

CORE COURSES

16.4 BMS801 Advances in Molecular Cell Biology

(1+1)

- Cell structure and organization, Cell signaling pathways
- The language of genetics and the terminology of molecular biology. Molecular genetics like DNA structure and function replication, transcription, protein synthesis and enzymology, DNA recombination, gene structure, function and regulation • Molecular cloning and molecular tools for studying genes and gene activity

16.5 Course Objectives:

Upon completion of course the students will be able to:

1. Comprehend in details the cell structure and organization
2. demonstrate the methods of DNA replication, transcription, protein synthesis and enzymology
3. discuss the molecular genetics of like DNA recombination, gene structure, function and regulation as well as cell signaling pathways and cancer
4. Have expertise in molecular cloning and molecular tools for studying genes and gene activity

16.6 Course Contents:

The course contents will include; Introduction to the Study of Cell Biology, The Chemical Basis of Life, Techniques in Cell and Molecular Biology, Enzymes and Metabolism, Mitochondrion and Aerobic Respiration, The Structure and Function of the Plasma Membrane, Cytoplasmic Membrane Systems, Interactions Between Cells and Their Environment, The Nature of the Gene and Genome, Expression of Genetic Information, Cytoskeleton and Cell Motility, Cellular Reproduction, Cell Signaling and Cancer. Methods in molecular biology; Transcription in Prokaryotes & Eukaryotes; RNA Polymerase & their promoters, Transcription Factors & Activators, Chromatin Structure and its effects on Transcription; Posttranscriptional events: Splicing, Capping & Polyadenylation; Translation Mechanism: Initiation, Elongation & Termination; Ribosomes & Transfer RNA; DNA Replication, Recombination and Transposition: Mechanism & Enzymology; Homologous Recombination; Site-specific Recombination & Transposition.

16.7 Recommended Books:

1. Karp, Gerald. Cell and Molecular Biology: Concepts and Experiments with Student Study Guide John Wiley & Sons, Latest Ed.
2. David S. Latchman. Basic Molecular and Cell Biology Wiley Blackwell, Latest Ed.
3. Stephen L. Wolfe. Introduction to Cell and Molecular Biology. Wiley Blackwell, Latest Ed.

4. Lizabeth A. Allison. Fundamental Molecular Biology. Wiley Blackwell, Latest Ed.
5. Harvey Lodish et. al., Molecular Cell Biology. W.H. Freeman & Co, Latest Ed.
6. Robert Weaver, Molecular Biology, McGraw Hill, Latest Ed.

16.8 Journals:

1. Biology of the Cell
2. Nature Cell Biology
3. Cell & Tissue Research
4. Journal of Cellular Physiology
5. Journal of Cellular Biochemistry
6. Journal of Molecular Cell Biology
7. Molecular and Cellular Endocrinology
8. Cellular Physiology and Biochemistry
9. Nature Reviews Molecular Cell Biology
10. International Journal of Biochemistry and Cell Biology

- The course is a requirement for all pre- and postdoctoral fellows. It consists of eight 2 hour sessions given in the first half of the spring semester. For all but the first sessions, a lecture to the whole class lasting 30 to 50 minutes will be followed by small group discussions which will involve case presentations.

16.10 Course Objectives:

Upon completion of course the students will be able to:

1. Comprehend basics of research in light of the modern ethics
2. Comprehend basic knowledge of the ethical issues in biomedical research
3. Select and design research project and critically analyze and communicate scientific data
4. Analyze literature critically and comprehend the foundations of Bioethics theories
5. how to deal with patients within the boundaries of biomedical ethics
6. how to improve the basic health care services on ethical grounds

16.11 Course Contents:

The course will include introduction to medical/bioethics, Ethical Theories, Historic perspective of bioethics in the development of vaccines and medicine and clinical trials, The Four Basic Principles of bioethics and their importance in research, Ethical justification and scientific validity of biomedical research involving human subjects, Ethical review committees. Ethical review of externally sponsored research, Obtaining informed consent: Essential information for prospective research subjects, Inducement to participate in research, Benefits and risks of study participation, Ethical justification of research involving individuals who are not capable of giving informed consent, Children, mentally retarded, behavioural disorders, Choice of control in clinical trials, and Research involving vulnerable persons, children, women and pregnant women. Safeguarding confidentiality, Bioethical research involving animals and research misconduct.

16.12 Recommended Readings:

1. Good Medical Practice (2013); General Medical Council
2. CIOM Guidelines available online
3. Beauchamp T, Childress J; Principles of Biomedical Ethics, 7th Edition. Oxford University Press.
4. Antoniou SA, Antoniou GA, Granderath FA, et al; Reflections of the Hippocratic Oath in modern medicine. World J Surg. 2010 Dec;34(12):3075-9. doi: 10.1007/s00268-010-0604-3.
5. Good Medical Practice - Explanatory Guidance; General Medical Council
6. Managing a child or young person with suspected maltreatment; NICE CKS, March 2014 (UK access only)

7. Confidentiality and information sharing; National Treatment Agency for substance misuse, 2003
8. Consent guidance; General Medical Council
9. John Arras and Bonnie Steinbock. *Ethical Issues in Modern Medicine*, Mayfield, Latest Ed.
10. Françoise Baylis, Jocelyn Downie, Benjamin Freedman, Barry Hoffmaster, and Susan Sherwin. *Health Care Ethics in Canada*. Harcourt Brace, Latest Ed.
11. Tom L. Beauchamp and James F. Childress. *Principles of Biomedical Ethics*. Latest Ed. Oxford University Press.
12. Jonathan Glover, *Causing Death and Saving Lives*. Penguin Books, Latest Ed.
13. Glenn C. Graber and David C. Thomasma. *Theory and Practice in Medical Ethics*. Continuum, Latest Ed.
14. Thomas A. Mappes and David Degrazia. *Biomedical Ethics*, 4th ed. McGraw-Hill, Latest Ed.
15. Ronald Munson and Christopher A. Hoffman. *Intervention and Reflection: Basic Issues in Medical Ethics*. Latest Ed. Wadsworth.
16. Gregory E. Pence. *Classic Cases in Medical Ethics*. 2nd ed., McGraw-Hill, 1990.
17. Michael Yeo. *Concepts and Cases in Nursing Ethics*. Broadview, Latest Ed.
18. Françoise E. Baylis. *The Health Care Ethics Consultant*. Humana Press, Latest Ed.

16.13 Journals:

1. American journal of bioethics
2. Journal of medicine and philosophy
3. Bioethics
4. Cambridge Quarterly of Healthcare Ethics
5. Hastings Center Report
6. Journal of Clinical Ethics
7. Journal of Medical Ethics
8. Journal of Medicine and Philosophy
9. Kennedy Institute of Ethics Journal

16.14	BMS803 Applied Biostatistics-II	(1+1)
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- principles of various study designs
- how to design a study and describe the validity and reliability of a study design
- fundamental concepts and methods of statistics in the areas of medical and biological Research.
- Have good command on use of statistical computer software for data analysis

16.15 Course Objectives:

Upon completion of course the students will be able to:

1. Comprehend basics of epidemiology and principles of various study designs
2. To design a study and describe the validity and reliability of a study design
3. Comprehend concepts and methods of statistics in Biomedical research
4. Have good command on use of statistical computer softwares for data analysis

16.16 Course Contents:

The course contents will include; Descriptive epidemiology, analytic epidemiology and epidemiological inference, Classification, morbidity and mortality rates, ratios, incidence, prevalence, sampling, screening, epidemiological models, Types of study design; their importance, uses, and limitations, field trials, controlled epidemiological surveys, sources of bias and causal models.

Introduction to statistics, types of statistical applications, population and samples, data analysis and presentation, variables, elementary statistical methods, tabulation, chart and diagram preparations, measures of central tendency and dispersion, sampling techniques and sample size estimation, probability and proportions, Tests of significance; normal test, t test, Chi square test etc, correlation and its applications, linear regression and multiple regression, logistic regression, sign test, Wilcoxon signed rank test, Mann Whitney test, Kruskal Wallis test, Spearman rank correlation, Clinical trials and intervention studies, Measures for developing health statistical indicators: morbidity and mortality statistics, Use of latest statistical computer softwares for data analysis.

16.17 Recommended Readings:

1. Biostatistics, A foundation for analysis in health sciences by Wayne W. Daniel.
2. Gordis, L. Epidemiology. Pennsylvania: W.B. Saunders Company. Latest Ed.
3. Rothman KJ. Modern Epidemiology. Boston: Little, Brown and Company, Latest Ed.

4. Kelsey JL, Thompson WD, Evans AS. Methods in Observational Epidemiology. New York: Oxford University Press, Latest Ed.
5. Kleinbaum DG, Kupper LL, Morgenstern H. Epidemiologic Research: Principles and Quantitative Methods. Belmont, CA: Lifetime Learning Publications, Latest Ed.
6. Lilienfeld DE, Stolley PD. Foundations of Epidemiology. New York: Oxford, Latest Ed.
7. Daniel WW. Biostatistics: A Foundation for Analysis in the Health Sciences. Latest Ed. John Wiley & Sons. Inc. New York.
8. Larson R and Farber B. Elementary Statistics: Picturing the World. Latest Ed, Prentice Hall Publications. USA.
9. Oliver, M. and Combard MS. Biostatistics for Health Professions. Latest Ed. Prentice Hall Publications, New Jersey.
10. Statistical Software: SPSS; EPIINFO; STATA; SAS

16.18 Journals:

1. Cancer Epidemiology
2. Epidemiologic Reviews
3. Annals of Epidemiology
4. American Journal of Epidemiology
5. International Journal of Epidemiology

16.19

BMS804 Presentation and Scientific writing skills

(1+1)

- Present and communicate research articles/research data in conferences and symposia. Critically analyse data, design a project and write up research proposals. Design experiments in the field of biological sciences.
- Collect information from the available resources, Prepare a presentation on a given topic, Deliver a lecture and manage a question-answer session
- Work as a productive member of a task force

16.20 Course Content

Here is the tentative list of topics to be covered in this course. This list is subject to change based on class progress and the instructors' discretion.

1. Introduction

- a. Basics of research

- b. Types of scientific communication
- c. Examples of different types of scientific communication
 - Original research articles
 - Research proposals ○
 - Review articles ○
 - Conference abstract ○
 - Really good stuff ○ Short
 - communications ○ Special
 - communications

2. Scientific Literature

- a. Searching the scientific literature
- b. Using online search engines
- c. Refereed journal?
- d. Plagiarism

3. Computer skills

- a. Using Computer technology
 - a. Microsoft Word
 - b. Formatting (including margins, tabs, indents, justification, etc)
 - c. Using the table feature
 - d. Creating tables of content
 - e. Microsoft Excel
 - f. Creating tables, charts, graphs

4. Poster Presentations

- a. Organization and formats for posters
- b. Using Microsoft power point

5. Oral Presentations

- a. Designing and preparing slides for an oral presentation
- b. Importing tables, charts and graphs from Excel
- c. Optimizing pictures for use in presentations
- d. Using visual aids without overdoing it
- e. Using Microsoft Power point

6. Synopsis development and steps to AS&RB

7. Thesis Writing

- a. Beginning to Write
- b. Establishing your constraints
- c. Organizing your writing
- d. Preparing outlines
- e. Standard formats for scientific papers, research projects and theses
- f. Style guides

b. Content

- a. Creating a literature review
- b. Preparing other sections of a research report (abstract, introduction, materials and methods, results and discussion, conclusions)
- c. Including and summarizing research data

c. Using Word to prepare thesis

- a. Thesis template formation
- b. Step wise guide to write thesis
- c. Some tricks and tips

d. Style and grammar

- a. Scientific writing style
- b. First-person vs. Third-person; Passive vs. active voice
- c. Avoiding excessive wording
- d. Grammar
- e. Avoiding misuse of words
- f. When to use footnotes

e. Reference citations

- a. How to use references
 - Within the text
 - How to make lists of references

f. Revising

- a. Dealing with revisions
- b. Accepting criticism
- c. Making sense of supervisors'/reviewers' comments

- d. Making the changes
- e. What to do if you don't agree with supervisor's/ reviewers' comments

16.21 Resources

Textbooks: Two books are required for this course:

1. How to Write and Publish a Scientific Paper. 6th Edition. Authors: Robert A. Day and Barbara Gastel.
ISBN: 0-313-33040-9
2. Alley, M. 2003. The Craft of Scientific Presentations: Critical steps to succeed and critical errors to avoid.
Springer, NY. 241 pages. ISBN:0-387-95555-0.

Laptops are must for the whole course

16.22 Assessment:

Students will be assessed on the following assignments containing 20 marks each:

- Assignment 01: Literature review
- Assignment 02: Drafting of research proposal
- Assignment 03: Presentation on review of a scientific paper
- Assignment 04: Power point presentation of research proposal
- Assignment 05: Poster presentation

16.23 BMS805 Biosafety and Biosecurity (1+0)

16.24 Course Objectives:

1. To empower students with the skills, tools, and confidence on sustainable bio-risk management.
2. To enable them to apply principles of biosafety and biosecurity in facilities.
3. To reduce/eliminate the risk of infection in laboratory setting.

16.25 Course Contents:

1. BRM introduction, scope & importance
2. Terminology
3. AMP Model – brief introduction
4. Biorisk assessment
 - a. Hazards & threat identification & analysis (frequency and magnitude) b. Levels of biological risks
 - c. Likelihood & consequences evaluation
5. Biorisk mitigation – introduction/ brief account of a-e
 - a. Elimination & substitution
 - b. Engineering control

- c. Administrative control
 - d. Practices & procedures
 - e. PPE
- 6. Performance – introduction
 - a. Key elements of performance
 - b. Control (monitoring protocols)
 - c. Assurance
 - d. Improvement
- 7. **Biosafety** – Introduction, purpose, requirement
 - a. Biosafety Levels – brief description of levels 1 – 4
 - b. BSL-1
 - c. BSL-2
 - d. BSL-3
 - e. BSL-4
 - f. Laboratory Design & Facilities
- 8. GLWPs - importance
 - a. Responsibility for enforcing GLWPs
 - b. Barriers to glwps
 - c. Lab equipment calibration & validation
- 9. PPE, **Biosecurity** – introduction, principles, history, objective
 - a. Key pillars of biosecurity
 - Physical security
 - Personal management
 - Information security
 - Transport security
 - Material control & accountability
 - b. Incident Management: Scope
 - c. Incident response system
 - d. Incident reporting
- 10. Waste management: Collection, segregation, transportation, storage & disposal
- 11. Decontamination

SPECIALITY COURSES *(Per Program Ref. Section 15.2.1)*

17 PHARMACOLOGY DEPARTMENT (PhD Pharmacology)

17.1 Overview

CORE/COMPULSORY COURSES	First/Fall Semester	(08 CREDITS PLUS 1)
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BMS-801 Advances in Molecular Cell Biology	(1+1)
BMS-802 Ethics for Research Scientists	(1+0)
BMS-803 Applied Biostatistics-II	(1+1)
BMS-804 Presentation and Scientific writing skills	(1+1)
BMS-805 Biosafety and Biosecurity	(1+0)
BMS-806 Research rotations (two)	(1+0) Elective

Other elective courses as appropriate for interest of student

No of credit hours for compulsory courses	(8+1)
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SPECIALITY COURSES	Second/Spring Semester	(08 CREDITS PLUS 1)
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PHM- 801: TECHNIQUES IN DRUG DESIGNING	(2+1)
PHM- 802: ADVANCES IN PHARMACOKINETICS	(1+0)
PHM- 803: CLINICAL PHARMACOLOGY II	(2+0)
PHM- 804: MOLECULAR PHARMACOLOGY	(2+0)
BMS-807 Teaching rotation (Elective choice)	(1+0)

No. of credit hours for specialty courses	(8+1)
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RESEARCH	Third to Sixth Semester	(06 CREDITS)
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BMS-899 Dissertation Research	(6 CREDITS)
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Student shall propose and complete a research project under the guidance of a faculty member

17.2 PHM- 801: TECHNIQUES IN DRUG DESIGN**(2 +1)****17.3 Course Objectives:**

Upon completion of course the students will be able to:

1. Understand different challenges in drug discovery
2. Comprehend knowledge and analytical techniques applied to drug development.
3. Analyze the bioactive compounds
4. Know various analytical methods assessing the purity

17.4 Course Contents

1. **Extraction:** Various methods of extractions.
2. **Fractionation:** Give concept of polarity of organic solvents and fractionation of natural products on the basis of polarity for pharmacological screening.
3. **Separation Techniques:** Need for learning separation techniques, separation techniques in natural product research and drug discovery, extraction techniques.
4. **Chromatography:** General principles, classification of chromatographic techniques, normal and reversed phase, bonded phase chromatography, stationary phases, activity of stationary phases, elutropic series, and separation mechanisms.
5. **Column chromatography:** column packing, sample loading, column development, detection.
6. **Flash chromatography and Vacuum liquid chromatography:** objectives, optimization studies, selecting column and stationary phases, selecting suitable mobile phases, automated flash chromatography, and reverse phase flash chromatography.
7. **High Pressure Liquid Chromatography (HPLC):** Principles, instrumentation, peak shapes, capacity factor, selectivity, plate number, plate height, resolution, band broadening, pumps, injector, detectors, columns, column problems, gradient HPLC, HPLC solvents, trouble shooting, sample preparation, method development.
8. **Gas chromatography:** principles, instrumentation, split-less injector, head space sampling, columns for GC, detectors, quantification.
9. **Biochromatography:** Size exclusion chromatography, ion exchange chromatography, ion pair chromatography, affinity chromatography general principles, stationary phases and mobile phases.
10. **Gas chromatography:** Introduction to GC-MS and LC-MS techniques and their application in natural products.

17.5 Recommended Readings:

1. Applied Thin Layer Chromatography, 2nd edition Elke Hahn Deinstrop
2. Wiley-VCH
3. HPLC Made to Measure: A Practical Handbook for Optimization Stavros Kromidas
4. Wiley-VCH
5. Thin Layer Chromatography: A Modern Practical Approach Practical HPLC method development
6. Lloyd R. Snyder, Joseph J. Kirkland and Joseph L. Glajch John Wiley and Sons
7. Braun RE, (1987) "Introduction to instrumental analysis" McGraw Hill Book Co. NY.
8. Bryant R, (1989) "The pharmaceutical quality control hand book" Aster Pub. Corp. Eugene. USA
9. Pakistan Pharmacopeia, (1973)
10. British Pharmacopeia (1993).
11. USP (1996).

12. Chapman JR, (1986) "Practical organic Mass Spectroscopy" John-Wiley & Sons. NY

17.6 PHM-802- ADVANCES IN PHARMACOKINETICS 1+0 Credit Hrs

17.7 Course Objectives:

Upon completion of course the students will be able to:

1. Comprehend basic knowledge of pharmacology
2. Comprehend knowledge of pharmacokinetics
3. Discuss the types of adverse drug reactions and outline the process of drug development and approval
4. Comprehend the mechanism of drugs action, bioavailability and excretion
5. Apply knowledge to impact changes that can positively impact basic and clinical research

17.8 Course Contents:

The course contents of this subject include, absorption distribution metabolism and elimination, Mechanism of drug absorption, physiochemical, biological and pharmaceutical factors affecting drug absorption through GIT, Drug disposition, Protein and tissue binding, Bioavailability and bioequivalence, Pharmacokinetic characterization of drugs, nonlinear pharmacokinetics, Physiologic pharmacokinetics models

17.9 Recommended Readings:

1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed.
2. Basis of Pharmacology by Goodman & Gillman Latest Ed.
3. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed.
4. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
5. Physicochemical Principles of Pharmacy, Fourth Edition Alexander T. Florence and David Attwood Pharmaceutical press
6. Pharmaceutical Dissolution Testing Jennifer Dressman and Johannes Kramer Taylor and Francis

17.10 Journals:

1. Acta Pharmacologica Sinica
2. Journal of Clinical Pharmacology
3. Biomedicine and Pharmacotherapy
4. European Journal of Pharmacology
5. Teaching and Learning in Medicine
6. British Journals of Clinical Pharmacology
7. Pharmacology, Biochemistry and Behaviour
8. European Journal of Clinical Pharmacology
9. Canadian Journal of Physiology & Pharmacology
10. Clinical and Experimental Pharmacology and Physiology

17.11	PHM: 803 Clinical Pharmacology II	2+0 Credit Hrs
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17.12 Course Objectives:

Upon completion of course the students will be able to:

1. Define a clinical trial
2. Define social process and Social change
3. Understand personality and interpersonal skills that may be helpful for understanding patients' profile, research colleagues' profile and dynamics of team members of clinical trials
4. Comprehend basic knowledge for carrying out of clinical trials.
5. Know current legislation of PAKISTAN regarding clinical trials and clinical studies
6. Know about the FDA rules and regulations for regulation of a clinical trial.
7. Understand the concept of a clinical trials
8. Design a clinical trial in clinical set up of local environment
9. Apply techniques of extrapolation based on findings of a trial

17.13 Course Contents:

The course contents of this subject include; social processes, social change, interpersonal skills, personal and group dynamics, definition of Clinical trial, types of clinical trial, registration of a clinical trial, regulation of a clinical trials, biasness and how to minimize the biasness, Current legislation of Pakistan related to drug research, FDA rules to regulate clinical research, interpretation of results of a clinical trial and its extrapolation.

17.14 Recommended Readings:

1. Basic & Clinical Pharmacology by Katzung 12th Edn.
2. Basis of Pharmacology by Goodman & Gillman Latest Ed.
3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
4. The manuals of Drug Laws
5. SROs on the websites of Drug Regulatory Authority of Pakistan/PM&DC/ Pharmacy Council of Pakistan.
6. The psychology of prejudices and discriminations Living churchil latest edition

17.15 Journals: Acta Pharmacologica Sinica

1. Journal of Clinical Pharmacology
2. The American Journal of Medicine
3. European Journal of Pharmacology
4. Biomedicine and Pharmacotherapy
5. Pharmacology, Biochemistry and Behaviour

6. European Journal of Clinical Pharmacology
7. Canadian Journal of Physiology & Pharmacology
8. Clinical and Experimental Pharmacology and Physiology

17.16

PHM 804: Molecular Pharmacology

2+0 Credit Hrs

17.17 Course Objectives:

Upon completion of course the students will be able to:

1. Outline various receptor-ligand (drug) interaction models
2. Review the principles of drug metabolism on molecular level
3. Interpret the genetic variations leading to changes in drug metabolism among the group of metabolizers.
4. List different epigenetic mechanisms governing expression of different genes.
5. Identify drugs that act through epigenetic mechanism by lab analyses
6. Review different types of enzymatic reactions exploitable by drug intervention.
7. Evaluate the changes in enzymes activity under various conditions through a defined lab protocol.
8. Compare DNA damages in a lab due to different toxins &/or drugs.
9. Evaluate and characterize anticancer mechanism of drugs.

17.18 Course Content

- I. Genomic Regulation of Drug Actions
 - A. Introduction to Pharmacogenetics and Personalized medicine
 - B. Genetic basis of drug response and roles of single nucleotide polymorphisms, copy number variation, tandem repeat polymorphisms; gene insertion and deletion; gene duplications; alternative splicing & their effects on drug
 - C. Drug Metabolism affected by polymorphisms in Cytochrome P450 isoforms.
- II. Drugs Acting Through Epigenetic Mechanisms
 - A. Fundamentals of Epigenetics
 - B. Examples of Drugs Acting Through Epigenetic Mechanisms
- III. Signal Transduction and Modulation
 - A. Types of Secondary Messengers
 - B. Types of Receptors including
 - C. Regulation of inter and intra cellular signalling
- IV. Molecular Pharmacology of Enzymes
 - A. Types of Enzymes on the basis of their mechanism of action
 - B. Effects of different drugs on enzyme function
- V. Pharmacology of Transcription and Translation
 - A. Different types of post-transcriptional and translational modifications.

- B. Induction and inhibition of gene expression
- C. Intervention at post-translational levels by modulating protein kinases and phosphatases
- VI. Regenerative medicine and gene therapy
 - A. Stems cells, their classification and features
 - B. Stem cell-based drugs
 - C. Cell therapy and regenerative medicine
 - D. Gene therapy protocols and role in treatment of monogenic disorders
- VII. Mitochondrial medicine
 - A. Principles of mitochondrial homeostasis
 - B. Drugs targeting mitochondrial channels and metabolism
- VIII. Techniques in Molecular Pharmacology
 - A. Single Nucleotide Polymorphisms (SNPs) Genotyping
 - B. Protocols for Evaluation of Enzyme Activity
 - C. Protein Separation and Purification
 - D. DNA Damage Assays
 - E. Anticancer Drug Testing & its Molecular Basis

17.19 Recommended Readings:

1. Clementi, Francesco, and Guido Fumagalli, eds. General and Molecular Pharmacology: Principles of Drug Action. John Wiley & Sons, 2015.
2. Molecular Pharmacology: From DNA to Drug Discovery by John Dickenson, Fiona Freeman, Chris Lloyd Mills and Christian Thode
3. Novel Anticancer Drug Protocols (Methods in Molecular Medicine) by John K. Buolamwini and Alex A. Adjei
4. Molecular Analysis and Genome Discovery by Ralph Rapley and Stuart Harbron
5. High Throughput Screening: Methods and Protocols (Methods in Molecular Biology) (Methods in Molecular Biology). by William P. Janzen
6. Molecular Similarity in Drug Design by P.M. Dean.
7. Basis of Pharmacology by Goodman & Gillman Latest Ed.
8. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard

Finkel, and Luigi X. Cubeddu. Latest Ed.

17.20 Journals:

1. The Annals of Pharmacotherapy
2. Basic Clinical Pharmacology
3. Biochemical Pharmacology
4. Biomedical Pharmacotherapy
5. British Journal of Pharmacology
6. Clinical and Experimental Pharmacology and Physiology
7. Clinical Pharmacology & Therapeutics
8. Current Opinion in Pharmacology
9. European Journal of Pharmacology
10. International Journal of Immunopharmacology
11. International Journal of Pharmaceutics
12. International Journal of Pharmacology
13. Expert Opinion in Pharmacology
14. Journal of Clinical Pharmacology
15. Journal of Pharmacy and Pharmacology
16. Journal of Pharmaceutical and Biomedical Analysis
17. Molecular Pharmaceutics
18. Pharmacogenomics
19. Pharmacogenetics and Genomics
20. Pharmacogenomics Journal
21. Pharmacogenomics Magazine
22. Pharmacological Reports
23. Pharmacological Research
24. Pharmacology Reviews
25. Pharmacology & Therapeutics
26. Trends in Pharmacological Sciences