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Course Outline for BIO 7C

MICROBIOLOGY

Effective: Fall 2015

I. CATALOG DESCRIPTION:

BIO 7C — MICROBIOLOGY — 5.00 units

Bacteria, fungi, protozoans, parasites, and viruses with an emphasis on their relationship to humans. Cultivation, control, metabolism, body's defense against disease, microbial genetics, laboratory tests, and contemporary diseases are discussed. Methods used in the laboratory include staining, investigation, cultivation, identification of unknowns, and sensitivity testing. (Note: Formerly MICR 1)

3.00 Units Lecture 2.00 Units Lab

Prerequisite

BIO 30 - Intro to College Biology
with a minimum grade of C
and

CHEM 30A - Intro and Applied Chemistry I
with a minimum grade of C
or

CHEM 1A - General College Chemistry I
with a minimum grade of C

Strongly Recommended

BIO 7A - Human Anatomy

ENG 1A - Critical Reading and Composition

Grading Methods:

Letter Grade

Discipline:

	MIN
Lecture Hours:	54.00
Lab Hours:	108.00
Total Hours:	162.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. BIO30

1. Describe and apply the scientific method and how it is used by scientists to further scientific knowledge;
2. Cite the characteristics and levels of organization exhibited by all living organisms;
3. Know the use of light microscope and dissecting scope.
4. Describe how cells/specialized cells are structured and function;
5. Describe basic cell metabolism
6. Describe/contrast, mitosis, and meiosis,
7. Describe structure, transmission and expression of genes
8. Explain the Darwinian concept of evolution as modified by modern scientific knowledge;
9. Describe how the modern (binomial) system names and classifies organisms.

B. CHEM30A

C. CHEM1A

Before entering this course, it is strongly recommended that the student should be able to:

A. BIO7A

1. speak and write using anatomical terminology

2. identify organizational levels of the body and explain how they are related
3. use anatomical terminology for regions, positions, planes and cavities
4. identify histological tissues and describe the structures, and functions of specific types of epithelial, connective, muscle and nervous tissues
5. give the structure, function, and location of body membranes
6. identify the structures and describe the function of the integumentary system
7. describe the structure of selected types of articulations
8. list the structural and functional divisions of the nervous system and describe the microscopic structure of a typical neuron
9. describe the anatomy of peripheral nerves including spinal and cranial nerves and the anatomy of the autonomic nervous system
10. identify and describe the anatomy of the brain and spinal cord
11. describe the location and structure of the major endocrine glands
12. identify components of blood and list their functions
13. identify the organs of the cardiovascular system, and describe the anatomy of the heart and blood vessels
14. trace the arterial and venous paths of circulation
15. describe the structure and function of the lymphatic system
16. describe the structures and functions of the respiratory system
17. describe the structures and functions of the organs and accessory organs of the digestive system
18. describe the gross anatomy and functions of urinary organs and the microscopic structure of the nephron
19. describe the structures and functions of the male and female reproductive systems

B. ENG1A

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

- A. describe the discoveries of microbe investigators and the significance of their work;
- B. compare and contrast procaryotic and eucaryotic cells;
- C. describe bacterial cellular structure and function;
- D. conduct procedures to cultivate and identify bacteria;
- E. handle microorganisms in a safe manner;
- F. identify common protozoans, flatworm, roundworms that parasitize humans, know the diseases they cause, and describe select life cycles;
- G. identify arthropod vectors of disease;
- H. recognize selected fungi and associated diseases;
- I. describe and perform selected techniques used in genetic engineering;
- J. explain how the human body defends itself against disease;
- K. describe the theory and interpretation of common clinical laboratory tests;
- L. demonstrate proficiency using the microscope, dissecting scope, and spectrophotometer;
- M. compare and contrast various selected mechanisms of antibiotic and antiviral sensitivity;
- N. conduct and interpret antibiotic sensitivity testing;
- O. explain the use of disinfectants, antiseptics, sanitizers and the mode of action of selected examples;
- P. describe staining methods and the interpretation of various selective and differential media;
- Q. recognize shapes, arrangements, and morphological structures of bacteria;
- R. explain, perform and interpret various biochemical test commonly used for bacterial identification.
- S. recognize and describe selected relevant bacterial and viral diseases.

V. CONTENT:

A. Lecture

1. Introduction to microbiology
 - a. History of microbiology
 - b. Microbes and humans
 - c. Microscopy
 - d. Normal microbiota
2. Prokaryotic cell structure
 - a. Shapes and arrangements
 - b. Flagella
 - c. Fimbriae
 - d. Pili
 - e. Capsules
 - f. Cell wall
 - g. Cell membrane
 - h. Endospores
3. Microbial growth
 - a. Growth requirements
 - b. Culture media
 - c. Obtaining and maintaining pure cultures
 - d. Bacterial growth curve
4. Microbial metabolism
 - a. Enzymes and enzyme activity
 - b. Structure and function of carbohydrates, proteins, lipids, nucleic acids
 - c. Anabolic and catabolic pathways
 - d. Carbohydrate metabolism
 - e. Aerobic and anaerobic respiration
 - f. Fermentation
5. Bacterial genetics
 - a. Structure and function of genetic material
 - b. Spontaneous and induced mutations
 - c. Mutant selection
 - d. Transformation, transduction and conjugation
 - e. Biotechnology and recombinant DNA technology
6. Identification and classification of prokaryotes
 - a. Bacterial diversity
 - b. Principles of taxonomy
 - c. Scientific nomenclature
 - d. Methods of classifying and identifying microorganisms
 - e. Strain differences
7. Eukaryotes: Protozoa, Fungi and Helminths
 - a. Characteristics of selected medically important protozoa
 - b. Characteristics of selected medically important fungi

- c. Characteristics of selected medically important helminths
 - d. Arthropods as vectors
- 8. Viruses and Prions
 - a. General characteristics of viruses
 - b. Virus interaction with host cells and viral reproduction
 - c. Taxonomy of viruses
 - d. Viruses and human disease
 - e. Latent and persistent viral infections
 - f. Viruses and cancer
 - g. Characteristics of prions
 - h. Prion diseases
- 9. Immune Response
 - a. Innate vs. adaptive immune response
 - b. First line defenses
 - c. Inflammation
 - d. Fever
 - e. Complement system
 - f. Cells of the immune system
 - g. The nature of antigens and antibodies
 - h. Clonal selection and clonal deletion theory
 - i. Humoral and cellular immunity
- 10. Application of Immune Responses
 - a. Vaccine and immunization technology
 - b. Diagnostic immunology
 - 1. Monoclonal antibodies
 - 2. Precipitation reactions
 - 3. Agglutination reactions
 - 4. Immunofluorescence tests
 - 5. Neutralization test
 - 6. Enzyme-linked Immunosorbent Assay (ELISA)
 - 7. Western blotting
- 11. Control of Microorganisms
 - a. Physical methods of microbial control (temperature, filtration, high pressure, osmotic pressure, radiation)
 - b. Chemical methods of microbial control (antiseptics, disinfectants)
- 12. Antimicrobial Medications
 - a. Features of antimicrobial drugs
 - b. Mechanism of action for select antimicrobial drugs
- 13. Epidemiology
 - a. Rate of disease in a population
 - b. Reservoirs and vectors
 - c. Modes of transmission
 - d. Infectious disease surveillance
 - e. Trends in infectious disease
 - f. Nosocomial infections
- 14. Contemporary Infectious Diseases
 - a. Skin Infections
 - 1. Normal flora of skin
 - 2. Bacterial skin diseases, such as impetigo, SSSS, RMSF, Lyme disease
 - 3. Viral skin diseases, such as varicella, rubeola, rubella, warts
 - 4. Dermatomycoses
 - b. Respiratory System Infections
 - 1. Normal flora of respiratory system
 - 2. Bacterial infections of upper respiratory system, such as strep throat, diphtheria, pinkeye
 - 3. Viral infections of upper respiratory system, such as common cold, adenoviral pharyngitis
 - 4. Bacterial infections of lower respiratory system, such as pneumococcal pneumonia, Klebsiella pneumonia, Mycoplasma pneumoniae, pertussis, tuberculosis, Legionnaires' disease
 - 5. Viral infections of lower respiratory system, such as influenza, Hantavirus pulmonary syndrome
 - 6. Fungal infections of the lung, such as coccidiomycosis, and histoplasmosis
 - c. Alimentary System Infections
 - 1. Normal flora of alimentary system
 - 2. Bacterial diseases of the upper alimentary system, such as dental caries, periodontal disease, Helicobacter pylori gastritis
 - 3. Viral diseases of the upper alimentary system, such as Herpes simplex, mumps,
 - 4. Bacterial diseases of the lower alimentary system, such as cholera, shigellosis, E. coli gastroenteritis, Salmonellosis, Campylobacteriosis
 - 5. Viral diseases of the lower alimentary system, such as Rotavirus, and Norwalk virus gastroenteritis, hepatitis A, B, and C
 - 6. Protozoan diseases of the lower alimentary system, such as giardiasis, amebiasis
 - d. Genitourinary Infections
 - 1. Normal flora of genitourinary system
 - 2. Urinary system infections, such as bacterial cystitis, leptospirosis
 - 3. Non-venereal genital system diseases, such as bulbovaginal candidiasis, Staphylococcal toxic shock syndrome
 - 4. Bacterial and viral sexually transmitted diseases, such as gonorrhea, syphilis, Chlamydia, Herpes simplex, papillomavirus, AIDS
 - 5. Protozoal STDs, such as trichomoniasis
 - e. Nervous System Infections
 - 1. Bacterial nervous system infections, such as meningococcal meningitis, listeriosis, leprosy, botulism
 - 2. Viral nervous system infections, such as meningitis and encephalitis, poliomyelitis, rabies,
 - 3. Protozoan diseases of the nervous system, such as African trypanosomiasis
 - 4. Transmissible spongiform encephalopathies
 - f. Wound Infections
 - 1. Common bacterial wound infections, such as staphylococcal wound infection, group A Streptococcal "flesh eaters", Pseudomonas aeruginosa, tetanus, gas gangrene
 - 2. Fungal wound infections, such as Sporotrichosis
 - g. Blood and Lymphatic Infections
 - 1. Bacterial diseases of the vascular system, such as subacute bacterial endocarditis, gram negative septicemia
 - 2. Bacterial diseases of lymphnodes and spleen, such as tularemia, brucellosis, plague
 - 3. Viral diseases of the vascular system, such as infectious mononucleosis, yellow fever
 - 4. Protozoan diseases, such as malaria
 - h. HIV Disease and Complications of Immunodeficiency

B. Laboratory Activities:

1. Use and care of microscope
2. Preparation of smears and staining procedures (Gram, acid-fast, endospore)
3. Bacterial morphology and arrangements
4. Microbes in the environment
5. Hanging Drop Technique
6. Morphological unknown
7. Aseptic and isolation techniques
8. Media preparation
9. Selective and differential media
10. Metabolic activities and biochemical tests for bacterial identification
11. Anaerobic culture methods
12. Example of rapid identification methods: Enterotube II
13. Temperature and bacterial growth
14. Effect of UV light on bacterial growth
15. Bacterial unknown identification and Bergey's Manual
16. Antibiotic testing – Kirby Bauer
17. Disinfectants and antiseptics testing
18. Effectiveness of hand scrubbing
19. Transformation of bacteria
20. Ames test for detecting possible chemical carcinogens
21. Epidemiology study
22. Fungi, protozoa, and helminth demonstration
23. Agglutination reactions
24. ELISA testing
25. Diagnostic PCR assay
26. Isolate and identify bacteria of the human skin
27. Isolate and identify bacteria from a throat swab
28. Oral flora and caries susceptibility
29. Fecal analysis
30. Urine culture
31. Identification of an Unknown from a clinical sample

VI. METHODS OF INSTRUCTION:

- A. Case studies
- B. Utilization of animations, CD, ROM, and other audio visual aids
- C. Derivation of conclusions and clinical implications
- D. Research project
- E. Laboratory observations, collection and analysis of data
- F. Written assignments and lab reports
- G. Multimedia lecture presentations and discussion on major themes and concepts
- H. Readings from the text and the laboratory manual
- I. Student-led presentations

VII. TYPICAL ASSIGNMENTS:

- A. Reading and Discussion
 1. Read Chapter 4, "Functional Anatomy of Prokaryotic Cells, by " Tortora, Funke and Case, pp. 77-97. Be prepared to sketch and label 6 shapes of bacteria. Explain the medical importance of bacterial capsules and endospores.
 2. Read Chapter 25, "Microbial Diseases of the Digestive System, by " Tortora, Funke and Case, pp. 706-738. Be prepared to compare and contrast food poisoning versus food-borne infections. Explain the implications of this distinction in how each would be managed clinically.
- B. Collaborative learning
 1. Work with your lab partner on "Throat Culture". Use a sterile swab to obtain an inoculum from the throat of your partner and swab a blood agar plate following the specified procedure in the lab manual.
 2. Form groups of three students to dramatize a chosen infectious disease that is of interest to you. One student is the patient, one student acts as the doctor and the third student plays the lab tech. In your "play", the "patient" displays all the symptoms, the "doctor" has to be able to answer questions from other class mates, and the "lab tech" explains the lab tests done and shows pictures of relevant test results. The presentation should take a maximum of 10 minutes. It should be an effective review of a given infection in order to remind ourselves of important points before the final. Since this is a drama, try to dress, look, and act the part. Do not tell the rest of the class what disease you will be enacting – they have to guess!
- C. Writing
 1. Complete the laboratory report for the Throat Culture Exercise in your lab manual.
 2. Relevance Writing: Locate a current event story relating to any topic of this course in a local newspaper or in one of the big national newspapers. (Use the library web site to access any US newspaper). Cite the newspaper in which it was found (with dates and authors). Write a paragraph outlining the article. Write a second paragraph describing how this topic relates to the course as discussed in class (or described in the book – if not yet discussed in class). This will reinforce the course content and help you on the exams. Minimum of 600 words per relevance writing.

VIII. EVALUATION:

A. **Methods**

1. Exams/Tests
2. Oral Presentation
3. Lab Activities
4. Other:
 - a. Examinations on lecture material
 - b. Laboratory practical testing
 - c. Bacterial unknowns
 - d. Grading of laboratory reports and written research paper
 - e. Evaluation of oral presentation(s)
 - f. Comprehensive final examination inclusive of ALL lecture and laboratory material

B. **Frequency**

1. At least 2 midterms
2. At least 8 laboratory quizzes and/or exams
3. At least 2 bacterial unknown determinations
4. At least 1 oral presentation
5. At least 1 written research paper or written report
6. 1 comprehensive final examination

IX. TYPICAL TEXTS:

1. Tortora, Funke *Case Microbiology, an Introduction*. 10 ed., Benjamin Cummings, 2010.
2. Johnson and Case *Laboratory Experiments in Microbiology*. 9 ed., Benjamin-Cummings, 2009.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Laboratory coat
- B. Colored pencils
- C. Disposable gloves