

# PRINCIPAL SUBJECT AREA

## MOLECULAR BIOLOGY AND BIOTECHNOLOGY

### 400 LEVEL COURSES

#### **MB 401 Molecular biology of plant and animal diseases (2 credits)**

(Prerequisites: MB 201, MB 226)

Genetic disorders; abiotic stresses; infectious diseases; host-parasite interactions; infectiousness of disease causing agents; host response to disease causing agents; diagnosis of disease; treatment; molecular aspects to drug resistance; rational drug design.

Recommended Texts:

1. Agrios, G. N. (1997) *Plant Pathology*, Academic Press
2. Fox, R. T. V. (1993) *Principals of Diagnostic Techniques in Plant Pathology C & B Intl.*
3. I. Roitt, I. (2001) *Essential Immunology*, Blackwell Science Ltd.

#### **MB 406 Evolution and Molecular Systematics (2 credits)**

(Prerequisites: MB 206, MB 226)

Molecular basis of heredity and evolution; genetic maps; general principle of systematics; phylogenetic variations in plant and animal taxa (cladistics and phenetics etc.); molecular phylogenies; speciation and hybridization; applications of molecular methods in biodiversity assessment; *in vitro* germplasm conservation

Recommended Text:

1. Ridley, M. (1996) *Evolution*, Blackwell.
2. Strickberger, M. W. (1999) *Evolution* (second edition), Jones and Bartlett Publishers.

#### **MB 411 Biotechnology II (2 credits)**

(Prerequisite: MB 321)

Biotechnology in food and agriculture (GM crops, cloning livestock); applications of molecular techniques in medicine (drug design, drug delivery, gene therapy); bioreactors (production of pharmaceuticals); new avenues of biotechnology; biofilm technology; biodiversity and biotechnology; embryonic stem cells and therapeutic cloning; top biotech companies and products; current prospects of biotechnology in Sri Lanka (includes a series of lectures by researchers from industry and other research institutions).

Recommended Texts:

1. Brown, T. A. (1990) *Gene Cloning: An Introduction*.
2. Walker, J. M., Gingold, E. B. (1993) *Molecular Biology & Biotechnology*, Royal Society of Chemistry.
3. Old, R. W., Primrose, S. B. (1994) *Principles of Gene Manipulation*, Blackwell Science.
4. Glick, B. R., Pasternak, J. J. (1998) *Molecular Biotechnology*, American Society for Microbiology

#### **MB 416 Environmental Biotechnology (2 credits)**

(Prerequisites: MB 226, MB 321)

Living organisms as pollution indicators; biodegradation; waste management; pollution treatment; bio-mining; biogas production; microbes in environmental management.

Recommended Texts:

1. R. Barry King, Gilbert M. Long, John K. Sheldon (1997) *Practical Environmental Bioremediation: The Field Guide* (Second Edition) Publisher: CRC Press.
2. Sarina J. Ergas, Daniel P. Y. Chang, Edward D. Schroeder, Juana B. Eweis (Editor) (1998) *Bioremediation Principals*, McGraw-Hill
3. Gareth M. Evans, Judith C. Furlong (2002) *Environmental Biotechnology : Theory and Application* John Wiley & Sons

**MB 421 Fermentation Technology (2 credits)**

(Prerequisites: CH 101, CH 102, MB 321)

Microorganisms used in industrial fermentation; isolation and preservation of pure cultures; mutants, factors influencing rate of mutation; bioreactors design and operation; culture media; sterilization; control of different parameters; process monitoring; isolation of products; current applications.

Recommended Texts:

1. Old, R. W., Primrose, S. B. (1994) *Principles of Gene Manipulation*, Blackwell Science.
2. Glick, B. R., Pasternak, J. J. (1998) *Molecular Biotechnology*, American Society for Microbiology

**MB 426 DNA and Forensic Medicine Laboratory (1 credit)**

(Prerequisites: MB 226,)

Principals and methods of DNA profiling; recent examples; techniques in DNA analysis; forensic DNA databases; implications in law enforcement.

Recommended Texts:

1. Glick, B. R., Pasternak, J. J. (1998) *Molecular Biotechnology*, American Society for Microbiology.
2. Patrick J. Lincoln, Jim Thomson, and James A. Thomson (1998) *Forensic DNA Profiling Protocol* first edition)

**MB 431 Molecular Entomology (2 credits)**

(Same as ZL 413)

(Prerequisites: MB 226, ZL 303)

Genome organization of insects; sex determination of insects; evolution and genetics of insect populations; developmental biology and gene manipulation in insects; molecular genetics of insect behaviour; molecular biology of vector-parasite/virus interactions, and of midgut, haemolymph and salivary gland targets for disruption of pathogen transmission; up-regulation of specific genes as a response to the development of pathogens; molecular targets of pesticides and molecular basis of resistance development; transgenic insects for agricultural pest management and disease vector control programs.

Recommended Texts:

1. M. A. Hoy (2003) *Insect Molecular Genetics*. Academic Press Inc. California.
2. J. D. Watson, N. H. Hopkins, J. W. Robersts, J. A. Steitz and A. M. Weiner (1987) *Molcular Biology of the Gene*. Benjamin/Cummings Publishing Company Inc.
3. P. J. Gullan ans P. S. Cranston (2205) *The Insects*. Blackwell Publishing Ltd.

**MB 436 Molecular Virology (2 credits)**

(Prerequisite: MB 226)

Introduction to virology; plant and animal viruses and zoonoses, virus life cycle; molecular mechanism of virus reproduction and pathogenesis; virus-host interactions; genetic modification of viruses; diagnosis of virus infections; virus mechanisms to evade host immunity; antiviral treatment; vaccination.

Recommended Texts:

1. Brock, T.D., Madigan, M. T., Martinko, J. M., Parker, J. (1996) *Biology of Micro-organisms*.(eighth edition) Prentice Hall International.
2. Cann, A.J. (1997) *Principles of Molecular Virology* (second edition) Academic Press.
3. Fields, B., Knipe, D. M., Howley, P. M. (1995) *Fundamental Virology* (third edition.) Lippincott-Raven.

**MB 441 Special Topics in Cell and Molecular Biology (3 credits)**

(Prerequisites: MB 311)

Cancer as a micro-evolutionary process; The preventable causes of cancer, Finding the cancer critical genes; The molecular basis of cancer cell behavior; Cancer treatment: present and future. Epidermis and its renewal by stem cells, Renewal by multi-potent stem cells: Blood cell formation; Fibroblasts and their transformations, stem cell engineering. Primordial germ cells and sex determination in mammals; Eggs; Sperm; Fertilization

Recommended Texts:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter (2007) *Molecular Biology of the Cell*, Garland Science.
2. Gerald Karp (2003) *Cell and Molecular Biology*. John Wiley & Sons, Inc.

### **BT 401 Nitrogen Fixation (3 credits)**

Nitrogen fixation (abiological and biological), the global cycle, importance and relevance to national development. Organisms and systems that fix nitrogen, free-living, symbiotic, associative and endophytic. Methods of measuring nitrogen fixation based on, Kjeldahl analysis, acetylene reduction assay, isotopes (radioactive and heavy  $^{15}\text{N}$ ), direct labelling and substrate labelling techniques. Gas chromatography, Mass Spectrometry and Emission Spectrometry. Enzymology of nitrogen fixation, the enzyme system, factors affecting the enzyme, oxygen sensitivity and mechanisms to protect the enzyme from oxygen inhibition. Requirements for nitrogen fixation and how these are met in nature. Biochemistry of nitrogen fixation including the mechanism. Genetics of nitrogen fixation, Nif genes and their regulation. Application of nitrogen fixation in agriculture and forestry.

Practical exercises based on above topics.

#### Recommended Texts:

1. Gallon, J. R. and Chaplin, A. E. (1987). *An Introduction to nitrogen fixation*. Cassell Education limited.
2. Alexander, M. (1984). *Biological nitrogen fixation - Ecology, technology and physiology*. Plenum publishing corporation.
3. Ladha, J. K., George, T. & Bohlool, B.B. (Eds.) (1992). *Biological nitrogen fixation for sustainable agriculture*. Kluwer Academic Publishers.
4. Khush, G. S. & Bennett, J. (1992). *Nodulation and nitrogen fixation in rice*. International Rice Research Institute, Philippines.

### **BT 402 Rhizobiology (3 credits)**

(Prerequisite: BT 302)

Introduction to the family Leguminosae & the nodule forming bacterium. *Rhizobium* characteristics. Counting *Rhizobium* in soil. Ecology of *Rhizobium*, rhizosphere of legumes. Abiotic and biotic factors affecting rhizobial growth in soil, numbers and distribution in soil, artificial introduction of *Rhizobium* into soil. Species relationships and cross inoculation groups. Effective and ineffective nodulation. Census of nitrogen fixers. Study of infection, nodulation.

Practical exercises based on above topics.

#### Recommended Texts:

1. The Biology of Nitrogen Fixation. Ed: A. Quispel. *Botanical Laboratory*, State University Leyden, The Netherlands (1974), North Holland Publishing Company, Amsterdam, Oxford American Elsevier Publishing Company, Inc. New York.
2. Vincent J. M. (1970) *A manual for the practical study of root-nodule bacteria*. Blackwell scientific Publications, Oxford and Edinburgh (I B P Handbook No. 15)
3. Somasegaran, P. & Hoben, H.J (1994). *Handbook for rhizobia*. Springer-Verlag, New York.

### **ZL 403 Applied Entomology (3 credits)**

Insect taxonomy, Classification and Identification of selected taxa. Insect genitalia and their importance; Beneficial insects and Biological control; Chemical methods of pest control; Insecticide resistance and Mechanisms of resistance; Insect ecology, Insect communication; Insect population dynamics and Life tables; Insect conservation.

Practicals based on above.

#### Recommended Texts:

1. *Agricultural Insect Pests of the Tropics and Their Control*. D.S. Hill.

### **ZL 408 Inland Fisheries and Aquaculture (3 credits)**

Fisheries of Sri Lanka, its importance, potential, regulation and management, fishing gear and methods of fishing, preservation and processing of food fish, techniques of natural stock enhancements in inland fisheries. General Principles and Economics of Aquaculture: Aquaculture methods and practices, culturable fish and shellfish, construction of fish farms, management of fish farms, fish nutrition, fish diseases, induced breeding and seed fish production, Culture of prawns and shellfish.

Practicals based on above.

#### Recommended Texts:

1. *A Manual of Freshwater Aquaculture*: R. Santhanam, N. Sukumaran & P. Natarajan.
2. *Aquaculture Systems and Practices: A Selected Review*. E. A. Baluyut.

**MB 471 Proposal Writing (1 credit)**

Review of research area; introduction to project; types and purposes of project proposals; structure and components of proposal; covering letter and the recipients of the proposal; identifying, justifying and presenting a problem; literature review and development of proposal; time frame, resource identification and budgeting.

**MB 490 Independent Study (1 credit)**

The student will work on a selected molecular biology topic of interest under the guidance of a faculty member who agrees to supervise such work. Number of credits registered depends on degree of difficulty.

**MB 495 Seminar (1 credit)**

The student will present a seminar on a topic assigned by the advisor.

**MB 499 Research Project (6 credits)**

The student will carry out a research project under the supervision of a faculty member. The student is required to give a seminar on the project and submit a report.