Department of Biochemistry and Molecular Genetics

Chairperson: Jaffa, Ayad
Professors: Boustany, Rose-Mary; Darwiche, Nadine; Dbaibo, Ghassan; Habib-Abdul Karim, Aida; Jaffa, Ayad; Nemer, Georges; Usta, Julaar; Ziadeh, Fuad
Associate Professors: Kurban, Mazen; Refaat, Marwan
Assistant Professors: Kadara, Humam; Khoury, Pierre; Kobeissy, Firas
Associates: Hasan, Anwarul; Karam, Pascale

Graduate courses

Courses in the graduate program are open to all graduate students enrolled in the various Biomedical Sciences Departments and in Biomedical Engineering as well as to science major graduates, such as Biology, Chemistry or related sciences upon the consent of the coordinator.

BIOC 302 Developmental Biochemistry 48.0; 3 cr.
A course that discusses the pre- and post-natal development of cardiac and skeletal muscles as well as hemopoiesis. This course is a mix of didactic lectures and interactive teaching. Each topic is presented by a faculty member and further illustrated by an article discussed by the students. Open to all graduate students in basic biomedical sciences and biology. Elective. Prerequisites: BIOC 321 and BIOC 322, or consent of the coordinator. Second semester.

BIOC 303 Molecular Biology of Cancer 48.0; 3 cr.
A course that deals with the regulatory mechanisms of tumor cell growth and cancer formation at the cellular, molecular, genetic, and epigenetic levels. This course includes a discussion of recent developments in the intra- and/or inter-cellular mechanisms involved in cellular proliferation, cell death, invasion, and metastasis. Elective. Open to all graduate students in basic biomedical sciences and biology. Second semester.

BIOC 305 Biochemical Research 48.0; 3 cr.
An elective course that discusses the theoretical basis of ongoing research projects. This course consists of didactic lectures, student presentation, and written assignments on novel aspects related to each topic. The course is open to all graduate students. Elective Prerequisites: BIOC 321 and BIOC 322, or consent of the coordinator. Summer.

BIOC 306 Mediators in Vascular Biology and Inflammation 32.0; 2 cr.
An elective course that describes the different mediators and their role in vascular biology and in inflammation. Elective. Open to graduate students in basic biomedical sciences and biology, and to medical doctors. Second semester.

BIOC 307/308 Biochemical Methods 0.128; 4 cr. (each)
A course that focuses on the basic principles and applications of the techniques of molecular biology, spectrophotometry, and chromatography. Elective. Open to all graduate students. Prerequisites: BIOC 321 and BIOC 322, or a background in biology. Summer; alternate years.

BIOC 309 Proteins and Enzymes 22.20; 2 cr.
An elective course open to all graduate students either as 2 credits or as 1 credit as 309A/309B, respectively. This course is composed of two units, Unit I: Protein Architecture discusses the stabilizing forces directing protein folding and thus conformation, introducing students to the various existing protein data banks. Unit II discusses the different kinetic approaches that may be used in studying the kinetic analysis of complex biological systems. Elective. Prerequisites: BIOC 321 and BIOC 322, or consent of the coordinator. Summer; alternate years.

BIOC 310 Molecular Basis of Genetic and Metabolic Disorders 16.32; 2 cr.
A course that deals with the molecular basis of genetic and metabolic disorders. This course presents a detailed overview of the molecular basis of known genetic diseases. Students also learn the methods used to map chromosomal aberrations or DNA mutations implicated in congenital diseases. Elective. Open to non-biochemistry majors. Elective. Prerequisites: BIOC 321 and BIOC 322 or a background in biology. Second semester; alternate years.

Undergraduate courses

BIOC 246 Biochemistry for Nursing 60.0; 4 cr.
A course that provides an introduction to basic concepts in biochemistry. It discusses the main biochemical pathways in the cell and defines the interrelations between the different metabolic pathways. The course is composed of three units: (a) general chemistry (b) organic chemistry (c) biochemistry. Offered to BS Nursing and is open to undergraduates in related sciences. First semester.

BIOC 255 Biochemistry for MLSP 45.0; 3 cr.
A course that provides an overview of structure, function, and metabolism of basic biological micro/macro molecules; a general review of the genetic makeup; and emphasizes the clinical relevance by correlating disease to basic information. The course is an introductory biochemistry course offered to undergraduate students in the Medical Lab Technology Program and related fields. Second semester.

The Department of Biochemistry and Molecular Genetics offers undergraduate courses to Nursing students and to Health Profession students enrolled in the Medical Laboratory Sciences Degree Program.

It also offers graduate level courses to medical students and to graduate students in the graduate program leading to a master’s degree in Biomedical Sciences, MSc Biochemistry and a doctoral degree (PhD) in Biomedical Sciences or Biomedical Engineering.

The requirements for admission to the graduate program are a BA with prerequisites in chemistry and biology courses or a BS degree from a university and an academic record with a cumulative average of 80 and above. Students should have a background in chemistry, biology, or a related medical science degree. Students will spend a minimum of two years in the graduate program during which they must complete 21 credits of graduate courses, pass a comprehensive exam, and submit a thesis (9 credits) based on independent research. The 21 credits of graduate courses include a total of 9 credits of required core courses and 12 credits of elective courses.

Required MSc courses in Biomedical Sciences track Biochemistry include BIOC 321 (1 cr.); BIOC 322 (1 cr.), BIOC 323 (2 cr.), BIOC 325 (2 cr.), and HUMR 305 (3 cr.).

Required PhD courses in Biomedical Sciences are listed on page 498 of the Graduate Catalogue.

The Department of Biochemistry and Molecular Genetics offers undergraduate courses to students in the Medical Lab Technology Program and related fields. Second semester.

Biochemistry for MLSP

A course that provides an overview of structure, function, and metabolism of basic biological micro/macro molecules; a general review of the genetic makeup; and emphasizes the clinical relevance by correlating disease to basic information. The course is an introductory biochemistry course offered to undergraduate students in the Medical Lab Technology Program and related fields. Second semester.

Biochemistry for Nursing

A course that provides an introduction to basic concepts in biochemistry. It discusses the main biochemical pathways in the cell and defines the interrelations between the different metabolic pathways. The course is composed of three units: (a) general chemistry (b) organic chemistry (c) biochemistry. Offered to BS Nursing and is open to undergraduates in related sciences. First semester.
BIOC 311/312  Biochemistry Tutorial  32.0; 2 cr. (each)
Students are assigned special topics (2) of current interest and are required to write a report evaluating the current status of the chosen subject. Elective. Open to biochemistry graduate students. First and second semesters and summer.

BIOC 313  Advanced Biochemistry  30.36; 3 cr.
A course that deals with the latest developments in molecular biology techniques and troubleshooting with hands-on bench experience. Elective. Open to all graduate students. Prerequisites: BIOC 321 and BIOC 322, or a background in biology. Second semester and summer.

BIOC 314  Mitochondria: Genetics, Protein, and Disease  32.0; 2 cr.
A course that provides a clear understanding of the biochemistry, molecular genetics, and bioenergetics of the mitochondria. It emphasizes the role of the mitochondrial dysfunction (mt-DNA mutations, environmental toxins) in the pathogenesis of mitochondrial diseases. Elective. Open to all graduate students in basic biomedical sciences and biology. Second semester and summer.

BIOC 315  Microscopic Biochemistry  20.40; 3 cr.
A course that introduces students to histochemical techniques and microscopic analysis. This includes embryonic dissection, antibody staining, in situ hybridization and whole mount hybridization. The course is composed of lectures and lab sessions. Elective. Open to all graduate students in basic sciences and related fields. Second semester; alternate years.

BIOC 316  Bioinformatics  0.30; 1 cr.
A course that introduces students to the latest bioinformatics literature. The format is a journal club in which recent journal articles are circulated and discussed. Guest lecturers are invited to present research related to the field. Students are also given an orientation on software currently available in the Computational Science and Bioinformatics Lab. Elective. Open to both basic biomedical sciences, and Arts and Sciences graduate students. Prerequisite: graduate standing.

BIOC 317 (a-k)  Selected Topics in Biochemistry  16.0; 1 cr.
A series of elective courses (a-i), each 1 credit. Each course emphasizes the basic concepts and introduces recent developments in the fields of (a) proteins; (b) carbohydrates; (c) lipids; (d) molecular biology; (e) cancer; (f) apoptosis; (g) cyclooxygenase and lipoxygenase; (h) Biochemical Toxicology; (i) congenital heart problems; (j) special techniques in biochemistry: PCR, sequencing, transfection, Elisa, FPLC, SDS-PAGE, western blotting; (k) Copper metabolism: Wilson's Disease. The course is open to medical doctors and graduates in medical and related fields. Elective. Prerequisite: consent of coordinator. Second semester and summer.

BIOC 321  Nucleic Acids and Basic Genetics  15.0; 1 cr.
This course discusses the principles of nucleic acids structure and function in eukaryotes. It includes the information for basic genetics in terms of genome structure as well as the diversity of gene regulation. Required from MS and PhD students in Biomedical Sciences. Requires consent of coordinator for other graduate disciplines. First semester.

BIOC 322  Protein Biochemistry  10.10; 1 cr.
This course deals with the biochemistry of proteins including their basic units, different structures, folding process and protein-protein interactions. It focuses on how changes at the structural level modify function. The course also covers the principles of protein purification and sequencing and introduces students to protein database, molecular modeling and systems biology. Required from MS and PhD students in Biomedical Sciences. Requires coordinator approval for other graduate disciplines. First semester.

BIOC 323  Cellular Metabolism and Regulation  25.10; 2 cr.
The course provides a coherent account of structural and metabolic biochemistry. It emphasizes basic concepts of dynamic state and regulatory mechanisms that allow conflicting pathways and reactions to occur while maintaining homeostasis at the organ and inter-organ levels. Required from MS and PhD students in biomedical sciences. Requires coordinator approval for other graduate disciplines. First semester.

BIOC 325  Receptors and Signal Transduction  25.10; 2 cr.
This course covers classical pathways involved in receptor signaling and activation of downstream targets and the molecular mechanisms involved. It deals with the inter- and intracellular communication, from the generation of signaling molecules through the cellular responses. Required from MS and PhD students in biomedical sciences. Requires consent of coordinator for other graduate disciplines. First semester.

BIOC 326 A,B  Bioinformatics Tools and Applications in Genomics 32.0; 2 cr.
This two module course (1 credit/module) introduces students to the new field of Next Generation Sequencing (NGS) technologies. It covers different NGS applications involved in basic research and precision medicine. Students will learn about modern methods, concepts and techniques that are widely used in the field. This will allow them to acquire knowledge on why and how NGS is shaping our understanding of biological sciences. Cases from the literature on genetics and genomics of diseases and their causes will be discussed. Elective. Prerequisite: consent coordinator. Second semester.

BIOC 327  Cancer Genomics 16.0; 1 cr.
This course explores and discusses the impact of genomics on reshaping our understanding of the molecular biology of cancer onset and progression and on advancing precision cancer medicine including risk assessment, early detection, diagnosis and therapy. Elective. Prerequisite: consent of coordinator. Open to all graduate students in basic biomedical sciences and biology. Fall semester.
**BIOC 330**  
**Translational Genetics and Genomics 32.0; 2 cr.**  
This course explores the role of genetics and genomics in the molecular pathobiology of human disease. The course also discusses the impact of genomics on advancing precision medicine including risk assessment, early detection, diagnosis and personalized therapy. *Elective.* Prerequisite: consent of coordinator. Open to all graduate students in basic biomedical sciences and biology. *Spring semester.*

**BIOC 395A/B**  
**Comprehensive Exam**  
Prerequisite: Consent of advisor.

**BIOC 399**  
**MS Thesis**  
A/B/C/D/E  
A 9 credit-hour course in which students conduct original research under faculty supervision. Faculty research focus includes: molecular mechanisms of inflammation, vascular biology, congenital heart problems, Wilson’s disease, diabetes, atherosclerosis, sphingolipid metabolism, genetics of autism and dermatological disorder, mechanism of brain injury, cancer, cell death.