

Master of Science in Biochemistry (Molecular Medicine Option).

Molecular medicine is a specialized area of medicine. Its main thrust is to understand the molecular and cellular basis of disease. Understanding the molecular basis of disease has the potential to unveil novel molecular and cellular markers and targets that can be exploited to develop cheap, efficacious and robust screening and diagnostic kits that can be used for mass screening and early detection of these diseases. In addition, identification of novel targets can be used to develop effective therapeutic interventions for better management of these conditions. Finally, unveiled cellular and molecular markers can be used as useful prognostic markers to monitor the effectiveness of therapeutic interventions.

Effective management of various medical conditions remains a major challenge in the medical field. Efficacious control of medical conditions requires an in depth knowledge of the biology of the pathogen (in cases of pathogen-causing diseases), the interaction of the pathogen and the affected cells and the cellular and molecular response of the cell to the infectious pathogen.

There is however, an increased incidence of non-communicable diseases whose etiology is not necessarily associated with classical pathogens. The incubation periods for most of these diseases such as cancer, cardiovascular diseases, asthma, rheumatoid arthritis, obesity and neurodegenerative diseases is known to be prolonged. In addition, the survival rate of most patients suffering from non-communicable diseases is generally poor. Given the prohibitive cost of mass screening and diagnosis of these diseases in developing countries, most patients present with the late stages of the disease making their management difficult. As a result the prognosis and outcome of most patients is poor, especially in developing countries.

Today, a majority of health care institutions, medical research institutions and tertiary institutions of higher learning at local, regional and international level have embraced and incorporated molecular medicine in their research portfolios. This has greatly augmented traditional medical research areas so as facilitate translational research that aims to develop solutions from the “bench to the bedside”. This trend is observed in some of the premier African Universities such as Cape Town, Stellenbosch, Witwatersrand, Ibadan and American Universities such as Johns Hopkins, Harvard, University of California Los Angeles and Berkley, Yale and Columbia.

MSc Biochemistry (Molecular Medicine option) is fundamentally a Biochemistry programme that is enriched with new areas such as biochemical and molecular basis of disease, bioinformatics, laboratory diagnostics, drug modeling and delivery. The outcomes of molecular medicine shall “feed” into and significantly “nourish” new scientific frontiers such as biotechnology and nanotechnology.

The Jomo Kenyatta University of Agriculture and Technology (JKUAT) Strategic Plan for 2009 to 2012 espouses the concept of developing programmes that are market driven, in tandem with local, regional and international trends and benchmarked with similar programmes globally. The MSc Biochemistry (Molecular Medicine option) programme is designed to capture the university’s vision and mission and strategic issue 2 (meeting customer expectations through market driven programmes).

MSc Biochemistry (Molecular Medicine option) shall be offered in the Department of Biochemistry with services from the Institute of Computer Science and Technology (ICSIT) and Mathematical Departments. It is anticipated that students shall greatly benefit from developing skills necessary for searching, computing and presenting scientific information relating to their training and arising from the research, they undertake in Biochemistry and Molecular Medicine.

COURSE OBJECTIVES

1. To provide students with requisite knowledge on the molecular basis of non-communicable and communicable diseases.
2. To provide students with practical skills in various areas of molecular medicine.
3. To expose students to recent advances in paramount areas of molecular medicine.
4. To provide students with computational skills in drug design to putative molecular and cellular targets
5. Demonstrate necessary skills in searching, computing and presenting scientific data.

Course Justification

Traditionally, Kenya like most of the developing countries have developed resource capacity in research and teaching of classical areas of clinical medicine, biochemistry, physiology and cell and molecular biology of human pathogens. There is however, a general lack of resource capacity in the area of molecular basis of disease particularly in life-style and non-communicable

diseases whose incidence has significantly increased particularly, in adolescent and young adults in Kenya. In addition, the epidemiology of these diseases is poorly studied and documented in different population strata (age, gender, race/ethnic and economic).

JKUAT is expected to launch the MBChB programme and College of Health Sciences soon. It is therefore anticipated that the clinical programmes offered shall be unique in that they shall combine both clinical and translational medical research. The MSc Biochemistry (Molecular Medicine option) programme is therefore expected to provide capacity training for requisite staff and researchers to oversee the successful blend of both clinical and translational research.

With the development and advancement of new areas such as biotechnology and nanotechnology, there is need to understand the molecular basis of diseases so as facilitate the development of effective and efficacious screening, diagnosis, therapy and prognosis of these diseases using these technological approaches.

Resultant from this effort, MSc. Biochemistry (Molecular Medicine Option) is advanced to include areas of Medical Genetics, Medical Diagnostics, Molecular Epidemiology, Molecular Cell Biology, Drug Discovery and Delivery systems. These study areas detail molecular aspects of current and emerging lifestyle and non-communicable diseases, aiming at finding cost effective and efficacious methods of disease diagnosis and prognosis as well as therapy. Consequently, courses developed in this programme make it unique and relevant to the medical needs of local, regional and international communities.

Various aspects of Biochemistry and Molecular Medicine are covered adequately in this programme to impart knowledge and skills amongst the trainees who at the end of this course are able to tackle challenges of disease locally and regionally where their contribution is greatly required. In addition, the graduates are expected to join organizations and institutions such as universities, research institutions and health care institutions mandated to find solutions to challenges related to health.

Regulations and syllabus for the Degree of Master of Science in Biochemistry (Molecular

Medicine Option).

1.0 Entry Requirements

- 1.1 The common regulations for all masters degrees in the University shall apply.
- 1.2 The general regulations for all masters' degrees in the Faculty/School shall apply.
- 1.3 The following shall be eligible for registration for the Master of Science degree in Biochemistry (Molecular Medicine Option).
- 1.3.2 A holder of at least a Second Class Honours (Upper Division) degree having studied Biochemistry or molecular biology as a major or regular subject.
 - 1.3.3 A holder of a Second Class Honours (Lower Division) Degree in Biochemistry or molecular biology combined with another relevant science subject may, under exceptional circumstances, be considered provided he/she produces evidence of having worked for at least two years in Biochemistry/Molecular Medicine/molecular biology or a closely related field.
 - 1.3.4 A holder of Bachelor of Veterinary Medicine, or Bachelor of Medicine and Bachelor of Surgery, or Bachelor of Pharmacy or other relevant biological sciences.
 - 1.3.5 A holder of a degree accepted as equivalent to one of the degrees mentioned in 1.3.1 to 1.3.3 above from another University recognized by Senate.

2.0 Duration and Pattern of the Course

- 2.1 The duration of the Master of Science course in Biochemistry (Molecular Medicine Option) shall be at least two academic years from the date of registration.
- 2.2 Students taking a Master of Science course in Biochemistry (Molecular Medicine Option) shall follow any of the following programmes;
 - 2.2.1 **Either** course work, examination and thesis,
 - 2.2.2 **Or** research and thesis only.
- 2.3 In the first year students shall take ten units which shall be assessed .by course-work and examination. Each unit shall comprise lectures which shall include tutorials and discussions. In addition, students will be required to attend/present Departmental seminars.
- 2.4 In the second year students will undertake research, seminar presentation (at least **two**

seminars on their research work) and thesis writing.

2.5 Students taking the programme by research or thesis only shall:

2.5.1 Present a research proposal to the departmental postgraduate board before formal registration by Board of Postgraduate studies

2.5.2 Upon successful registration, the student shall commence on the research and present quarterly reports to Board of Postgraduate studies during the course of the study.

2.5.3 That the regulations for thesis/dissertation/project outlined in section 4.0. shall apply.

Course Distribution

First Semester

HBB 3100 Research Methodology

HBB 3101 Advanced Molecular Biology

HBB 3102 Bioinformatics

HBB 3104 Biochemistry of Nucleic Acids

HBB 3115 Biochemical and Medical Laboratory

Diagnostics and Biosafety

HBB 3118 Medical Molecular Genetics

HBB 3119 Enhanced Drug Bioavailability and

Delivery Systems

HBB 3151 Biochemical and Molecular basis of Chronic

Non-communicable and life style diseases

Second Semester

HBB 3111 Principles of Molecular Epidemiology

HBB 3121 Advanced Biochemical Techniques and Instrumentation

HBB 3155 Cell Signaling Pathways

HBB 3120 Special topics in Molecular Medicine

HBB 3152 Advanced Biochemical and Molecular Basis of Cancer

HBB 3153 Biochemical and Molecular Basis of

Neurodegenerative Disorders

HBB 3214 Molecular Modeling and Chemo-informatics