

# Ph.D. Biochemistry



## DOCTOR OF PHILOSOPHY IN BIOCHEMISTRY (PhD BIOCHEMISTRY)

### PROGRAMME STRUCTURE

#### YEAR 1

##### SEMESTER 1

###### **CORE**

		<b>CREDITS</b>
FASC 701	Science and Society	3
BCMB 630	Research Methodology & Scientific Communication	3
BCMB 701	Advance Topics in Bioinformatics	3
FASC 700	Special Topics in Science	3

**Total** **12**

##### SEMESTER 2

###### **CORE**

		<b>CREDITS</b>
FASC 702	Advanced Quantitative Research Methods	3

*Candidates should select at least 3 credits base on your proposed thesis area*

BCMB 702	Advances in Biochemical Pharmacology and Toxicology	3
BCMB 704	Advances in Molecular Biology and Applications	3
BCMB 706	Advances in Natural Product Research	3
BCMB 708	Advances in Biomedical and Infectious Diseases Research	3

###### **ELECTIVES**

FASC 710	Teaching Science at Tertiary Level	3
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**Total** **18**

#### YEAR 2

BCMB 710	Seminar 1	3
BCMB 720	Seminar II	3
BCMB 700	Thesis	

#### YEAR 3 & 4

BCMB 730	Seminar III	3
BCMB 740	Seminar IV	3
BCMB700	Thesis	45

#### **BCMB 630:**

### **RESEARCH METHODOLOGY AND SCIENTIFIC COMMUNICATION**

Students will be taken through various topics in research methodology and scientific communication. The major topics to be discussed are: elements of scientific project planning; research design and statistical analysis; laboratory quality assurance; standards for quality research; initial considerations; scientific and technical presentation; professional conduct.

#### **BCMB 701**

### **ADVANCED TOPICS IN BIOINFORMATICS**

This course will expose students to all the bioinformatic tools that are being used to acquire and analyse biological data across all the major types of experiments. Software programmes used for genomics, transcriptomics and proteomics/protein networks are considerably different, and hence it is important for students to learn the main softwares used in these fields of molecular biology as well as the new and updated versions that will be introduced from time-to-time. In addition to reviews of bioinformatic tools covering these main areas of molecular biology, softwares used in high-content image analysis, lipidomics as well as chemoinformatics will also be included to give students a holistic view of the bioinformatics. The course will be mainly conducted through the use of review articles selected by the lecturer during the period of the course for students to study in groups and present at lectures for discussions. At the beginning of the course, there will be a few lectures to be given by the course instructor to provide general overview of the bioinformatic landscape.

#### **BCMB 702**

### **ADVANCES IN BIOCHEMICAL PHARMACOLOGY AND TOXICOLOGY**

This course will equip students with the necessary theoretical knowledge in taking up research on medicinal plants. Major topics in biochemical pharmacology and toxicology would be discussed in this course with particular emphasis on medicinal plant research. This will include advanced topics in toxicity testing and safety evaluation, herb-drug interactions, and mitochondrial as pharmacological targets.

#### **BCMB 704**

### **ADVANCES IN MOLECULAR BIOLOGY AND APPLICATIONS**

The goal of this course is to provide graduate-level instruction on molecular biology with detailed analysis of the biochemical mechanisms that control the maintenance, expression, and evolution of prokaryotic and eukaryotic genomes. The topics will cover current advances in methodological approaches for analyzing the function of cellular macromolecules and macromolecular complexes in DNA replication, recombination, transposition and repair, gene expression and its regulation, mRNA splicing, genome organization, non-coding RNAs, signal transduction, protein synthesis, folding and degradation, growth control, and other life processes. A focus on critical thinking and problem solving will be used to show how fundamental, highly-significant biological problems are solved. We will also explore the logic of experimental design and data analysis.

#### **BCMB 706**

### **ADVANCES IN NATURAL PRODUCT RESEARCH**

Compounds and biomolecules derived from nature will continue to represent an important source of new chemical entities for use as medicines, food supplements and other applications. The main source for the search and study of natural products has been plant; this course will cover the use of plants as well as other promising but traditionally unused sources. Efforts will be made to study fungi, actinomycetes, myxobacteria, macroalgae and microalgae as potential sources of new natural products being both primary and secondary metabolites. The main classes of natural products such as alkaloids, polyketides, glycopeptides, aminoglycosides, cyclic peptides, etc will be discussed including their predominant uses. Product discovery platforms use for the isolation of new compounds will also be discussed, namely the traditional bioassay assisted screening and the modern genome-guide approaches.

#### **BCMB 708**

### **ADVANCES IN BIOMEDICAL AND INFECTIOUS DISEASES RESEARCH**

The course is aimed equipping students with knowledge on current methods for studying the transmission, diagnosis, and pathogenesis of diseases that are of public health concern in sub-Saharan Africa. Diseases to be covered include infectious diseases such as Malaria, HIV, and TB, neglected tropical diseases (NTDs) such as Leishmania, Buruli ulcer, and Schistosomiasis. Current knowledge of the biology of the causative agents, as well as progress towards improved therapeutic mechanisms and vaccine

development will be discussed. The relevance of genomics and proteomics for research into the various diseases will also be emphasized.

#### **BCMB 710 SEMINAR I**

Each student will make a presentation, on his/her thesis research proposal. In addition each student will be required to attend all departmental seminars.

#### **BCMB 720 SEMINAR II**

This is experiential research, which would be carried out either inside or outside of the laboratory. The student will be attached to research groups and will use the period to optimise his/her methods and also develop protocols. Students will be required to present (oral and written) progress report.

#### **BCMB 730 SEMINAR III**

Each student will make a presentation, on his/her thesis progress report. In addition, each student will be required to attend all departmental seminars.

#### **BCMB 740 SEMINAR IV**

Each student will present a final seminar on his/her research findings prior to the submission of thesis.

#### **FASC 700 SPECIAL TOPICS IN SCIENCE**

The course examines historical and contemporary issues in science, relating to the student's area of specialization and relevance. Such topics are expected to challenge the students into exploring current and relevant research trends/discoveries in scientific approaches. The course will enable students explore scientific knowledge in modern science, and add on to their depth of information in their chosen areas of speciality. It is expected that, the course will complement other courses on the PhD flagship of the various departments in the Sciences and elsewhere. Additionally, it will expose students to current trends of presentations, and foster stronger confidence-building attitude that will enable enhanced international academic competitive spirit.

#### **FASC 701 SCIENCE AND SOCIETY**

This course will enable students gain insights on the practice of science as a discipline including major scientific concepts like inductivism are examined as well as the history of science and science itself, an overview of current approaches to research and an understanding of research partnerships, networks and appropriate methods of communicating science depending on the audience. The aim of the course is to help students to fit their research to relevant trends and directions for national development. Course content will cover topics such as the basis for the scientific method; conceptual frameworks; the philosophy of science; ethics in research; pure versus applied science debates; approaches to research; science for development and the merit of broader impact criteria; north south/south south collaboration and partnerships; research networks; communicating science to the policy make, lay audience and to the media.

#### **FASC 702 ADVANCED QUANTITATIVE RESEARCH METHODS**

The course will serve as a step up for students who need to add up to their knowledge in quantitative methods of research techniques and analyses. Topics to be covered include: Sampling distributions and hypothesis testing. Sample size determination. Categorical data and chi-square, Non parametric tests. Principles of Design of Experiments. Analysis of variance and its assumptions. Experiments with single and multiple factors. Orthogonal and multiple Comparisons. Completely Randomized, Randomized Complete Block, repeated measures, cross over and Latin square designs. Nested designs. Fixed, random and mixed effects models. Factorial designs. Confounding. Fractional factorial designs. Split plot designs. Incomplete block designs. Analysis of covariance. Regression models: basic concepts; Regression Model Diagnostics. Categorical data analysis. Logistic regression, univariate and multivariate. Confounding and collinearity in logistic regression. Model selection in logistic regression.

#### **FASC 710 TEACHING SCIENCE AT THE TERTIARY LEVEL**

It is anticipated that many of the students who go through the PhD programme in the Sciences may nurse special interest in teaching and academia. Focusing on group discussions, this course is expected to equip students with the requisite knowledge in overall management of students at the tertiary level. The course will focus on teaching the methodologies and techniques in handling Science-teaching at the undergraduate level. Topics such as laboratory supervision and safety, grading issues, special needs students, lecturing and tutoring

examination preparation, teacher/student relationship, tertiary education management, will be discussed through reading, class/group discussions as well as presentations.

### BCMB 700 THESIS

Each student will undertake a major research project and present a written dissertation. In addition, students will present an oral defence of their thesis.



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