. Mesosomes
5. Inclusion bodies
 - i) organic storage compounds
 - ii) inorganic storage compounds
 - iii) gas vacuoles

C. Cell Membrane

1. Composition
2. Functions
 - i) barrier
 - ii) selective transport
 - iii) energy production

D. Cell Wall

1. Gram positive model
 - i) peptidoglycan: composition
 - ii) teichoic acids
2. Gram negative model
 - i) outer membrane: composition; LPS
3. Unusual cell walls
 - i) Mycobacterium
 - ii) Mycoplasma
 - iii) Archebacteria

E. Structures outside the cell wall

1. Glycocalyx
 - i) Slime layer
 - ii) Capsule
2. Role of structures

F. Cell Appendages: Functions

1. Pili
2. Fimbriae
3. Flagella
 - i) General structure
 - ii) Classification:
 - monotrichous
 - amphitrichous
 - lophotrichous
 - peritrichous
 - iii) Chemotaxis
 - iv) Phototaxis
 - v) Magnetotaxis

G. Endospores

1. Function
2. Characteristic position and shape
3. Triggers for sporulation/germination
4. Genera associated with endospores

H. Endosymbiotic Hypothesis

VIII. Microbial Nutrition

A. Energy Sources

1. Phototrophs
2. Chemotrophs

B. Carbon Sources

1. Autotrophs
2. Heterotrophs

C. Hydrogen/electron Sources

- 1. Lithotrophs
- 2. Organotrophs
- D. Nitrogen, Phosphorus, Sulfur and Iron
- E. Growth Factors
 - 1. Fastidious organisms
- F. Uptake of Nutrients
 - 1. Simple diffusion
 - 2. Facilitated diffusion
 - 3. Active transport
 - 4. Group translocation
 - i) PEP:PTS model in *E.coli*
- G. Culture Media
 - 1. Chemically defined
 - 2. Complex media
 - i) Peptone
 - ii) Tryptone
 - 3. Enriched media
 - 4. Differential media
 - 5. Selective media
 - 6. Solid vs liquid media
 - i) Agar: properties

IX. Metabolism: Energy Generation

- A. Thermodynamics
 - 1. First and Second Laws
 - 2. Entropy; free available energy
 - 3. Exergonic and endergonic reactions
 - 4. Equilibrium constant
 - 5. ATP
 - 6. Coupling reactions
 - 7. Standard Reduction Potential
 - i) Negative numbers: good electron donors
 - ii) Positive numbers: good electron acceptors
- B. Redox reactions
 - 1. Oxidation
 - 2. Reduction
 - 3. Electron donors and acceptors
- C. Catabolic and Anabolic reaction
- D. Enzymes
 - 1. Energy of activation
 - 2. Active sites
 - 3. Enzyme inhibitors
 - i) Competitive inhibitors
 - ii) Noncompetitive inhibitors
 - 4. Environmental effects on enzymes
- E. Phosphorylation
 - 1. Substrate-level phosphorylation
 - 2. Oxidative phosphorylation
 - 3. Photophosphorylation

X. Energy Generating Reactions: Catabolic reactions

- A. Stage I reactions
- B. Stage II reactions
 - 1. Glycolysis
 - 2. Pentose Phosphate Pathway: advantages

3. Entner Doudoroff Pathway: advantages
- C. Stage III reactions
 1. TCA cycle: energy yields
 2. Electron Transport Chain
 - i) Components of the chain
 - ii) Proton Gradient
 - iii) ATP-synthase
- D. Fermentations
 1. Ethanol fermentation
 2. Lactic acid fermentation
 3. Mixed acid fermentation
 4. Regeneration of NAD^+
- E. Anaerobic respiration
 1. Electron donors and acceptors
- F. Oxidation of inorganic molecules

XI. Energy Generating Reactions: Photosynthesis

- A. Light and dark reactions
- B. Oxygenic and anoxygenic reactions
- C. Green and purple sulfur bacteria

XII. Microbial Growth

- A. Bacterial Growth Curve
 1. Log phase
 2. Exponential phase
 3. Stationary phase
 4. Death phase
- B. Generation Time
 1. Formula for calculating generation time
- C. Measurements of Bacterial Growth
 1. Direct methods
 - i) Petroff-Hausser Counting Chambers
 - ii) Viable Counts
 2. Indirect methods
 - i) Dry weight
 - ii) Turbidity measurements
- D. Influences of Environmental Factors on Growth
 1. Osmotic Pressure
 - i) Osmotolerant, osmophilic, extreme halophiles
 - ii) *Halobacterium salinarium*
 2. pH
 - i) Acidophiles, neutrophiles, alkalophiles
 - ii) *Helicobacter pylori*
 3. Temperature
 - i) Psychrophiles, psychrotrophs, mesophiles, thermophiles
 - ii) *Thermus aquaticus*
 4. Oxygen
 - i) Obligate aerobes, facultative anaerobes, aerotolerant strict anaerobes, microaerophiles
 - ii) Oxygen radicals - SOD
 5. Pressure: hydrostatic and barometric
 - i) Barotolerant and barophilic organisms
 6. Radiation

- i) Ionizing and non-ionizing radiation
- ii) *Deinococcus radiodurans*

XIII. Nucleic Acid and Protein Synthesis

- A. DNA structure
 - 1. Composition of a nucleotide
 - 2. Numbering of carbon atoms
 - 3. Orientation
 - 4. Associated with cell cycle, except for plasmid synthesis
 - 5. Origin of replication
 - 6. Role of hydrogen bonds in double helix
- B. DNA Replication
 - 1. Semiconservative; antiparallel
 - 2. Enzymes involved
 - 3. Leading and lagging strands. Okasaki fragments
 - 4. Monomer as triphosphate nucleotides
- C. RNA Transcription
 - 1. Enzymes involved
 - 2. Sense and antisense strands
 - 3. Promoter sequences and terminator sequences
 - 4. Eukaryotic mRNA processing
 - i) Intron splicing
 - ii) Poly A tail
 - iii) Methyl-G capping structure
 - 5. Intron sequence conservation
- D. Protein Synthesis - Translation
 - 1. Genetic Code
 - i) Nucleotide - amino acid equivalence
 - ii) Triplet code
 - iii) Degeneracy of code
 - 2. Role of rRNA, ribosome composition
 - i) Eukaryotic and prokaryotic ribosomes
 - 3. Role of tRNA
 - i) Aminoacyl transferases
 - ii) Anticodons
 - 4. Initiation and termination signals: start and stop codons
 - 5. Peptide bond formation: A and P sites of ribosome
 - 6. Simultaneous transcription and translation in prokaryotes
 - 7. Initiation and elongation factors
 - i) Diphtheria toxin disruption

XIV. Regulation of Gene Expression

- A. Constitutive gene expression
- B. Inducible gene expression
 - 1. Lac Operon model
 - i) Structural genes: x, z and a
 - ii) Regulatory gene
 - iii) Operator and promoter regions
 - iv) Role of inducer
- C. Repressible gene expression
 - 1. Tryp Operon model
 - i) Structural genes
 - ii) Leader region: complementary regions

- iii) Location of tryptophan codons and stop codon
- iv) Role of ribosomes in the attenuation process
- v) Effect of low and high levels of media tryptophan

XV. Overview of microbial genetics

- A. Fred Griffith - Transforming factor
- B. Hershey and Chase - Nature of transforming factor
- C. Mutations
 - 1. Role of oncogenes
 - 2. Point mutations
 - i) Silent - neutral
 - ii) Missense
 - iii) Nonsense
 - 3. Frame-shift mutations
 - 4. Induced mutations
 - i) Intercalators: ethidium bromide
 - ii) Ultraviolet light
 - iii) Base analogs
 - iv) Altered nitrogenous bases
- D. Detection of Mutagens
 - 1. Ames test
 - i) His⁻ mutant
 - ii) Background revertants
 - iii) How petri plate is prepared

XVI. Bacterial Recombination

- A. Transformation
- B. Conjugation
 - 1. F plasmids
 - 2. F⁺, F⁻ and Hfr crosses
- C. Transduction
 - 1. Generalized
 - 2. Specialized
- D. Recombinant DNA technology
 - 1. Restriction endonucleases
 - 2. Reverse transcriptase
 - 3. Gel electrophoresis
 - 4. Southern transfers
 - 5. PCR

XVII. Control of microorganisms

- A. Terms used:
 - Sterilization; Sanitation
 - Disinfectants; Antiseptics
 - Cidal and Static agents
- B. Factors influencing the effectiveness of antimicrobial agents
- C. Physical methods of control
 - 1. Heat:
 - i) Autoclaves
 - ii) Thermal Death Point (TDP)
 - iii) Thermal Death Time (TDT)
 - iv) Decimal Reduction Time (DRT)
 - v) Pasteurization
 - vi) Dry Heat

2. Filtration
3. Radiation
- D. Chemical methods of control
 1. Phenolics
 2. Alcohols
 3. Halogens
 4. Heavy metals
 5. Quats
 6. Aldehydes
 7. Sterilizing gases
 8. Phenolic Index

XVIII. Virology

- A. Introduction
- B. Characteristics of viruses
 1. Host range
 2. Structure
 - i) Icosahedral or helical symmetry
 - ii) Enveloped and non-enveloped
 - iii) Complex shapes (bacteriophages)
 3. Nucleic acid composition
- C. Culturing viruses
 1. Bacteriophages
 - i) Plaque assays
 2. Animal viruses
 - i) Embryonated eggs
 - ii) Primary cell cultures
 - iii) Continuous cell lines
- D. Virus identification
 1. Serology
 2. Electron microscopy
- E. Bacteriophages
 1. One-step growth curve
 2. Lytic viruses: T - even phages
 3. Lysogenic viruses: Lambda phage
 - i) Organization of the lambda genome
 - ii) Early and late transcripts
 4. Implications of lysogeny
 - i) Immunity
 - ii) Transduction
 - iii) Diseases associated with the lysogenic state
- F. Eukaryotic viruses
 1. Penetration and uncoating
 2. Retroviruses
 3. Replication strategies
 - i) RNA viruses: (-) and (+) stranded
 - ii) Retrovirus: reverse transcriptase
- G. Viral damage to cells
- H. Viroids
- I. Prions
- J. Insect viruses
- K. Cancer

XIX. Antimicrobial Chemotherapy

- A. Development of Chemotherapy
 - 1. Gerhard Domagk - sulfa
 - 2. Alexander Fleming - penicillin
 - 3. Selman Waksman - streptomycin
- B. Characteristics of a good antimicrobial agent
 - 1. Selective toxicity: therapeutic dose, toxic dose, therapeutic index
 - 2. Spectrum of activity
 - 3. Non allergenic
 - 4. Solubility
- C. Classification of antimicrobial agents
 - 1. Source
 - 2. Their action
- D. Testing the effectiveness of an agent
 - 1. Disk Diffusion tests
 - i) Kirby Bauer
 - 2. Dilution Susceptibility tests
 - i) MLC
 - ii) MIC
- E. Mechanisms of action of antimicrobial agents
- F. Factors influencing the effectiveness of a drug
- G. Synthetic drugs
 - 1. Sulfa
 - 2. Isoniacid and ethambutol
 - 3. Quinolones
- H. Antibiotics and semisynthetic drugs
 - 1. Anti-cell wall agents
 - i) Penicillins
 - ii) Cephalosporins
 - 2. Anti-ribosomal agents
 - i) Tetracycline
 - ii) Chloramphenicol
 - iii) Aminoglycosides
 - iv) Erythromycin
- I. Antifungal, antiviral and antiprotozoan drugs
 - 1. Antifungal
 - i) Nystatin, amphotericin B
 - ii) Imidazole, miconazole and ketoconazole
 - 2. Antiviral
 - i) Amantadine
 - ii) Acyclovir
 - iii) AZT
 - 3. Antiprotozoan
 - i) Quinine, chloroquine, mefloquine
 - ii) Metronidazole (flagyl)
- J. Drug Resistances
 - 1. Alter or destroy drug
 - 2. Modify the target
 - 3. Decrease permeability of drug
 - 4. Drug pumps
 - 5. Alteration of enzyme targeted, or increase its synthesis

XX. Host - Parasite Relationships

- A. Symbiosis
 - 1. Mutualism
 - 2. Commensalism

- 3. Parasitism
- B. Pathogenicity and Virulence
- C. Factors contributing to Virulence
 - 1. Adherence
 - 2. Preferred portal of entry
 - 3. Dose of infecting organisms
 - i) LD₅₀ ; ID₅₀
 - 4. Production of specific enzymes
 - i) Hemolysins, leukocidins
 - ii) Coagulases, fibrinolysins
 - iii) Hyaluronidases
 - 5. Production of toxins
 - i) Endotoxins
 - ii) Exotoxins
 - Cytotoxins, neurotoxins and enterotoxins

XXI. Host Non-Specific Defenses

- A. General Factors
 - 1. Nutritional status of host
 - 2. Age
 - 3. Fever
 - 4. Genetic factors
- B. Physical Factors
 - 1. Integrity of skin and mucous membranes
 - 2. Eyes
 - 3. Respiratory tract
 - 4. GI tract
 - 5. Genito/urinary tract
- C. Chemical Factors
 - 1. Fibronectins
 - 2. Beta Lysin
 - 3. Interferon
 - 4. Complement
 - 5. Tumor Necrosis factor α
 - 6. Bacteriocidins
- D. Biological Factors
 - 1. Normal flora
 - 2. Inflammatory Response
 - 3. Phagocytosis

XXII. Immunology

- A. Immunity: classifications
 - 1. Innate
 - 2. Active naturally acquired
 - 3. Active artificially acquired
 - 4. Passive naturally acquired
 - 5. Passive artificially acquired
- B. Specific immunity: humoral and cell-mediated
- C. Antigen
 - 1. Definition
 - 2. Antigenic determinants or epitopes
 - 3. Haptens
 - 4. T-cell dependent and T-cell independent
- D. Antibodies or immunoglobulins

1. Classes of immunoglobulins
 - i) IgG
 - ii) IgM
 - iii) IgA
 - iv) IgD
 - v) IgE
2. Structure of immunoglobulins
 - i) Heavy chain: constant and variable regions
 - ii) Light chain: constant and variable regions
3. Clonal selection theory
4. Antibody diversity
5. Polyclonal reactions vs. Monoclonal antibodies
6. Effects of antibodies
 - i) tagging of antigens
 - ii) toxin neutralization
 - iii) viral neutralization
 - iv) opsonization
 - v) immune complex formation

E. T lymphocytes

1. Antigen receptors
2. Activation of T-lymphocytes
 - i) Context of proper MHC
3. Classes of T- lymphocytes
 - i) Regulator cells: helper and suppressor
 - ii) Effector cells: cytotoxic,
 - iii) Delayed-type hypersensitivity cells

F. Immune Tolerance

1. Clonal deletion hypothesis
2. Functional inactivation hypothesis

G. Diseases of the Immune System

1. Type I: Anaphylaxis.
 - i) IgE-mediated
 - ii) Localized
 - iii) Generalized
2. Type II: Cytotoxic reactions
 - i) Blood transfusion reactions
 - ii) Hemolytic diseases of the new born
 - a) ABO incompatibilities
 - b) Rh incompatibilities
 - c) Rhogam to Rh⁻ mothers
3. Type III: Immune complex diseases
4. Type IV: Delayed hypersensitivities
 - i) Poison Ivy reactions

H. Transplant rejections

I. Immunodeficiencies

J. Applications of Immunity

1. Vaccines
 - i) Inactivated
 - ii) Attenuated
 - iii) Subunit vaccines
 - Recombinant vaccines
 - Antiidiotypic vaccines
 - Toxoids
2. Diagnostic tests
 - i) Precipitation reactions

- Ouchterlony
- ii) Agglutination reactions
 - Staph latex reaction
 - Monospot
 - Hemagglutination and hemagglutination inhibition
- iii) Complement fixation reaction
- v) ELISA: enzyme linked immuno sorbent assay

XXIII. Microbial Taxonomy

- A. Definition of a bacterial species
- B. Phylogenetic and phenetic classifications
- C. Whitaker and Woese kingdom classifications
- D. Bergeys Manual of Systematic Bacteriology

XXIV. Prokaryotic Diversity

- A. Gram negative bacteria of general importance
 - 1. Spirochetes
 - i) *Treponema pallidum*
 - ii) *Borrelia burgdorferi*
 - 2. *Campylobacter jejuni*
 - 3. *Bdellovibrio*
 - 4. Enterobacteriaceae
 - i) *Escherichia coli*
 - ii) *Enterobacter aerogenes*
 - iii) *Salmonella*
 - iv) *Shigella*
 - 5. Vibrionaceae
 - 6. Rickettsiae
 - 7. Chlamydiae
 - 8. Mycoplasma
- B. Gram positive bacteria
 - 1. Gram positive cocci
 - i) *Staphylococci*
 - ii) *Deinococcus*
 - iii) *Streptococci*
 - iv) *Leuconostoc*
 - 2. Endospore forming gram positive rods and cocci
 - i) *Bacillus*
 - ii) *Clostridium*
 - 3. Irregular nonsporing positive rods
 - i) *Corynebacterium*
 - ii) *Arthrobacter*
 - 4. Mycobacteria
- C. Other gram negative bacteria
 - 1. Photosynthetic bacteria
 - i) Oxygenic
 - Purple bacteria
 - Green bacteria
 - ii) Anoxygenic
 - Cyanobacteria
 - 2. Chemolithotrophs
 - i) Nitrifying bacteria
 - ii) Colorless sulfur bacteria

XXV. Archaeobacteria

- A. Major differences from eubacteria
 - 1. Cell wall composition
 - 2. Lipids and membranes
 - 3. Genetic differences
 - 4. Metabolic differences
- B. Major groups of Archaeobacteria
 - 1. Methanogens
 - 2. Sulfate reducers
 - 3. Extreme halophiles
 - 4. Cell wall-less Archae
 - 5. Extreme thermophiles

XXVI. Actinomycetes

- A. General properties
- B. Major groups
 - 1. Nocardioforms
 - 2. Actinomycetes with multilocular sporangia
 - 3. Actinoplanates
 - 4. Streptomycetes
 - 5. Maduromycetes
 - 6. Thermomonospera
 - 7. Thermoactinomycetes

XXVII. Eukaryotic microorganisms

- A. Fungi
 - 1. General characteristics
 - 2. Reproduction
 - 3. Classification according to sexual spores
 - i) Zygomycota
 - ii) Ascomycota
 - iii) Basidiomycota
 - iv) Deuteromycota
 - 4. Mycosis
 - i) Cutaneous
 - ii) Subcutaneous
 - iii) Systemic mycoses
 - iv) Opportunistic mycoses
- B. Algae
 - 1. General characteristics
 - i) Economic importance
 - ii) Toxins produced
- C. Protozoans
 - 1. General characteristics
 - 2. Classification according to motility
 - i) Ameboid
 - Entamoeba histolytica*
 - ii) Sporozoa
 - Plasmodium*
 - Toxoplasma*
 - iii) Ciliata
 - Balantidium coli*
 - iv) Flagellata

Trichomonas
Giardia
Trypanosoma

Laboratory Schedule

Lab 1

Ex. 1 – Use and Care of the Microscope

p 3

Look at prepared slides:

Algae – Cyan bacteria series

Fungi – prepared slides

Protozoa – Toxolasma or Trypanosoma slides

Bacteria – bacteria 3 types slides

Ex. 2 – Examination of living organisms

pg 13

Wet mounts and hanging drop slides

Darkfield microscopy – Hand out

Lab 2

Ex. 10 – Transfer of bacteria – Aseptic technique
3 cultures (2broths and 1 slant) to be inoculated onto:
broth, slant and agar deep (each culture) pg 75

Ex. 3 – Preparation of smears and simple staining
Microscopic Measurements – Hand out pg 25

Lab 3

Ex. 4 – Negative staining pg 31
Ex. 5 – Gram staining pg 35
Ex. 6 – Acid Fast staining – Hand out pg 41

Lab 4

Ex. 7 – Structural stains – Endospore stain pg 47
Ex. 9 - Microbes in the environment (making media) pg 67
Ex. 19 – Oxygen and the growth of bacteria pg 141

Lab 5

Ex. 11 – Isolation of bacteria by dilution techniques pg 85
Streak plate: pour plate
Spread plate technique (page 201)
Membrane Filter technique (Appendix F: page 423)

Lab 6

Ex. 8 – Morphological unknown pg 57
Organisms to be given out:
Neisseria, Strep, Staph, E. coli, Bacillus, Mycobacterium
This is part of the lab practical:
Points are given for correct identification of shape, gram stain and correct
Identification: ID due at end of lab period

Lab 7

LAB PRACTICAL #1

Lab 8

Ex. 20 – Growth curve: role of temperature pg 149
4 groups of students
A) E. coli in 37° C shaker
B) E. coli in 45° C shaker (or 15° C still, if not available)
C) E. coli in 37° C still incubator
D) E. coli in 45° C still incubator

Students will use side armed flasks.

Ex. 21 – Biofilms pg 157

Lab 9

- Ex. 22 – Physical methods of control: Heat pg 167
Ex. 23 - Physical methods of control: UV radiation pg 175
Ex. 24 - Chemical methods of control: disinfectants pg 181

Lab 10

- Ex. 25 - Chemical methods of control: Antimicrobial drugs pg 185
Ex. 38 - Titration of a bacteriophage pg 277
(We will use purchased T4 E. coli phage)

Lab 11

- Ex. 46 - Bacteria of the skin pg 333
Ex. 47 – Bacteria of the respiratory tract pg 337
Also a gram positive unknown will be given:
S. aureus: S. epidermidis; Strep salivarius;
Micrococcus roseus: Micrococcus luteus; Enterococcus faecalis

Tests to be done are: MSA, gram stains, catalase, coagulase, glucose fermentation and arabinose fermentation.

Lab 12

Hand out Gram negative unknown:

Pseudomonas, Alcaligenis; E. coli; Enterobacter; Proteus; Serratia

- Ex. 14 – Fermentation of carbohydrates pg 105
Ex. 15 - Protein catabolism – part 1 (urea) pg 113
Ex. 16 - Protein catabolism – part 2 (indole) pg 119
Ex. 17 - Respiration (nitrate reduction) pg 125
Students will perform: oxidase, TSI, Mac Conkeys, EMB,
Cetrimide, citrate, nitrate reduction, MRFP, SIM and urea.

Lab 13

Reading of all tests.

Lab 14

Gram negative unknown due.

PRACTICAL #2

Lab 15

View film: AIDS the Story So Far
Review for final exam

Goggles required for all labs.

Laboratory Manual:
Laboratory Experiments in Microbiology
Eighth Edition, 2007
Johnson & Case
Benjamin Cummings, Publishers