

POSTGRADUATE INSTITUTE OF SCIENCE

UNIVERSITY OF PERADENIYA



M.Sc. Programme in Medical Microbiology

1. INTRODUCTION

Human infections remain a common cause of morbidity and mortality in Sri Lanka and the rest of the world. Immunization, the availability of antibiotics and improved standards of living has caused an appreciable reduction in several important and previously common infectious diseases. However, vaccines and effective antimicrobial agents are still not available for many viral, bacterial, fungal and parasitic diseases which continue to affect millions of human beings every year. In addition, the emergence of multi-resistant microbes has reduced the effectiveness of many currently available antimicrobial agents. Newly emerging infections, travel associated infections and the threat of bioterrorism bring fresh threats to human beings throughout the world. Effective control of infective diseases requires a multi-pronged approach, central to which is the availability of a network of efficient and reliable microbiology diagnostic and reference laboratories.

The establishment and running of diagnostic and research laboratories requires persons trained in laboratory methodology, including molecular techniques which are being increasingly used for diagnostic and epidemiological purposes. Laboratory personnel also require training in laboratory management and competence in using information technology for accurate record keeping, archiving and analysis of data.

2. AIMS

- (i) The postgraduate training programme in medical microbiology aims to produce scientists ready to apply modern methods of diagnosis of infective diseases caused by viruses, bacteria, fungi and other parasites.
- (ii) These scientists will be able to pursue a career in research or in diagnostic microbiology

3. LEARNING OBJECTIVES

On completion of the course, the successful candidates shall have achieved the following overall objectives:

- (i) A knowledge of the morphology, genetics, growth characteristics, laboratory identification, habitat, transmission and pathogenicity of viruses, bacteria, fungi and parasites commonly associated with human infections.
- (ii) Acquired practical skills in the laboratory diagnosis of human infections caused by viruses, bacterial, fungi and other parasites
- (iii) An understanding of the applications of molecular biology in the diagnosis of human infections

- (iv) Understood the safety and public health aspects of virus, bacterial, fungal and other parasitic infections and the principles of prevention and control
- (v) Acquired the knowledge and skills required to establish and manage a diagnostic microbiology laboratory
- (vi) Understood current trends in medical microbiology and be able to critically appraise published work
- (vii) Be able to communicate information clearly, both verbally and in writing
- (viii) Demonstrate an ability to design, undertake and interpret a research project and present it in the form of a dissertation

4. PROGRAMME ELIGIBILITY

Candidate having a Bachelor's Degree in Biological, Medical, Veterinary, Dental or Agricultural sciences from a recognized University or equivalent qualifications acceptable to the PGIS are eligible to enroll in the programme. The final selection will be made according to the selection procedure stipulated by the Postgraduate Institute of Science. Employed candidates who are eligible for admission should produce evidence of leave granted to follow the programme and a letter of release from the Head of the relevant Department/Institution.

5. PROGRAMME FEE

(N.B. The Programme fees given below may be revised.)

	M.Sc. programme fee
Local Candidates	Rs. 225,000/-
Foreign Candidates	Rs. 450,000/-

Programme fees shall be paid in two installments, 50% at registration and the balance 50% within six months from registration. Other payments including registration fee, medical fee, library subscription, examination fee, science deposits and library deposits should be paid according to the procedure stipulated by the PGIS.

6. THE PROGRAMME STRUCTURE AND DURATION

This programme consists of course work and a research project, having a total credit value of 30 (course work, 24 and research project, 6). The programme will be conducted at the, Faculties of Science, Medical, Veterinary, Dental and Agriculture, University of Peradeniya and at the Postgraduate Institute of Science by resource persons specialized in the respective fields from the University of Peradeniya and also from other national institutions. The programme will be conducted on a course unit basis, as stipulated by the PGIS for all M.Sc. programmes. As such, the rules and regulations governing this programme will be as in the PGIS Hand Book 2002.

The course work will be conducted over a period of two semesters of 15 weeks each. The M.Sc. programme will be conducted over a period of 18 months inclusive of the time allocated for the research project. The research project will take 3 - 6 months, which could overlap the course work. Satisfactory completion of a minimum of 24 credits of course work (with a GPA of not less than 3.00) is required for the programme in addition to the six credits allocated for the research project. After successfully completing the research project, the student is eligible for the award of the M.Sc. Degree.

An academic advisor will be appointed to each candidate enrolling for the programme. The advisor and the candidate must keep in touch with the programme co-ordinator for the smooth conduct of the programme. English will be the medium of conducting lectures and examinations. IT facilities are available for the programme.

The M.Sc. programme comprises the following:

1. **Preliminary courses** – The students are strongly advised to follow the preliminary courses even though they are not considered in the computation of the final GPA. The preliminary courses will not necessarily be conducted at the beginning of the programme.
2. **Core courses** – These courses deal with General and Molecular Microbiology and Laboratory management and are compulsory for all students (8 credits).
3. **Medical Courses** – These courses deal with different aspects of Medical microbiology and will be compulsory for all students (16 credits).
4. **Research project** with a dissertation and a seminar based on the project (6 credits).

Programme Summary

Course Code	Course	Lecture Hrs.	Practical Hrs.	No. of Credits
Preliminary courses				
PLS 551	* Basic Statistics	10	15	Non-credit
PLS 552	** Scientific writing and presentation skills			Non-credit
PLS 553	*** Independent Study			Non-credit
Semester I				
Core courses				
PLS 556	General Microbiology	30	30	3
PLS 557	Laboratory management I	3	24	1
PLS 558	Recombinant DNA Technology	15	30	2
Medical courses				
PLS 566	Bacteriology I	20	50	3
PLS 567	Bacteriology II	20	50	3
Semester II				
Core courses				
PLS 559	Applied Molecular Biology	15	30	2
Medical courses				
PLS 568	Virology	20	20	2
PLS 569	Mycology	10	40	2
PLS 570	Parasitology	15	30	2
PLS 571	Diagnostic Microbiology	15	60	3
PLS 572	Laboratory management II	5	20	1
Research Project				
PLS 599	Research Project	(3 – 6 months)		6

* *Equivalent to PLS 402 (requires a minimum of a 'C' grade)*

** *General course offered by the PGIS*

*** *Requires a minimum of a 'C' grade*

7. PROGRAMME CONTENTS

PLS 551: Basic Statistics

(Non Credit: Lectures and Laboratory)

Population and sample; Measures of central tendency and dispersion; Sampling distribution of mean; Introduction to probability; The Z distribution and calculation of probabilities; Principles of hypothesis testing, Type I and II errors, power of test; Two sample paired and non-paired 't' test; Simple linear regression and correlation; Analysis of 2-dimensional categorical tables (chi-square test).

PLS 552: Scientific writing and Presentation skills

(General course offered by the PGIS)

Structure/layout of the Project Report, Title and Abstract, Introduction and Bibliography, Computer aided literature survey, Experimental Materials and Methods, Results/Discussion and Conclusion, Problems in report writing and presentation.

PLS 553: Independent Study

(Non Credit)

Students will critically review literature on a selected topic from the course units offered. A written report and an oral presentation are expected at the conclusion of the study.

PLS 556: General Microbiology

(3 Credits: Lectures and laboratory)

Introduction to Microorganisms: The common attributes and differences (diversity), discovery, early studies and pioneering microbiologists, usefulness in other areas of science, occurrence and importance.

Scope of microbiology: Based upon the organisms – Virology, Bacteriology, Protozoology, Phycology, Mycology and Microparasites. Based upon applied fields – Agricultural microbiology, Environmental microbiology (water, waste, soil etc.), Exomicrobiology (microbes in outer space), Food microbiology (post harvest technology), Geochemical microbiology (fossil fuel energy), Industrial microbiology, Medical microbiology, Microbial biotechnology and Pathology.

Study of microorganisms: Microscopy – Compound, Oil immersion, Ultra-violet, Dark field, Phase contrast, Fluorescence and Immuno-fluorescence, Scanning and transmission electron microscopy. Sterile techniques, culturing of microorganisms, isolation, purification, characterization (morphological, physiological, biochemical and serological) and identification. Application of modern techniques based upon molecular characterization of proteins and nucleic acids. Classification – Position among major kingdoms, uncertainties and controversies. **Major groups:** Viruses, Mycoplasmas, Rickettsiae and Chlamydiae, Bacteria, Cyanobacteria (blue-green algae), Micro-algae, Fungi and Protozoa. **Growth, Development and Reproduction:** Population curves, limiting factors, methods of reproduction and perennation. **Genetics of microorganisms**

PLS 557: Laboratory Management I

(1Credit: Lectures and laboratory)

Calibration and maintenance of equipment; Safety and occupational Health in a Microbiology Laboratory; Principles of safety; safety cabinets – use and maintenance; immunization; incident report and action

PLS 558: Recombinant DNA Technology

(2 Credits: Lectures and laboratory)

Function of DNA and RNA, Introduction to gene cloning, Bacterial chromosome, episomes and plasmids, extraction of genomic DNA and plasmids, restriction enzymes, cloning vectors, DNA amplification by PCR, manipulation and transformation, expression of recombinant genes in microbial system, isolation and purification of recombinant clones, screening of recombinants, probes, Identifying, Analyzing and Sequencing cloned DNA, Enzymes in cloning, Application of Recombinant DNA Technology, DNA fingerprinting.

PLS 559: Applied Molecular Biology

(2 Credits: Lectures and laboratory)

Genomics: Genome structure and organization, Gene expression of Prokaryotes and Eukaryotes, construction of genomic and cDNA libraries, screening libraries. Proteomic analysis: 1D & 2D gel electrophoresis, Immunoblotting, hybridization, Blotting techniques, MALDI-TOF MS (Matrix Assisted Laser Desorption Ionization-Time Of Flight- Mass Spectrometry), RFLP (Restriction Fragment Length Polymorphism), AFLP (Amplified Fragment Length Polymorphism) and RAPD (Random Amplified Polymorphic DNA). Nutrigenomics (Nutritional Genomics): Connection between human genetic diversity and nutrition. Bioinformatics: application in molecular biology databases of biological information, Sequence analysis, structure and alignment of nucleic acids & proteins using data banks -NCBI, EMBL, Swiss-Prot, Protein structure and function-prediction.

PLS 566: Bacteriology I

(3 Credits: Lectures and laboratory)

Bacterial morphology, classification and methods of visualizing bacteria as applied to bacteria causing human disease; Micrometry and enumeration of bacteria; Bacterial habitat, transmission and pathogenicity; Koch's postulates and proof of causation of disease; Bacterial isolation and principles of identification; Bacteria of clinical importance with emphasis on laboratory identification : Gram positive cocci; Gram negative cocci; Gram positive bacilli; Parvobacteria

PLS 567: Bacteriology II

(3 Credits: Lectures and laboratory)

Bacteria of clinical importance with emphasis on laboratory identification : Enterobacteria; Anaerobes; Mycobacteria; Rickettsiae; Chlamydia; Mycoplasma; Antibiotics and antibiotic susceptibility testing; Testing for resistance mechanisms

PLS 568: Virology

(2 Credits: Lectures and laboratory)

Viral structure, classification and growth characteristics ; methods of identification of viruses; Viruses of clinical importance in human disease; diagnosis of viral infections in diagnostic laboratories; prevention of viral infections and relevance to diagnostic laboratories; antiviral agents and their mode of action

PLS 569: Mycology

(2 Credits: Lectures and laboratory)

Morphology, classification and growth characteristics of fungi of clinical importance; Isolation and identification of fungi of clinical importance; antifungal agents and their mode of action

PLS 570: Parasitology

(2 Credits: Lectures and laboratory)

Aetiology, pathogenesis, clinical presentation, diagnosis, epidemiology and prevention of parasitic diseases with particular emphasis on those commonly occurring in Sri Lanka; Diagnosis of parasitic infections. Life cycles, breeding habits and biology relating to disease causation or transmission of medically important arthropods; Identification of medically important arthropods, with emphasis on those prevalent in Sri Lanka.

PLS 571: Diagnostic Microbiology

(3 Credits: Lectures and laboratory)

Specimen collection and transport; processing of specimens in clinical laboratories ; reporting; turn around time; confidentiality; Data storage and retrieval; Archiving; Diagnostic molecular methods for infective diseases; Malaria, Molecular entomology:

PLS 572: Laboratory management II

(1 Credit: Lectures and laboratory)

Quality assurance; Accreditation – national and international standards (ISO); Administration, finance, human resources in laboratory management; audit in the laboratory

PLS 599: Research Project

(6 Credits)

Each student is required to conduct and complete a research project on topic falling within the discipline of Microbiology. A dissertation and a seminar on the project will be evaluated for the final grades. Students are expected to present a pre-proposal at the commencement of the project. The selection and planning of the project should commence during the second academic semester.

8. PROGRAMME EVALUATION

Programme evaluation will be as stipulated in the PGIS Handbook 2002.

9. PANEL OF TEACHERS

- Dr. C. L. Abayasekara, Dept. of Botany, Faculty of Science, Univ. of Peradeniya
B.Sc. (Perad.), Ph.D. (Perad.)
- Prof. N. K. B. Adikaram, Dept. of Botany, Faculty of Science, Univ. of Peradeniya
B.Sc. (Ceylon), Ph.D. (Belfast)
- Dr. S. Adikari, Dept. of Anatomy, Faculty of Medicine, Univ. of Peradeniya
MBBS (Sri Lanka), Ph.D. (Sweden)
- Prof. S. N. Arseculeratne, Department of Microbiology, Faculty of Medicine, Univ. of Peradeniya
MBBS (Ceylon), Dip.Bact. (Manch.), D.Phil. (Oxon.)
- Dr. A. Arulkanthan, Department of Pathobiology, Faculty of Veterinary Medicine & Animal Science, Univ. of Peradeniya
BVSc (Sri Lanka), M.Sc. (Washington D.C.)
- Dr. S. B. P. Athauda, Dept. of Biochemistry, Faculty of Medicine, Univ. of Peradeniya
B.Sc. (Perad.), Ph.D. (Tokyo)
- Prof. B. F. A. Basnayake, Dept. of Agriculture Engineering, Faculty of Agriculture, Univ. of Peradeniya
B.Sc. (Cranfield), DEA. Eng. (Pierre et Marie urie)
- Prof. J. S. Edirisinghe, Department of Parasitology, Faculty of Medicine, Univ. of Peradeniya
MBBS (Ceylon), MSc (London), Ph.D. (London), MD (Colombo)
- Dr. A. Ellepola, Dept. of Oral Medicine and Periodontology, Faculty of Dental Sciences, Univ. of Peradeniya
BDS (Perad.), Ph.D. (Hong Kong)
- Prof. I. A. U. N. Gunatilleke, Dept. of Botany, Faculty of Science, Univ. of Peradeniya
B.Sc. (Ceylon), Ph.D. (Cantab.)
- Dr. W. M. D. R. Iddawela, Department of Parasitology, Faculty of Medicine, Univ. of Peradeniya
MBBS (Perad.), Ph.D. (Perad.)
- Dr. S. Jayathilake, Dept. of Oral Medicine and Periodontology, Faculty of Dental Sciences, Univ. of Peradeniya
BDS (Sri Lanka), Ph.D. (Hong Kong)
- Dr. A. W. Kalupahana, Department of Pathobiology, Faculty of Veterinary Medicine & Animal Science, Univ. of Peradeniya
BVSc (Sri Lanka), M.Sc. (Cantab.)
- Dr. R. Kalupahana, Department of Pathobiology, Faculty of Veterinary Medicine & Animal Science, Univ. of Peradeniya
BVSc (Sri Lanka), Ph.D. (Cantab.)
- Prof. S.H.P.P. Karunarathne, Department of Zoology, Faculty of Science, Univ. of Peradeniya
B.Sc. (Ceylon), M.Sc. (Ceylon) Ph.D. (London)
- Dr. A. P. Kodituwakku, Department of Microbiology, Faculty of Medicine, Univ. of Peradeniya
MBBS (Colombo), Ph.D. (Adelaide), MAIMS (Australia)
- Prof. S. A. Kulasooriya, Dept. of Botany, Faculty of Science, Univ. of Peradeniya
B.Sc. (Ceylon), Ph.D. (London)
- Dr. F. Noordeen, Dept. of Microbiology, Faculty of Medicine, Univ. of Peradeniya
BVSc (Sri Lanka), M.Phil. (Sri Lanka)
- Dr G. J. Panagoda, Division of Microbiology, Dept. of Oral Medicine and Periodontology, Faculty of Dental Sciences, Univ. of Peradeniya
B.Sc. (Panjab), M.Sc. (Keaniya), Ph.D. (Hong Kong)
- Prof. P. A. J. Perera, Dept. of Biochemistry, Faculty of Medicine, Univ. of Peradeniya
B.Sc. (Ceylon), Ph.D. (Glas.)
- Dr. R. P. V. J. Rajapakse, Dept. of Pathobiology, Faculty of Veterinary Medicine & Animal Science, University of Peradeniya
BVSc (Sri Lanka), Ph.D. (Perad.)

- Dr. S. Rajapakse, Division of Microbiology, Dept. of Oral Medicine and Periodontology, Faculty of Dental Sciences, Univ. of Peradeniya *BDS (Sri Lanka), M.Phil. (Sri Lanka), Ph.D. (Australia)*
- Dr. R. M. S. Ratnayake, Dept. of Botany, Faculty of Science, Univ. of Peradeniya
B.Sc. (Perad.), M.Sc. (Otago), Ph.D. (Auckland)
- Dr. P.K. Samarajeewa, Plant Genetic Resource Center, Gannoruwa
B.Sc.Agric. (Perad.), Ph.D. (Japan)
- Dr. P. Samaraweera, Dept. of Molecular Biology and Biotechnology, Faculty of Science, Univ. of Peradeniya
B.Sc. (Perad.), Ph.D. (Arizona)
- Dr. S. Samita, Dept. of Crop Science, Faculty of Agriculture, University of Peradeniya
B.Sc. Agric. (Perad.), M.Phil. (Perad.), Ph.D. (Edin.)
- Dr. P. Sarawanakumar, Dept. of Botany, Faculty of Science, Univ. of Peradeniya
B.Sc. (Bharathidasan), M.Sc. (Bharathidasan), Ph.D. (Bharathidasan)
- Prof. Vasanthi Thevanesam, Dept. of Microbiology, Faculty of Medicine, Univ. of Peradeniya
MBBS (Ceylon), DM (Perad.), MRCP (UK), MRCPATH (UK)
- Prof. D. J. Welgama, Dept. of Parasitology, Faculty of Medicine, Univ. of Peradeniya
BVSc (Ceylon), MVSc (Ceylon), Ph.D.(Qld)
- Prof. M. K de S. Wijesundera, Dept. of Parasitology, Faculty of Medicine, Univ. of Peradeniya
MBBS (Ceylon), M.Sc. (London), Ph.D. (Perad.), MD (Colombo)
- Dr. T. G. Wijewardana, Department of Pathobiology, Faculty of Veterinary Medicine & Animal Science, Univ. of Peradeniya
BVSc (Sri Lanka), M.Phil. (Sri Lanka), Ph.D. (Edin.)
- Prof. R. L. Wijeyeweera, Dept. of Paedodontics, Faculty of Dental Sciences, Univ. of Peradeniya
BDS (Sri Lanka), Ph.D. (SUNY)

RECOMMENDED REFERENCES

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5. Cheesbrough Monica. Medical Laboratory Manual for Tropical Countries. Vol: 1 & 11, Butterworth-Heinemann Ltd. Oxford.
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23. WHO Bench Aids for diagnosis of malaria. WHO Geneva.
24. WHO Manual of Basic techniques for a Health laboratory. WHO Geneva.

Journals

Annales de l'Institut. Pasteur (French)
 Annual review Microbiology
 Applied Microbiology
 Bacteriology Reviews
 Clinical Infectious Diseases- USA
 Journal of Bacteriology
 Journal of General Microbiology
 Journal of Infectious Diseases
 Journal of Viral Infections and Immunity
 Mikrobiologia (English translation of Russian)
 Reviews of Clinical Microbiology- USA
 Southeast Asian Journal of tropical Medicine- Bangkok
 Transactions of the royal Society of Tropical Medicine & Hygiene-London
 World Journal of Applied Microbiology and Bacteriology
 Zentrablattfur Bakteriologie, Parasitenkunde, Infektionskrankheiten and Hygiene German)

Web sites

1. <http://www.who.ch>- World Health Organization
2. <http://www.ncbi.nlm.nih.gov/PubMed>- PubMed -Medline on the Web.
3. <http://www.cdc.gov>- US Centres for Disease Control (Atlanta)
4. <http://www.who.int/emc/>- WHO Communicable Disease Surveillance and Response

PROGRAMME COORDINATORS

Dr. Sarangi Athukorala
 Department of Botany
 Faculty of Science
 University of Peradeniya
 Peradeniya
 Tel: +94 81 239 4532
 Email: sarangi_a@yahoo.com

Dr. Faseeha Noordeen
 Department of Microbiology
 Faculty of Medicine
 University of Peradeniya
 Peradeniya
 Tel: +94 81 238 6532
 Email: faseeha.noordeen12@gmail.com