

**LANDMARK UNIVERSITY OMU ARAN
COLLEGE OF SCIENCE AND ENGINEERING
DEPARTMENT OF BIOLOGICAL SCIENCES**

Omega 20115/16

COURSE COMPACT

Course Code: MCB 421

Course Title: Pharmaceutical Microbiology and Antimicrobial Agents (2 Units)

Course status: Compulsory

Course Duration: Two hours per week for 14 weeks (28 hours)

Course Lecturers: **Irokanulo** E O., (PhD Applied Microbiology)
Ndako James, (Medical Microbiology)

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Office Location: CSE Building Room A312 and A308

Consultation Hours: Monday – Fridays (Lecture free hours not later than 6pm)

Course Content:

Overview of Pharmaceutical Microbiology and Antimicrobial agents; Nature of Antimicrobial Phenomenon: Origin of antimicrobial phenomenon; Antimicrobial agents; Antibiotic resistance; Physical and Chemical Antimicrobial Agents: Physical and chemical control of microbial growth; Mechanism of action of specific anti microbials; Isolation and Production methods of Antibiotics from microorganisms: Antibiotic producing microbes; Isolation methods; Antimicrobial Substances of Plant origin: *Antibacterial Activity of naturally occurring compounds* from plants; New antimicrobials of plant origin; Testing antimicrobial agents: Standard test methods for determining antimicrobial agents; Tests for bacteriocidal and bacteriostatic effects of antimicrobial agents; Drug spoilage and preservation: Methods and principles of preservation of pharmaceutical, drug and drug products; Drug contamination and spoilage; Mechanism of drug spoilage; Practical; Tutorials

Course Description:

The course will commence with an introduction and overview of pharmaceutical microbiology and antimicrobial agents. This will be followed by elaboration and detailed discussion on the phenomenon: antimicrobial agents. The course will also evaluate the origin, spread and consequences of antimicrobial resistance in treatment of diseases especially those that are highly

contagious. The role that antimicrobial resistance has played in drug development in recent years will be taught. The course will also examine the mechanisms involved for the transfer of resistance from one organism to another. The isolation and production methods of antimicrobials from plant, microorganisms and other sources will be taught. Other subjects that will be taught include; microbial susceptibility to antimicrobials and factors that do enhance or retard their effectiveness, drug preservation, drug products, contamination of drugs and mechanism of drug spoilage

Course Justification:

The role that microorganisms play in drug and antibiotic interaction is essential to drug effectiveness and must be properly understood for better application. A course in pharmaceutical microbiology will help elucidate to a large extent some of these and prepare the students for future endeavour in research, diagnosis and in industry.

Course Objectives

At the end of the course, students will be able to;

- Describe what Pharmaceutical microbiology and Antimicrobial agents are.
- Understand the interrelationship between microorganisms and drugs
- Explain the role that microbes and plants play in antibiotic production
- Describe the methods of producing antimicrobial agents
- Describe the methods of Testing antimicrobial agents

Course Requirement:

Appropriate texts (books, journals and access to E- learning) for reference are important. Pharmaceutical microbiology involves among others, the handling and manipulation of microorganisms. Therefore, a course in pharmaceutical microbiology will require that every participating student in addition to having the relevant study materials, also understands the dangers associated with exposure and handling of the microorganisms. Students are therefore required to acquaint themselves with necessary personal protective equipment (PPE) that they need for handling and processing materials meant for drug assays.

Method of Grading:

	Grading	Score (%)
1	Assignment	10
2	Practical	5
3	Test	15
3	Final Examination + Practical	70
4	Total	100

Method of Lecture Delivery / Teaching:

- 1 The use of multimedia will be adopted in normal lecture delivery. This will be complemented with assignments, tests, tutorials. Practical sessions for testing of antimicrobial agents on microorganisms will also be organized to enable students learn to manipulate microorganisms for antibiogram assays.
- 2 Students will be taught various techniques used in the isolation, purification and standardization of antibiotics from plants and microorganisms.

A. Course Outline

Contents/topic	Teacher
<p>Week 1: Introduction: What is Pharmaceutical Microbiology and Antimicrobial agents</p> <p>Objective: <i>At the end the course, students will appreciate the relationship between microbiology and pharmaceutical science as well as the role of microorganisms in the manufacture of pharmaceuticals (drugs, vaccines). In addition, students will understand the need or otherwise to exclude specific strains of microorganisms that are regarded as objectionable in living things and other materials.</i></p> <p>Description: <i>Understanding the over-riding interest in pharmaceutical microbiology; role of microbiologist in pharmaceutical formulations; study of microorganisms associated with the manufacture of pharmaceuticals (drugs, vaccines to medical devices).</i></p> <p>Study Question: What is Pharmaceutical Microbiology?</p>	E. O. Irokanulo
<p>Week 2: Nature of Antimicrobial Phenomenon: Origin of antimicrobial phenomenon</p> <p>Objective:</p> <ul style="list-style-type: none">- <i>To appreciate the phenomenon surrounding antibiotic evolution and the history of antibiotic resistance which is now known as a “modern phenomenon “.</i> <p>Description:</p> <ul style="list-style-type: none">- <i>Students will learn and appreciate the history of antibiotics and early contributors to this discovery.</i>- <i>Drug innovation and use in human and animal health and agriculture.</i> <p>Study Question: The reality of antimicrobials and their origin.</p>	E. O. Irokanulo

<p>Week 3: Antimicrobial agents</p> <p>Objective: <i>The students will learn what antimicrobials are, their role in combating infectious and other microbial diseases and their uses.</i></p> <p>Description:</p> <ul style="list-style-type: none"> - <i>The various forms in which antimicrobial agents can present (synthetic chemicals as well as chemical substances or metabolic products made by microorganisms and chemical substances derived from plants).</i> <p>Study Question: What antimicrobial agents are and the different forms in which they can present.</p>	<p>E. O. Irokanulo</p>
<p>Week 4: Antibiotic resistance</p> <p>Objective: <i>The students will learn how antimicrobial resistance in microorganisms develops and is transferred from one organism to another. They will also understand the consequences that antimicrobial resistance pose to health care delivery particularly in developing economies and the challenges this pose to drug development.</i></p> <p>Description:</p> <ul style="list-style-type: none"> - <i>The natural biological phenomenon – antibiotic resistance.</i> - <i>Causes of antibiotic resistance.</i> - <i>How the phenomenon is transferred.</i> - <i>Consequences of antibiotic resistance.</i> <p>Study Question: Mechanism of antibiotic resistance</p>	<p>E. O. Irokanulo</p>
<p>Week 5: Physical and Chemical Antimicrobial Agents: Physical and chemical control methods of microbial growth.</p> <p>Objective: <i>The students will learn and understand basic forms and application of commonly used methods of disinfecting materials and the role that antimicrobial agents play in agriculture, medicine, food science and biotechnology. They will also learn and appreciate the different physical and chemical agents that can be used.</i></p> <p>Description:</p> <ul style="list-style-type: none"> - To understand the relative resistance of microbial forms. - To understand the general terms often used in physical and chemical antimicrobial agents and their principles of action. - To understand how microbial death occurs and the factors that can mediate such. <p>Study question: Physical and chemical control methods of microorganisms</p>	<p>E. O. Irokanulo</p>

<p>Week 6: Mechanism of action of specific antimicrobials</p> <p>Objective: <i>The students will learn and appreciate the different types of antimicrobials and classes of antibiotics. They will also be taught the modes of action by the antimicrobials.</i></p> <p>Description:</p> <ul style="list-style-type: none"> - An overview of antimicrobial agents and their actions. - To understand the drug targets in bacteria, viruses and fungi. - To understand factors that could disrupt the intended action of the antimicrobials. <p>Study question: The principle of selective toxicity.</p>	<p>E. O. Irokanulo</p>
<p>Week 7: Isolation and Production methods of Antibiotics from microorganisms: Antibiotic producing microbes</p> <p>Objective: <i>The students will learn, know and understand useful antibiotics and their screening process from microorganisms and other sources.</i> <i>Students will learn the different methods and sources for the production of antibiotics</i></p> <p>Description:</p> <ul style="list-style-type: none"> - Antibiotic producing microbes and their sources. - The isolation, purification and characterization of antibiotics producing microorganisms. - Test for selective toxicity and therapeutic activities of isolated drugs. <p>Study question: Screening methods for antibiotics.</p>	<p>E. O. Irokanulo</p>
<p>Week 8: Isolation methods</p> <p>Objectives: <i>Students will learn and know of other sources of antibiotic production, their purification and concentration.</i></p> <p>Description:</p> <ul style="list-style-type: none"> - Commercial production of antibiotics - Synthetic forms of antibiotics, their advantages and shortcomings. <p>Study question: Screening methods for antibiotics</p>	<p>E. O. Irokanulo</p>
<p>Week 9: Practical</p> <p>Objective: <i>The students will engage in practical sessions on identifying antibiotic producing microorganisms, harvesting and concentration of antibiotics.</i></p>	<p>Ndako J</p>

<p>Week 10: Practical Objective: <i>The students will engage in practical sessions on antibiotic susceptibility methods against different bacteria.</i></p>	Ndako J
<p>Week 11: Assignments/ Test</p>	E. O. Irokanulo
<p>Week 12: Tutorial Objective: <i>The students will engage in group discussions to review of earlier topics (Weeks 1 – 8) for better understanding and application.1</i></p>	E. O. Irokanulo
<p>Week 1: Antimicrobial Substances of Plant origin: Objective: <i>The students will learn of the antibacterial activity of naturally occurring compounds from plants.</i> Description: <ul style="list-style-type: none"> - Historical perspective of medicinal plants. - Plant products as antimicrobial agents. - Identification and uses of medicinal plants in treating microbial diseases. </p>	Ndako J
<p>Week 2: New Antimicrobials of Plant Origin Objective: <i>Plants with promising antimicrobial activity. Development of phytomedicines and the ethnomedicinal approach</i> Description: <ul style="list-style-type: none"> - Present use of plants as antimicrobials (<i>Therapeutic and economic benefits of plant antimicrobials</i>). - Plants with promising antiinfective activity. </p>	Ndako J
<p>Week 3: Testing antimicrobial agents: Objective: <i>Students will learn the standard test methods for determining antimicrobial agents.</i> Description: <ul style="list-style-type: none"> - Standardized methods for in-vitro antibacterial and antifungal susceptibility. - Susceptibility of organisms to systemic and topical agents. </p>	Ndako J

<p>Week 4: Tests for bacteriocidal and bacteriostatic effects of antimicrobial agents</p> <p>Objective: <i>Students will learn of the bacteriostatic and bacteriocidal mechanism in treatment of infectious diseases.</i></p> <p>Description :</p> <ul style="list-style-type: none"> - Clinical relevance of bacteriostatic and bacteriocidal effects of drugs in treatment of infectious diseases. - To learn the tests for determining bacteriocidal and bacteriostatic effects of antimicrobial agents. 	Ndako J
<p>Week 5: Drug spoilage and preservation:</p> <p>Objective: <i>students will learn what factors that predispose drug spoilage and how these antimicrobial may be preserved.</i></p> <p>Description:</p> <ul style="list-style-type: none"> - Microbial spoilage and preservation of pharmaceutical products. - Discerning the nature and phenotypic appearance of spoilt drugs and pharmaceuticals. - Methods and principles of preservation of pharmaceuticals, drug and drug products. 	Ndako J
<p>Week 6: Drug contamination and spoilage</p> <p>Objective: <i>The students will learn at the end of the course how the contamination of pharmaceuticals with microorganisms take place as well as how to prevent such occurrence.</i></p> <p>Description:</p> <ul style="list-style-type: none"> - Conditions associated with contamination of pharmaceuticals with microorganisms. - Effects of contamination of pharmaceuticals with microorganisms. 	Ndako J
<p>Week 7: Mechanism of drug spoilage</p> <p>Objective: <i>The students should learn the physical, chemical and microbiological principles that lead to drug spoilage.</i></p> <p>Description: Mechanism and rate of drug degradation. Microbial, physical and chemical means of drug degradation.</p>	Ndako J
<p>Week 8: Practical</p>	Ndako J
<p>Week 9: Practical</p>	Ndako. J

Week 10: Practical	Ndako .J
Week 11: Tutorial	Ndako. J
Week 12: Tutorial	Ndako. J

Ground Rules and Regulation:

1. Punctuality
2. Dedication and Diligence

Alignment with Goals and Vision of Landmark University:

To prepare the students and harness their potential for future challenges in applied research into drug and vaccine development against human, animal and plant diseases .

Contemporary Issues / Industry Relevance:

Understanding the relationship between microorganisms and drugs: their importance to man and plants and application in the cure of disease

Recommended Reading:

Prescott's Microbiology, 8th ed. (International ed. 2011)

Todar's Textbook of Bacteriology (Kenneth Todar PhD)

Microbiology Clinical: Bruker

R. SMART and D. F. SPOONER (1972) J. Soc. Cosmet. Chem. 23 721-737 , 1972 Society of Cosmetic Chemists of Great Britain. Pp 721 -738

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Bruker Corporation: Pharmaceutical Microbiology

Industrial Pharmaceutical Microbiology: Standards & Controls - 2015 Edition
edited by Geoff Hanlon and Tim Sandle

Prepared by E. O. Irokanulo