

Maharashtra University of Health Sciences,
Nashik

SYLLABUS

**Fellowship Course in Molecular
Pathology**

I Title of the course: Fellowship Course in Molecular Pathology'

II) Aims/ Objective and desirability: To train postgraduate students in laboratory medicine in molecular diagnostic protocols and their application in oncology, genetics, infectious disease and pharmaco-genomics.

III) Eligibility Criteria for admission: Post graduate Pathology, Microbiology, Biochemistry and Pharmacology (As per general fellowship guidelines: Document A)

V) Syllabus / Course contents:

Introduction to Molecular Pathology. Nucleic acid structure, replication, transcription, translation;

Nucleic acid extraction

DNA extraction

Southern, Northern, dot/slot blot; electrophoresis, nucleic acid probe preparation, agarose/PAG

DNA amplification techniques and applications including reverse transcriptase (RT)-PCR, in situ

PCR, mutational analysis: PCR, sample preparation, Karyotyping and Fluorescence-in-situ-hybridization

Analyze PCR product using agarose gel electrophoresis and interpret results.

Ligase chain reaction, nucleic acid sequence-based amplification, Assessment of current FDA-approved kits and their applications. RNA isolation.

RT-PCR, relative RT-PCR, competitive RT-PCR: experimental design, controls, kits, and specialized applications.

PCR-based mutation detection: single-stranded conformational polymorphism analysis, heteroduplex analysis, denaturing gradient gel electrophoresis, chemical cleavage, ribonuclease cleavage

PCR-based mutation detection: allele-specific and multiplex PCR; competitive oligonucleotide priming, DNA sequencing, interpretation, troubleshooting

DNA chips, automation, gene therapy; applications in diagnosis of genetic disorders, human genome project, ethical considerations

Procedural and practical psychomotor skills:

- Extraction & Assessment of purity of DNA, restriction enzyme digestion
- Southern, Northern, dot/slot blot; electrophoresis, nucleic acid probe preparation, agarose/PAG
- Setting up a PCR
- Karyotyping and FISH technologies
- Isolation of cellular RNA, & setting up RT-PCR and its interpretation
- Electrophoresis techniques
- Heteroduplex analysis, denaturing gradient gel electrophoresis, chemical cleavage, ribonuclease cleavage
- In situ nucleic acid hybridization and amplification, DNA sequencing
- Single-strand conformational polymorphism, fluorescence digital imaging.

V) Teaching Scheme :

- 1) Lectures
- 2) Practical : Above psychomotor skill
- 3) Seminar, panel discussion
- 4) Laboratory skills related to molecular techniques as mentioned in the syllabus
- 5) Journal club
- 6) Research work to be presented as a paper in conference

VI) Evaluation/ Examination Scheme

- 1) **Attendance:** As per general fellowship guidelines (Document A)
- 2) **Logbook and credit hours** as per general fellowship guidelines (Document A)
- 3) **Final written assessment:** Two papers of 100 marks each

Paper 1 : Basics of Molecular techniques including nucleic acid structure and techniques involved in molecular biology

PaperII: Applications of molecular techniques in Oncology, Infectious disease, genetic disorders & pharmacogenomics

Practical : Two Case studies , Two Laboratory techniques, OSCE : Lab data, Electrophoresis, Blotting techniques and, Instruments

VII) Infrastructure & Staff:

- **Well established molecular laboratory routinely performing PCR, RT-PCR, Blotting techniques, microarray technology, FISH, Karyotyping, Viral loads and Nucleic acid Sequencing facilities**

Text Books & Reference Books :

1. Basic Concepts of Molecular Pathology Series: Molecular Pathology Library, Vol. 2; Cagle, Philip T. Allen, Timothy C. (Eds.); Springer 2009, Softcover ISBN: 9780387896250 \$79.95
2. Molecular Pathology: The Molecular Basis of Human Disease; William B. Coleman, Gregory J. Tsongalis (Eds.); Academic Press; 1 edition 2009 ISBN 10: 0123744199 ISBN 13: 978-0123744197
3. Genomics and Personalized Medicine (2 volumes); Huntington F. Willard, Geoffrey S. Ginsburg; Elsevier 2009 ISBN: (set) 97801236942011 \$319.96
4. Medical Genetics, 4th Edition; Lynn B. Jorde, John C. Carey, and Michael J. Bamshad, Mosby ISBN: 9780323053730 \$67.95
5. DNA from A to Z & Back Again; Carol A. Holland and Daniel H. Farkas; AACCC Press 2008 159425088X \$30.00
6. Molecular Genetic Pathology, 1st ed.; Liang Cheng and David Zhang; Humana Press 2008 ISBN: 1588299740
7. Genomics and Clinical Medicine; Dhavendra Kumar and David Weatherall; Oxford University Press 2008 ISBN 13: 978019518834
8. Fundamentals of Molecular Diagnostics; David E. Bruns, Edward R. Ashwood, and Carl A. Burtis; Saunders 2007 ISBN: 1416037373 \$59.95
9. Molecular Diagnostics: Fundamentals, Methods, & Clinical Applications; Lela Buckingham and Maribeth Flaws; F. A. Davis Company 2007 0803616597
10. Thompson & Thompson Genetics in Medicine, 7th ed.; Robert L. Nussbaum, Roderick R. McInnes, and Huntington F. Willard; WB Saunders 2007 9781416030805 \$62.65
11. Medical Genetics at a Glance; Dorian J. Pritchard, Bruce R. Korf; Wiley-Blackwell 2007 ISBN13: 9781405148467
12. Molecular Pathology in Clinical Practice; Debra G.B. Leonard; Springer 2006 038733226X \$164.00; New Edition Springer 2009 Softcover ISBN: 978038787373
13. Molecular Diagnostics; George P. Patrinos and Wilhelm Ansorge, (Eds.); Academic Press 2005 ISBN: 0125466617 \$104.00
14. Molecular Diagnostics for the Clinical Laboratorian, 2nd ed.; William B. Coleman and Gregory J. Tsongalis, (Eds.); Humana Press 2005 ISBN: 1588293564 \$135.00
15. Smith's Recognizable Patterns of Human Malformation Sixth Edition; Kenneth Jones; Saunders 2005 ISBN 10: 0721606156 ISBN 13: 9780721606156
16. Principles of Molecular Pathology; Anthony A. Killeen; Humana Press 2003 ISBN: 1588290859 \$120.00
17. Molecular Testing in Laboratory Medicine: Selections from Clinical Chemistry, 1998-2001; David E. Bruns, Y.M. Dennis Lo, and Carl T. Wittwer; AACCC Press 2003 ISBN: 1890883603 \$62.00 (\$50.00 for AACCC members)
18. Human Molecular Genetics 3; Tom Strachan and Andrew P. Read; Garland Science 2003 ISBN: 0815341822 \$104.95
19. Human Molecular Biology: An Introduction to the Molecular Basis of Health and Disease; Richard J. Epstein; Cambridge University Press 2003 ISBN: 052164481X \$65.00
20. Inborn Errors of Development: The Molecular Basis of Clinical Disorders of Morphogenesis; Charles J. Epstein, Robert Erickson, Anthony Wynshaw-Boris; Oxford University Press 2003 ISBN: 9780195145021 Molecular Microbiology: Diagnostic Principles and Practice David H. Persing, Fred C. Tenover, James Versalovic, Yi-Wei Tang, Elizabeth R. Unger, David A.; Relman, and Thomas J. White, (Eds.)
21. ASM Press 2003 ISBN: 155581221X \$124.95 Manual of Clinical Microbiology, 9th ed. Patrick R. Murray, Ellen Jo Baron, James H. Jorgensen, Marie Louise Landry, Michael A. Pfaller, (Eds.); ASM Press 2007 ISBN: 9781555813710 \$209.95
22. Molecular Pathology in Clinical Practice: Infectious Diseases Debra G.B. Leonard; Springer, 2008 ISBN 10: 0387873678 ISBN 13: 978-0387873671
24. Molecular Protocols in Transfusion Medicine Gregory A. Denomme, Maria Rios, and Marion E. Reid; Academic Press 2000 ISBN: 0122093704 \$96.95

25. Pharmacogenomics, Second Edition (Drugs and the Pharmaceutical Sciences) Werner Kalow, Urs B. Meyer, Rachel F. Tyndale (Eds.); Informa HealthCare; 2 edition 2005 ISBN 10: 1574448781 ISBN 13: 9781574448788
26. Pharmacogenomics: The Search for Individualized Therapies Julio Licinio, Ma-Li Wong (Eds.); Wiley-VCH; 1 edition 2002 ISBN 10: 3527303804 ISBN 13: 9783527303809
27. Pediatric Endocrinology and Inborn Errors of Metabolism. Kyriakie Sarafoglou, (Ed.); McGraw Hill 2009 ISBN 10: 0071439153 ISBN 13: 9780071439152
28. Physician's Guide to Treatment and Follow-up of Metabolic Diseases Nenad Blau, Georg F. Hoffmann, James Leonard, Joe T.R. Clarke (Eds); Springer 2006 ISBN10: 354022954, ISBN 13: 9783540-339544
29. Inborn Metabolic Diseases: Diagnosis and Treatment 2nd ed. John Fernandes, Jean-Marie Saudubray, Georges van den Berghe, John H. Walter (Eds.); Springer 2006 ISBN: 9783540287834
30. Atlas of Metabolic Diseases 2nd ed. William L. Nyhan, Bruce A. Barshop, Pinar T. Ozand; Hodder Headline Group 2005 ISBN: 0340809701
31. A Clinical Guide to Inherited Metabolic Diseases 2nd ed. J.T.R. Clarke; Cambridge University Press 2002 reprinted 2003 ISBN: 0521890764 (paperback)
32. The Molecular Basis of Human Cancer William B. Coleman and Gregory J. Tsongalis (Eds.); Human Press 2001 ISBN 10: 0896036340, ISBN 13: 9780896036345 \$149.50; Humana Press 2008 1934115185 \$149.50
33. Cell and Tissue Based Molecular Pathology A volume in the Foundations in Diagnostic Pathology Series Raymond R. Tubbs and Mark H. Stoler, (Eds.); Churchill Livingstone 2008 ISBN: 0443069018 \$159.00
34. Molecular Genetic Testing in Surgical Pathology John P. Pfeifer; Lippincott Williams & Wilkins 2006 ISBN: 0781747481 \$149.00
35. Molecular Haematology, 2nd ed. Drew Provan and John Gribben, (Eds.); Blackwell Science 2005 ISBN: 1405112557 \$229.95
36. WHO Classification of Tumours Series Formerly published by the IARC Press now WHO Press
37. Diagnostic Pathology and Molecular Genetics of the Thyroid: A Comprehensive Guide for Practicing Thyroid Pathology Yuri E Nikiforov, Paul W Biddinger, Lester D Thompson; Lippincott ISBN 10: 0781774594 ISBN 13: 978078174598 2009 \$199
38. Molecular and Genetic Basis of Renal Disease A companion to Brenner and Rector's The Kidney David B. Mount and Martin R. Pollak; Saunders 2008 ISBN: 9781416002529 \$134
39. Molecular Basis of Cardiovascular Disease, 2nd Edition A Companion to Braunwald's Heart Disease Kenneth R. Chien; Saunders 2004 ISBN: 9780721694283 \$172
40. The Molecular and Genetic Basis of Neurologic and Psychiatric Disease, 4th Edition Roger N. Rosenberg, Salvatore DiMauro, Henry L Paulson, Louis Ptacek, and Eric J. Nestler (Eds.); Lippincott Williams & Wilkins 2007 ISBN: 9780781769563
41. Genetics and Molecular Aspects of Gastrointestinal Disease, An issue of Clinics in Laboratory Medicine David C. Whitcomb and Antonia Sepulveda; Saunders Title 2005 ISBN: 9781416027027 \$74.95