

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: BIOL 121 Department: Biological Sciences

Course Title: Microbiology Semester: Spring Year: 1997

Objectives/Competencies

Course Objective	Competencies
1. Understand the development and scope of the field of microbiology	<ol style="list-style-type: none">1. List the major groups of microorganisms and their distinctive characteristics2. Identify the contributions of van Leeuwenhock, Pasteur, Lister, Koch, Jenner, and Fleming3. Compare the theories of Spontaneous generation and Biogenesis4. Describe beneficial activities of microorganisms including biogenesis and genetic engineering
2. Develop an understanding of the classification of microorganisms	<ol style="list-style-type: none">1. Explain the importance of taxonomy2. Compare and contrast the overall cell structure of procaryotes and eucaryotes3. List the major characteristics used to differentiate among kingdoms in both the five-kingdom and the three-kingdom systems4. Explain the purpose of <u>Bergey's Manual</u> and how staining and biochemical tests are used to identify bacteria

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3. Comprehend the main concepts of biochemistry	<ol style="list-style-type: none">1. Identify the elements and building blocks present in carbohydrates, proteins, lipids, and nucleic acids2. Compare the structure of DNA and RNA3. Describe the mechanism of enzymatic activity and inhibition4. Describe examples of biochemical reactions which are used to help identify bacteria in the lab5. Identify the role of ATP and the fundamental differences between anabolism and catabolism6. List the product and the number of ATP molecules produce from the glycolysis of one molecule of glucose7. Compare the end products and amount of ATP produced from fermentation and aerobic respiration
4. Understand the anatomy and function of procaryotic cells.	<ol style="list-style-type: none">1. Know the approximate diameters of a human lymphocytes, a bacterium, and a virus2. Identify the three basic shapes of bacteria and their arrangements3. Describe the structure and function of the glycocalyx, flagella, axial filaments, and fimbriae4. Compare and contrast the cell walls of the Gram positive and Gram negative bacteria, the archaeobacteria, and mycoplasmas5. Describe the structure and functions of the plasma membrane6. Identify the functions of the ribosomes and inclusions

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5. Develop and understanding of microbial growth	<p>7. Describe the function of endospores and the processes of sporulation and germination</p> <ol style="list-style-type: none">1. Classify microorganisms into five groups on the basis of preferred temperature range2. Identify how and why the pH of culture media is controlled3. Explain the importance of osmotic pressure to microbial growth4. Compare the nutritional patterns of heterotrophs, photoautotrophs, and chemoautotrophs5. Provide a use for carbon, nitrogen, phosphorus, and sulfur in microbial growth6. Explain how microorganisms are classified on the basis of oxygen requirements7. Describe binary fission and compare the phases of microbial growth8. Explain how a chemostat is able to maintain a culture in log growth9. Explain several direct and indirect methods of measuring cell growth
6. Understand the control of microorganisms	<ol style="list-style-type: none">1. Define the key terms related to microbial control2. Explain how microbial growth is affected by the type of microbe, its physiological state, and the ambient environmental conditions3. Describe the effect of microbial control agents on cellular

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<p>7. Develop a respect for and an understanding of Antimicrobial drugs</p> <p>8. Understand the basics of microbial genetics and Biotechnology</p>	<p>structures</p> <ol style="list-style-type: none"> 4. Describe the general microbial death pattern 5. Compare the effectiveness of most heat and dry heat 6. Explain how an autoclave functions 7. Describe how filtration, cold, desiccation, and osmotic pressure suppress microbial growth 8. Explain how radiation kills cells 9. List the factors related to effective chemical disinfection 10. Interpret the results of use-dilution tests 11. Identify the methods of action and the preferred uses of chemical disinfectants <ol style="list-style-type: none"> 1. Distinguish between a synthetic drug and an antibiotic 2. Define spectrum of activity, and superinfection 3. Describe the problems of chemotherapy for viral, fungal, protozoal, and helminth infections 4. Identify the major methods of action for the antimicrobial chemotherapeutic agents 5. Describe microbial susceptibility testing 6. List several ways to avoid the development of resistance 7. Compare and contrast synergism and antagonism <ol style="list-style-type: none"> 1. Define gene, genetic code, genotype, phenotype, and genome 2. Describe the structure and replication of DNA 3. Describe the processes of transcription and translation 4. Determine amino acid sequences from a DNA sequence

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<p>9. Develop an appreciation of the diversity of bacteria</p>	<ol style="list-style-type: none"> 5. Classify mutations by type 6. Identify the purpose of and outline the procedure for the Ames test 7. Compare and contrast the three major methods of recombination in bacteria 8. Define plasmid and transposon and discuss the functions 9. Compare and contrast genetic engineering, recombinant DNA, biotechnology, and gene therapy 10. Identify the role of a vector in genetic engineering 11. Define restriction enzymes and briefly outline how they are used to make recombinant DNA 12. List some of the major applications of genetic engineering
<p>10. Develop an understanding of medically important eucaryotic microorganisms</p>	<ol style="list-style-type: none"> 1. List the characteristics used to classify and identify bacteria according to <u>Bergey's manual</u> 2. Identify the major characteristics of the medically important bacterial genera <ol style="list-style-type: none"> 1. List the characteristics of fungi and differentiate fungi from bacteria 2. Describe the structure and asexual reproduction of molds and yeast 3. Explain the medical importance of the dimorphic fungi 4. Describe the five major types of mycoses and an example of each 5. List the defining characteristics of protozoa

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<p>11. Develop an understanding of viruses</p>	<ol style="list-style-type: none"> 6. Describe the outstanding characteristics of the four phyla of protozoa and give an example of each 7. Describe the process and importance of encystment 8. Differentiate between intermediate host and definitive host 9. List the distinguishing characteristics of parasitic helminths 10. Discuss the characteristics of round worms and tapeworms 11. Briefly describe the life cycles of tapeworms, <u>Enterobius</u>, <u>Trichinella</u>, and <u>Ascaris</u> 12. Define arthropod vector and differentiate between vectors and infective agent 13. Name one disease which is transmitted by each of the following: mosquitoes, ticks, fleas, and flies <ol style="list-style-type: none"> 1. Differentiate between a virus and bacterium 2. Describe the chemical composition and structure of enveloped and nonenveloped viruses 3. List the characteristics which are considered when classifying viruses 4. List the characteristics of the major virus families which cause human disease 5. Describe how bacteriophages and animal viruses are cultured 6. Describe the lytic and the lysogenic cycle of the T-even bacteriophages

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<p>12. Comprehend the general principles of disease and Epidemiology</p>	<ol style="list-style-type: none"> 7. Compare and contrast the replication cycles of DNA and RNA animal viruses 8. Describe the replication of HIV and how this is related to the disease characteristics of AIDS 9. Define oncogene, proto-oncogene, and transformed cell 10. Explain several methods of activating oncogenes 11. Differentiate between slow viral infections and latent viral infections and provide several examples of each 12. Differentiate between virus, viroid, and prion.
<p>13. Understand the mechanisms of pathogenicity</p>	<ol style="list-style-type: none"> 1. Define the major terminology used to describe disease 2. List Koch's postulates 3. Define normal flora and transient flora as well as the locations of normal flora 4. Discuss the benefits and the possible dangers of normal flora 5. Contrast human, animal, and nonliving reservoirs 6. Explain the various methods of disease transmission 7. Define nosocomial infections and explain the importance 8. Provide an example of a compromised host 9. Identify four predisposing factors for disease 10. Define epidemiology 11. List several approaches which will break the chain of transmission in an epidemic <ol style="list-style-type: none"> 1. Compare LD50 and ID50 2. List the portals of entry

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<p>14. Understand the nonspecific defenses of the host</p>	<ol style="list-style-type: none"> 3. Explain, using examples, ways microbes adhere to host cells 4. Explain how capsules, cell wall components, and enzymes contribute to pathogenicity 5. Contrast the nature and effects of exotoxins and endotoxins 6. List the cytopathic effects of viral infections 7. Discuss the causes of symptoms in fungal, protozoal, helminthic, and algal diseases
<p>15. Develop a comprehension of the immune response</p>	<ol style="list-style-type: none"> 1. Define nonspecific resistance 2. Describe the role of skin and mucous membranes in nonspecific resistance and differentiate between mechanical and chemical factors 3. List additional examples of the “first line of defense” 4. Classify phagocytic cells and describe the roles of neutrophils and macrophages 5. Describe the stages of inflammation and their relationship to nonspecific resistance 6. Discuss the role of fever I nonspecific resistance 7. Discuss the function of complement 8. Discuss the role of interferon

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<p>16. Understand the principles of both active and passive immunization</p>	<ol style="list-style-type: none"> 4. Compare and contrast the 5 classes of immunoglobulins 5. Describe the clonal selection theory 6. Identify the consequences of antibody-antigen reaction 7. Distinguish between a primary and secondary response 8. Outline the procedure for making monoclonal antibodies 9. Describe the functions of the different types of T-cells 10. List several different cytokines, their functions, and the specific cells from which they are secreted
<p>17. Develop and understanding of hypersensitivity, autoimmune disorders, and immunosuppression.</p>	<ol style="list-style-type: none"> 1. List the types of preparations available for passive immunization as well as an appropriate use for each 2. Compare and contrast the various types of vaccines 3. Identify the vaccines which are in frequent use as well as the type of preparation used in each case <ol style="list-style-type: none"> 1. Define shocking dose, sensitizing dose, and desensitization 2. Describe the mechanism of anaphylaxis 3. Describe the mechanism of cytotoxic reaction and how drugs can induce them 4. Describe the basis of the human blood group systems and their relationship to blood transfusion and hemolytic disease of the newborn 5. Describe the mechanism for cell-mediated reactions 6. Give examples of the type II, type III, and type IV autoimmune disorders 7. Define HLA and its importance in tissue transplantation

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<p>18. Develop an understanding of the major infectious diseases</p>	<ol style="list-style-type: none"> 8. Explain how rejection of a transplant occurs and how it can be prevented 9. Discuss the immunosuppression which accompanies AIDS including the more commonly occurring opportunistic infections and therapies 1. Describe the infectious agent, the route of transmission, the reservoirs, the signs/symptoms, the therapy, and prevention of the major infectious diseases of the human 2. Discuss post-streptococcal sequellae 3. List the infectious diseases which are capable of producing congenital defects 4. Compare food infection and food intoxication 5. List the infectious agents which are commonly carried by healthy humans 6. Discuss the infectious agents which are sometimes transmitted to human from infected animals 7. Compare acute and subacute endocarditis 8. Discuss the importance of granuloma formation in disease and list several diseases where granulomas are formed 9. List several diseases which predispose a person to cancer later in life 10. Describe the diseases which lead to latency 11. Discuss the problem of multiple drug resistance