

MEDICINE (FACULTY BASED COURSES)

INTRODUCTION

All medicine graduate programs may require from their students to study the following Faculty Based Courses. These courses may be considered compulsory for some programs and electives for the others.

0500-501	Basic Molecular Biology	(1)
0500-502	Basic Immunology	(1)
0500-503	Research Communication I	(1)
0500-504	Research Communication II	(1)

COURSE DESCRIPTION

0500-501: BASIC MOLECULAR BIOLOGY CR: 1

Nucleic acid structure and functions; DNA analysis by agarose gel and DNA sequencing; DNA Replication: Mechanism, Regulation, Differences between prokaryotic and eukaryotic process; DNA damage, repair and mutagenesis, and diseases associated with defective repair; Transcription mechanisms and processing of primary RNA; The genetic code, protein synthesis and regulation; Restriction and modification enzymes and their importance in molecular biology.

0500-502: BASIC IMMUNOLOGY CR: 1

Introduction to immunity, Innate and acquired immunity, Organs and cells of the immune system, the Major Histocompatibility Complex and its role in antigen presentation, Humoral immunity, antibodies and complement, Cell-mediated immune function T cells and macrophages, Cytokines and their roles in immune responses, Transplantation immunology, immunoprophylaxis and immunotherapy, Autoimmunity and autoimmune diseases, Hypersensitivity

500-503: RESEARH COMMUNICATION I CR: 1

The aim of this course is to improve the student's ability to locate and retrieve information in the library, take effective notes, recognize and manipulate biomedical word roots and affixes of classical origin, write scientific English and communicate effectively in seminars. The course has the following components, which are designated to achieve this aim: Library skills, biomedical terminology, basic information structure, processing and seminar skills.

0500-504: RESEARH COMMUNICATION II CR: 1

This course has its emphasis on improving the student's ability to collect and organize relevant information, and then communicate that information effectively for research reporting purposes, whether as a written report or a seminar presentation. The timing of the course is contrived to oblique the student to present his thesis background and methods in a seminar.

MEDICINE (GENERAL COURSES)**INTRODUCTION**

All Medical graduate programs require the study of one or more of the following courses offered by the **Department of Community Medicine and Behavioral Sciences**.

0510-501	Biostatistics and Computer in Medicine	(2)
0510-502	Advanced Biostatistics	(1)
0510-503	Epidemiology	(1)
0510-504	Radiotracer Methodology in Biological Research	(2)
0510-601	Biostatistical Method in Medical Research	(3)
0510-602	Epidemiology of Infectious Diseases	(3)

COURSE DESCRIPTION**0510-501: BIOSTATISTICS AND COMPUTER IN MEDICINE****CR: 2**

This is a 2 credit hour faculty-required course intended for students joining the graduate M.Sc. program in the Faculty of Medicine, Kuwait University. The course takes into account the fact that enrolled students belong to various backgrounds and hence it includes a diversity of topics to meet their interest. The course is characterized by the inclusion of statistical methods in epidemiology (relative risk, odds ratio to measure the association between diseases and factors, evaluation of diagnostic tests), determination of size of investigations and power, analysis of variance, and design of controlled randomized clinical trials. It also includes multivariate statistical methods such as multiple linear regression and binary multivariable logistic regression. It focuses on concepts, limitations, validity and assumptions underlying these statistical methods.

The course also provides students with knowledge about hardware and software computer technology in addition to the skills of applying the procedures of the SPSS statistical package, and information about computer uses in medicine

(hospital information system, drug information system and computer-assisted diagnoses).

0510-502: ADVANCED BIOSTATISTICS**CR: 1**

Planning of statistical investigation. Controlled comparative studies: Clinical and simple comparative trials, two period cross over design. Analysis of variance. Experimental design. The control of misclassification error. Survivorship tables and life tables. Biological assays: Parallel-line, slope ratio and quantal response. Non-parametric statistics: One-sample run test, Mann-whitney test, Kruskal-Wallis analysis of variance, and Kendall rank correlation.

0510-503: EPIDEMIOLOGY**CR: 1**

Scope of epidemiology, basic measures of frequency, sources of morbidity data, direct and indirect standardization. Planning of an epidemiological investigation, survey planning, variability of measurements, validation and problems in validation, measurement of experimental error, population screening and disease control.

**0510-504: RADIOTRACER METHODOLOGY
IN BIOLOGICAL RESEARCH
CR: 2**

This course provides an introduction to the principles and procedures underlying the use of radioactive isotopes in biological research. The material will be presented at a level requiring only elementary mathematics and the principles and procedures will be illustrated with practical examples drawn from actual laboratory work. The course begins with the materials, and detection and measurement of radiation, and progresses to discussions and illustrations of the applications and problems of radiation measurement and experimental design in biology and medicine and methods used for reduction of radiation exposure. Hazards associated with the use of radioactive material will be discussed. Topics which will be given special emphasis include Gamma and Beta counting of biological samples autoradiography, radiochromatography, use in life science and clinical research, and radiation safety measures.

**0510-601: BIOSTATISTICAL
METHODS IN MEDICAL
RESEARCH
CR: 3 PR: 0510-501 or its equivalent.**

The course primarily aims at equipping students with tools of research. This includes univariate statistical methods update, sampling methods and sample size, experimental design, multivariate

analysis, logistic regression, survival analysis: clinical trials, statistical methods in epidemiology, analysis of matched data and nonparametric statistics. Mann-Whitney, Wilcoxon paired test, Kruskal-Wallis and Spearman rank correlation.

**0510-602: EPIDEMIOLOGY OF
INFECTIOUS DISEASES
CR: 3**

Concepts and definitions, epidemiological models, causality, epidemic process, indices of health and disease, natural history of infectious diseases, contact patterns, measuring infectivity, methods and techniques for studying an infection in the community, time and place clustering, use of routinely collected data, special surveys, surveillance of infectious diseases, field investigation, analysis of an outbreak, seroepidemiology, the effect of bias, confounding and misclassification on the identification of source/reservoir of infection and mode of transmission, statistical techniques often used in infectious disease epidemiology, mathematical models for epidemics, primary and secondary prevention in the infectious disease epidemiology, epidemiology of vaccination, control, elimination and eradication, epidemiology of emerging infections and epidemiology of specific infectious diseases.

Ph.D. IN MEDICAL SCIENCES [PATHOLOGY]

INTRODUCTION

The Department of Pathology (Faculty of Medicine) offers a Ph.D. program in **Pathology**. Only Full-time Students are admitted to this program. The objective of the program is: to promote excellent and independent scientific and ethical approaches to the design, acquisition and analysis of experimental data, and to provide the student with supervised teaching experience. A graduate successfully completing this program will be expected to have an in depth knowledge in specific areas of Pathology: (Histology, Clinical Chemistry, Hematology, Molecular Pathology and Cytology). A major part of the program is the dissertation, which requires high quality research in a specific area of Pathology.

PROGRAM REQUIREMENTS

The program requirements are:

33 TOTAL COURSE CREDITS

9-15 Course credits in the major specialization

0570-601	Electron Microscopy	(3)
0570-602	Genetics and Cytogenetics	(3)
0570-603	Molecular Pathology	(3)
0570-604	Experimental Pathology	(3)
0570-605	Molecular Pathology of Cancer	(3)
0570-606	Clinical Chemistry at the extremes of life	(3)
0570-607	Clinical Chemistry of Cancer	(3)
0570-608	Metabolic Diseases	(3)
0570-612	Cytopathology – Basic Cytopathology	(3)
0570-613	Advanced Cytopathology	(3)
0570-614	Application of Radioisotopes in Medical Research	(3)
0570-615	Seminar I	(1)
0570-616	Seminar II	(1)
0570-617	Seminar III	(1)
0570-618	Advances in Haematology	(3)
0570-619	Advances in Clinical Chemistry	(3)
0570-620	Advances in Histopathology	(3)

0-6 Courses outside the major specialization* (3 credits each)

0510-601	Biostatistical Methods in Medical Research
0520-601	Molecular Techniques and Instrumentation
0520-604	Immunology
0540-562	Molecular Biology and Biotechnology
2050-511	Human Molecular Genetics
2050-512	Molecular Medicine

2050-523	Bioinformatics
2050-524	Genomics
2050-525	Proteomics

* Students may study other appropriate Graduate Level Courses outside the Department of Pathology, with the approval of the Program Committee.

18 COMPULSORY

0570-697 to 699 Dissertation

COURSE DESCRIPTION

0570 – 601: ELECTRON MICROSCOPY CR: 3

The course is designed to introduce the graduate student to the different types of electron microscope in common usage in medical research. The student is also required to understand the operation of each type of electron microscope and to participate in the preparation and examinations of specimens using the microscope. At the end of the course, the student is expected to know the areas of medical research in which the electron microscope can be of use, and be able to apply it to his own research. The course deals with the components and physics of the different types of electron microscopes, tissue processing for electron microscopy, comparison between transmission and scanning electron microscopes, image analysis, enhancement and interpretation, application of electron microscopy in diagnosis and research, immuno-electron microscopy, future of electron microscopy.

0570-602: MOLECULAR GENETICS AND CYTOGENETICS CR: 3

This course is designed to introduce the graduate student to the principles of molecular genetics and cytogenetics as applied to diagnostic testing, including direct mutational analysis, linkage analysis, karyotyping, FISH and comparative genomic hybridization analysis. The course will cover mode of inheritance. The major clinical indications for molecular testing and the clinical implications of test results. The students will be introduced to calculation of genetic risk and the integration of molecular and clinical data. The course will emphasize a wide variety of inherited disorders at the levels of genes and chromosomes with special appreciation of issues pertaining to quality assurance, necessary in the management of a diagnostic

laboratory. Ethical issues in genetics, particularly those raised by molecular diagnostic testing will be highlighted.

0570-603: MOLECULAR PATHOLOGY CR: 3

This course is designed to introduce the graduate student to the fundamentals of molecular biology. Topics include nucleic acid structure, DNA replication and repair, transcription and translation, DNA and protein sequence analysis, accessing DNA and protein sequence databases on the internet, protein secondary structure prediction, searching for motifs and domains in proteins, protein 3D structure, molecular graphics.

0570-604: EXPERIMENTAL PATHOLOGY CR: 3

Pathology, as other areas of biology, employs various experimental systems for the investigation of different medical conditions, as well as testing and monitoring of agents before they can be applied to the human. The graduate student must be familiar with these systems and their application in medical research. The student is expected to know the different experimental systems that are in common use in medical research. The course will deal with science and experimentation, experimental systems in medicine, human experimentation, animal experimentation, ethical aspects of human and animal experimentation, methods in animal experimentation, animal models for different diseases (e.g. diabetes, coronary artery disease, osteoporosis and cancer), alternatives to animal and human experimentation, problems of validity and reliability in animal experimentation, safety methods.

**0570-605: MOLECULAR PATHOLOGY OF CANCER
CR: 3**

This course will cover the identification and mechanisms involving environmental carcinogens, DNA damage and mutagenesis by endogenous and exogenous mechanisms, nucleotide excision repair and mismatch repair. The discovery, biochemistry, and function of oncogenes and tumour suppressor genes, growth factors, signal transduction pathways, and regulators of the cell cycle, including cyclins, cyclin dependent kinases and their inhibitors, apoptosis, telomerases and cell to cell matrix interactions will be discussed. Molecular mechanisms of cancer metastasis, tumour angiogenesis and molecular basis of cancer diagnosis, prognosis and treatment will be emphasized.

**0570-606: CLINICAL CHEMISTRY AT THE EXTREMES OF LIFE
CR: 3**

This course is designed to show that there are differences in disease processes which arise at the extremes of life which the graduate student should be aware of. At the end of the course the student will be required to be familiar with the rational use of the clinical laboratory in the diagnosis of these diseases. The course covers postnatal investigations of the small for date infants, neonatal respiratory disorders and their investigations, neonatal hydrogen ion disturbances, neonatal hypoglycaemia and their investigations, investigation of disorders of calcium and phosphorus metabolism, neonatal hyperbilirubinaemia, inborn errors of metabolism, congenital hypothyroidism, biochemical aspects of ageing, factors that affect laboratory results in geriatric patients, screening for diseases in geriatric patients.

**0570-607: CLINICAL CHEMISTRY OF CANCER
CR: 3**

The objective of the course is to introduce the graduate student to the metabolic effects of tumours and the biochemical markers of cancers. The course will cover the biochemistry and clinical investigations of carcinoid tumours, multiple endocrine neoplasia, ectopic hormone secretions, metabolic changes in malignancy, paraneoplastic syndromes, tumour markers, assays for tumour markers, critical assessment of the usefulness of tumour markers by tumour origin.

**0570-608: METABOLIC DISEASES
CR: 3**

This course is designed to cover the concepts and mechanisms of metabolic diseases. It will cover introduction to metabolism, links between carbohydrate, protein and lipid metabolism, biochemistry, principles of investigation and diagnosis of diabetes mellitus, hypoglycaemic syndromes, glycogen storage diseases, disorders of haemosynthesis and porphyrias, metabolic bone diseases, hyperlipidaemias and atherosclerosis.

**0570-612: BASIC CYTOPATHOLOGY
CR: 3**

Basic morphological description of cells from different body sites, collection of samples for gynaecological and nongynaecological exfoliative cytology and their routine staining; collection of samples by fine needle aspiration (FNA) (of superficial and deep seated organs) with and without imaging guidance, their preparation and staining; screening programmes in cytology; cervical cytology with brief history of classification and details of Bethesda system of classification; respiratory cytology other than FNA (sputum, bronchial brush and bronchial lavage), effusions of body cavities (pleural, pericardial, ascitic and CSF); urinary cytology, infections in cytology: FNA cytology of head and neck lesions; FNA cytology of thyroid; FNA cytology of lymphomas and leukemias, FNA cytology of breast.

**0570 - 613: ADVANCED CYTOPATHOLOGY
CR: 3**

This Course will include FNA cytology of thorax, FNA cytology of G.I. tract and associated organs (pancreas, liver and gall bladder); FNA cytology of genitourinary system (kidney, prostate, ovary and testis); role of morphometry and image analysis in cytology, role of electron microscopy in cytology, role of flow cytometry in cytology; role of cytochemistry in cytology; role of immunocytochemistry in cytology; role of molecular biology techniques in cytology, ThinPrep and automation in screening of smears, use of experimental animals for research in cytology and quality assurance in cytology.

**0570-614: APPLICATION OF RADIOISOTOPES IN MEDICAL RESEARCH
CR: 3**

The course will cover basic principles of nuclear medicine, radiation safety procedures, radiation dosimetry, measurement of radiation in vivo and in-vitro; techniques of radiolabelling, and application of nuclear technology in tracing metabolic products,

scanning organs and tissues, and imaging techniques for various organs and systems. The course contents will comprise the following:- Basic principles of nuclear physics; Nuclides and radionuclides; origin of nuclides, - cyclotron, nuclear reactor, fission products; nature of radioactivity, mechanisms of radioactive decay, interaction of electrons, x-rays and δ -radiation with matter; radiopharmaceutics; in-vitro radiolabelling techniques; quality control of "hot lab" ; radiation detection and relevant instrumentation; imaging techniques in the study of pathology in different organs and tissues; scintigraphy in neoplastic and non-neoplastic lesion in various organs and tissues; application of monoclonal antibodies in scintigraphic techniques; autoradiography.

**0570-615: SEMINAR I
CR: 1**

The candidate will be assigned a topic to his/her area of specialization in pathology. He/she will be asked to critically review the literature and present it in the department.

**0570-616: SEMINAR II
CR: 1**

The candidate will be assigned a topic to his/her area of specialization in pathology. He/she will be asked to critically review the literature and present it in the department.

**0570-617: SEMINAR III
CR: 1**

The candidate will be assigned a topic to his/her area of specialization in pathology. He/she will be asked to critically review the literature and present it in the department.

**0570-618: ADVANCES IN HAEMATOLOGY
CR: 3**

This course is designed to cover molecular principles of blood coagulation including role of platelets, endothelial cells and coagulation protein and their cellular interactions, regulatory process of coagulation including fibrinolysis, clinical and laboratory evaluation of hemorrhagic and thrombotic disorders including both hereditary and acquired disorders. It also includes principles of hematopoiesis, growth factors required for erythropoiesis, myelopoiesis and thrombopoiesis. Anemias will be addressed in reference to nutritional causes such as iron deficiency anemia and deficiency of vitamin B12 and folic acid and mode of diagnosis. Hemolytic anemias are also covered. This includes methods of detection of hemolysis, classification of causes. Hemoglobinopathies are also included emphasizing the genetic and molecular background and methods of diagnosing these disorders. It also

covers principles and recent discoveries of cytogenetic and other molecular causes underlying acute and chronic leukemias especially addressing important mutations leading to clinical presentation and development of new therapeutic modalities.

**0570-619: ADVANCES IN CLINICAL CHEMISTRY
CR: 3**

This course is designed to prepare the students for a career in postgraduate research in the discipline. The programme will consist of tutorials, seminars and practical exercises designed to facilitate the acquisition of knowledge on recent developments in the field. The subject matter to be covered will focus on the more specialized tests performed in a modern clinical biochemistry routine and/or research laboratory.

**0570-620: ADVANCES IN HISTOPATHOLOGY
CR: 3**

This course is designed to prepare the students for a career in postgraduate research in the discipline. The program will consist of tutorials, seminars and practical exercises designed to facilitate the acquisition of knowledge on recent developments in the field. The subject matter to be covered will focus on the more specialized tests performed in a modern clinical biochemistry routine and/or research laboratory.

NON-DEPARTMENTAL COURSES

**0510-601: BIOSTATISTICAL METHODS IN MEDICAL RESEARCH
CR: 3**

The course primarily aims at equipping students with tools of research. This includes univariate statistical methods update, sampling methods and sample size, experimental design, multivariate analysis, logistic regression, survival analysis : clinical trials, statistical methods in epidemiology, analysis of matched data and nonparametric statistics. Mann-Whitney, Wilcoxon paired test, Kruskal-Wallis and Spearman rank correlation.

**0520-601: MOLECULAR TECHNIQUES AND INSTRUMENTATION
CR: 3**

Polymerase chain reaction, RT-PCR, in-situ PCR, ligase chain reaction, strand displacement assay, cloning and expression of foreign DNA, plasmid, cosmid and phage vectors, site directed mutagenesis, restriction fragment length polymorphism, use of isotopes, nucleic acid and antibody probes, electrophoresis, chromatography, autoradiography,

electron microscopy, DNA synthesis, protein synthesis, Southern, northern and western blotting, hybridization, one and two dimensional gel electrophoresis, ultracentrifugation, DNA and protein sequencing, image analysis, DNA and peptide synthesis, construction and screening of DNA and genomic DNA libraries. Microarray technology will be emphasized in this course.

0520 - 604: IMMUNOLOGY
CR: 3

Antigens and haptens (Immunogenicity of antigens, epitopes, mitogens and haptens), antigen receptors (structure, function, generation of diversity, immunoglobulin superfamily), major histocompatibility complex (organization and inheritance, structure, polymorphism), antigen processing and presentation (role of antigen processing cells, MHC - restriction, regulation of processing), complement (steps in complement activation, receptors, biological function, regulation), generation of the humoral immune response (kinetics, steps in B cell activation, proliferation and differentiation), cell-mediated immunity (T cell activation, cytotoxic responses mediated by CD8 and CD4 T cells) cytokines (general properties, secretion and function of cytokines, cytokine receptors, role of cytokines in inflammation and disease), hybridomas and monoclonal antibodies (formation and selection of hybrid cells, production and function of monoclonal antibodies, T cell hybridomas).

2050-511: HUMAN MOLECULAR GENETICS
CR: 3

The rules of inheritance; The human pedigrees; Mitochondrial inheritance; Chromosome mapping. Human genome organization; Identification of human disease genes; Population genetics; Development genetics; Chromosomes and chromosomal abnormalities; Mutations and human disease; Dynamic mutations; genetic imprinting congenital abnormalities; Quantitative and behavior traits; Monogenic disorders; Metabolic disorders; Pharmacogenetics and ecogenetics; Polygenic disorder; The genetics of cancer; Genetic counseling; Prenatal diagnosis; Genetic screening; Altering genetic traits; Genetics and social issues.

2050-512: MOLECULAR MEDICINE
CR: 3

Introduction: Molecular Mechanisms of Human Disease. Molecular Haematology and Oncology. Molecular Biology of Cardiovascular Disease. Molecular Neurobiology. Organisation of the Immune system and Autoimmune Disease. Molecular basis of Virulence. Selection and Evolution: Implications for Molecular Medicine. Molecular Medicine-Diagnostic and Therapeutic Potential. Molecular Pathology. Ethical issues in medicine.

2050-523: BIOINFORMATICS
CR: 3

2050-524: GENOMICS
CR: 3