

# BIOCHEMISTRY (BCH)

The following courses are offered by the Faculty of Science.

## **BCH 1100 Elements of Biochemistry (3 units)**

An introduction to the structure, function and metabolism of compounds in biological systems and the biochemical basis of certain clinical disorders.

**Course Component:** Lecture

## **BCH 1500 Éléments de biochimie (3 crédits)**

Introduction aux structures, fonctions et métabolisme des substances biologiques et à la base biochimique de quelques maladies.

**Volet :** Cours magistral

## **BCH 2333 Introduction to Biochemistry (3 units)**

The chemistry and biological properties of amino acids, proteins, nucleic acids, lipids, carbohydrates, and vitamins. The course includes laboratory and tutorial sessions. Priority given to students for whom this course is mandatory. Previously BCH 2140 and BCH 2336.

**Course Component:** Discussion Group, Laboratory, Lecture

Prerequisites: CHM 2120

## **BCH 2733 Introduction à la biochimie (3 crédits)**

Les propriétés chimiques et biologiques des acides aminés, des protéines, des acides nucléiques, des lipides, des glucides et des vitamines. Le cours comprend des expériences dans des laboratoires et des tutorats. Priorité est donnée aux étudiants pour lesquels ce cours est obligatoire. Antérieurement BCH 2540 et BCH 2736.

**Volet :** Groupe de discussion, Laboratoire, Cours magistral

Préalable : CHM 2520.

## **BCH 3120 General Intermediary Metabolism (3 units)**

The properties of enzymes, bioenergetics, the metabolic and nutritional role of carbohydrates, lipids and amino acids.

**Course Component:** Lecture

Prerequisite: BCH 2333.

## **BCH 3125 Protein Structure and Function (3 units)**

Protein structure, with an emphasis on modern physical methods used for its study. Advanced enzyme kinetics. Mechanisms of enzyme action. Regulation of enzyme activity. Introduction to protein engineering.

**Course Component:** Lecture

Prerequisite: BCH 2333.

## **BCH 3170 Molecular Biology (3 units)**

Gene structure, expression and replication, protein synthesis: regulatory mechanisms and cellular regulation in prokaryotes and eukaryotes.

**Course Component:** Lecture

Prerequisites: BCH 2333, BIO 2133. The courses BCH 3170, BIO 3170 cannot be combined for units.

## **BCH 3346 Biochemistry Laboratory II (3 units)**

Experiments related to intermediary metabolism and physical biochemistry. Priority given to students for whom this course is compulsory.

**Course Component:** Laboratory

Prerequisite: BCH 2333.

## **BCH 3356 Molecular Biology Laboratory (3 units)**

Basic techniques in molecular biology (recombinant DNA, vectors, plasmids, gene screening, protein analysis) and their use in genetic engineering and cloning research. This course cannot be combined for units with BIO 3151. Priority given to students for whom this course is compulsory.

**Course Component:** Discussion Group, Laboratory

Prerequisite: BCH 2333. BCH 3170 or BIO 3170 is corequisite to BCH 3356. The courses BCH 3356, BIO 3151 cannot be combined for units.

## **BCH 3520 Métabolisme intermédiaire général (3 crédits)**

Propriétés des enzymes, bioénergétique, le rôle métabolique et nutritionnel des acides aminés, glucides et lipides.

**Volet :** Cours magistral

Préalable : BCH 2733.

## **BCH 3525 Structure et fonctions des protéines (3 crédits)**

Structure des protéines et méthodes physiques modernes servant à l'étudier. Cinétique enzymatique avancée. Mécanismes catalytiques enzymatiques. Régulation de l'activité enzymatique. Introduction à l'ingénierie des protéines.

**Volet :** Cours magistral

Préalable : BCH 2733.

## **BCH 3570 Biologie moléculaire (3 crédits)**

Structure, expression et réplication des gènes, synthèse protéique: mécanismes de régulation chez les procaryotes et eucaryotes.

**Volet :** Cours magistral

Préalables : BCH 2733, BIO 2533. Les cours BCH 3570 et BIO 3570 sont mutuellement exclusifs.

## **BCH 3746 Laboratoire de biochimie II (3 crédits)**

Travaux pratiques dans les domaines du métabolisme intermédiaire et de la biochimie physique. Priorité accordée aux étudiants et étudiantes pour qui ce cours est obligatoire.

**Volet :** Laboratoire

Préalable : BCH 2733.

## **BCH 3756 Laboratoire de biologie moléculaire (3 crédits)**

Travaux pratiques en biologie moléculaire (ADN recombinant, vecteurs, plasmides, criblage génétique, analyse des protéines) et utilisation de ces méthodes pour l'ingénierie génétique et pour le clonage des gènes. Les cours BCH 3756 et BIO 3551 sont mutuellement exclusifs. Priorité accordée aux étudiants et étudiantes pour qui ce cours est obligatoire.

**Volet :** Groupe de discussion, Laboratoire

Préalable : BCH 2733. Le cours BCH 3570 ou BIO 3570 est concomitant à BCH3756.

**BCH 4040 Projet de recherche - Biochimie / Honours Research - Biochemistry (9 crédits / 9 units)**

Un projet de recherche de deux sessions se fera sous la direction d'un professeur désigné par le Département de biochimie, microbiologie et immunologie. Les résultats des travaux de recherche seront présentés sous forme d'affiche; aussi, un rapport de recherche sera soumis. Cours contingenté. / A two session research project will be done under the supervision of a professor designated by the Department of Biochemistry, Microbiology and Immunology. Students will present the results from the research work as a poster; a thesis describing the project must also be submitted. Limited enrollment.

**Volet / Course Component:** Recherche / Research

Compléter les cours obligatoires de niv. 1000, 2000, 3000 du B.Sc. spéc. et conserver une MPC min. de 6.5/MP de 6.5 ou plus, calculée avec les 2 dernières années à temps plein au prog. spéc. (min. de 54 cr. incl. tous les cours obligatoires de niv. 3000) / Must complete all compulsory 1000, 2000 3000 level courses in the Hon. BSc with a CGPA of 6.5/GPA of 6.5 or greater calculated from the 2 most recent years of full-time study in the Hon. BSc (min. of 54 units incl. all compulsory 3000 level courses).

**BCH 40401 Projet de recherche - Biochimie (Partie 1 de 2) / Honours Research - Biochemistry (Part 1 of 2)**

Un projet de recherche de deux sessions se fera sous la direction d'un professeur désigné par le Département de biochimie, microbiologie et immunologie. Les résultats des travaux de recherche seront présentés sous forme d'affiche; aussi, un rapport de recherche sera soumis. Cours contingenté. Préalable : L'étudiant ou l'étudiante doit avoir complété les cours obligatoires de niveau 1000, 2000, 3000 du B.Sc. spécialisé en biochimie et avoir conservé une MPC minimale de 6.5 ou plus ou avoir une MP de 6.5 ou plus, calculée à partir des deux dernières années à temps plein au programme spécialisé (minimum de 54 crédits incluant tous les cours obligatoires de niveau 3000). (Partie 1 de 2) / A two session research project will be done under the supervision of a professor designated by the Department of Biochemistry, Microbiology and Immunology. Students will present the results from the research work as a poster; a thesis describing the project must also be submitted. Limited enrollment. Prerequisite: The student must have completed all compulsory 1000, 2000 and 3000 level courses in the Honours BSc program with a CGPA of 6.5 or greater or with a GPA of 6.5 or greater calculated from the two most recent years of full-time study in the Honours program (minimum of 54 units including all compulsory 3000 level courses). (Part 1 of 2)

**Volet / Course Component:** Recherche / Research

Compléter les cours obligatoires de niv. 1000, 2000, 3000 du B.Sc. spéc. et conserver une MPC min. de 6.5/MP de 6.5 ou plus, calculée avec les 2 dernières années à temps plein au prog. spéc. (min. de 54 cr. incl. tous les cours obligatoires de niv. 3000) / Must complete all compulsory 1000, 2000 3000 level courses in the Hon. BSc with a CGPA of 6.5/GPA of 6.5 or greater calculated from the 2 most recent years of full-time study in the Hon. BSc (min. of 54 units incl. all compulsory 3000 level courses).

**BCH 40402 Projet de recherche - Biochimie (Partie 2 de 2) / Honours Research - Biochemistry (Part 2 of 2) (9 crédits / 9 units)**

Un projet de recherche de deux sessions se fera sous la direction d'un professeur désigné par le Département de biochimie, microbiologie et immunologie. Les résultats des travaux de recherche seront présentés sous forme d'affiche; aussi, un rapport de recherche sera soumis. Cours contingenté. Préalable : L'étudiant ou l'étudiante doit avoir complété les cours obligatoires de niveau 1000, 2000, 3000 du B.Sc. spécialisé en biochimie et avoir conservé une MPC minimale de 6.5 ou plus ou avoir une MP de 6.5 ou plus, calculée à partir des deux dernières années à temps plein au programme spécialisé (minimum de 54 crédits incluant tous les cours obligatoires de niveau 3000). (Partie 2 de 2) / A two session research project will be done under the supervision of a professor designated by the Department of Biochemistry, Microbiology and Immunology. Students will present the results from the research work as a poster; a thesis describing the project must also be submitted. Limited enrollment. Prerequisite: The student must have completed all compulsory 1000, 2000 and 3000 level courses in the Honours BSc program with a CGPA of 6.5 or greater or with a GPA of 6.5 or greater calculated from the two most recent years of full-time study in the Honours program (minimum of 54 units including all compulsory 3000 level courses). (Part 2 of 2)

**Volet / Course Component:** Recherche / Research

Préalable: BCH 40401 / Prerequisite: BCH 40401

**BCH 4101 Human Genome Structure and Function (3 units)**

First half the of course will focus on human chromosomes, chromatin structure, genome organization, genetic and physical mapping and the human genome project. Second half will examine the genome at the level of the gene, and covers gene structure, gene regulation, gene splicing, mRNA transport and protein synthesis. Examples of inherited and acquired genetic diseases will be discussed. Courses BCH 4101, BPS 4101 cannot be combined for units.

**Course Component:** Lecture

Prerequisite: BCH 3170 or BIO 3170.

**BCH 4116 Analytical Biochemistry (3 units)**

An overview of modern bioanalytical chemistry with particular emphasis on analysis of biomolecules (proteins, peptides, RNAs and DNAs) and their interactions with other biomolecules, drugs and cells. Chemical principles of spectroscopic methods, immunoassays, Western, Northern and Southern blottings, SDS-PAGE, quantitative PCR, capillary electrophoresis, flow cytometry and protein mass spectrometry. Medical molecular diagnostics of biomarkers and biopharmaceuticals.

**Course Component:** Lecture

Prerequisite: CHM 2354 or BCH 2333. The courses BCH 4116, BIM 4316 cannot be combined for credits.

**BCH 4122 Structural Biology of Proteins (3 units)**

Advanced course on recent findings concerning the molecular structure of proteins and structure-function relationships, with particular emphasis on protein folding and the interactions of proteins with proteins, carbohydrates, lipids, nucleic acids, and other molecules.

**Course Component:** Lecture

Prerequisite: BCH 3125.

### **BCH 4123 Pathological Biochemistry (3 units)**

Introduction to the study of the changes in human biochemical processes in disease states and to how these alterations can be used to diagnose and monitor the treatment of various disorders. Topics are approached through clinical cases and a short review of normal physiology, followed by a discussion on how the given disease alters normal biochemical parameters and how they can be measured by the clinical laboratory and then used in its diagnosis and management. No previous medical knowledge is required but a reasonable understanding of human biochemistry and physiology is expected.

**Course Component:** Lecture

Prerequisite: BCH 3120.

### **BCH 4124 Carbohydrates and Glycobiology (3 units)**

A succinct and current overview of the fundamental facts, concepts, and methods in glycosciences by revealing the complex involvement of glycans and complex oligosaccharides in human-related physiology and pathology.

**Course Component:** Lecture

Prerequisite: BCH 2333.

### **BCH 4125 Cellular Regulation and Control (3 units)**

An advanced course on the biochemistry of hormones and growth factors and their molecular action in metabolic and physiological regulation including the structure of biological membranes and their role in processes such as signal transduction.

**Course Component:** Lecture

Prerequisite: BCH 3120 or BIO 3153.

### **BCH 4126 Structural Biology of Membranes (3 units)**

Advanced course on the principles governing the structural and functional organization of biological membranes and the experimental approaches used for their study. Recent research in selected fields such as membrane protein biogenesis, membrane-related pathologies, structural biology of membrane proteins, membrane biophysics, and cell signaling will be discussed.

**Course Component:** Lecture

Prerequisite: BCH 3125.

### **BCH 4130 Normal Human Nutrition (3 units)**

Studies of nutrients essential to humans and their requirements. Not necessarily offered every year.

**Course Component:** Lecture

Prerequisite: BCH 3120.

### **BCH 4171 Advanced Nutrition in the Diseased and Normal States (3 units)**

An advanced course in nutritional biochemistry emphasizing the role of nutrients in disease and the methodology for critical evaluation of the literature. Not necessarily offered every year.

**Course Component:** Lecture

Prerequisite: BCH 3120.

### **BCH 4172 Topics in Biotechnology (3 units)**

A lecture and seminar course on the application of molecular biology to the field of biotechnology. Areas to be discussed include the properties of gene cloning and expression systems, the use of vectors for gene cloning in prokaryotes and eukaryotes and the production of proteins in heterologous hosts. Invited speakers will describe various advances in biotechnology.

**Course Component:** Discussion Group, Lecture

Prerequisite: BCH 3170 or BIO 3170. The courses BCH 4172, BIO 4174 cannot be combined for units.

### **BCH 4188 Synthetic Biology (3 units)**

An advanced course on the use of molecular level tools to control replication, transcription, translation and regulation of expression of genetic material in prokaryotic and eukaryotic systems, including their viruses, for designing and remodeling biological systems.

**Course Component:** Lecture

Prerequisites: BCH 3125, (BCH 3170 or BIO 3170).

### **BCH 4300 Selected Topics in Biochemistry (3 units)**

Lectures and seminars on selected topics in Biochemistry.

**Course Component:** Lecture

Prerequisite: 9 units of lecture courses in BCH.

### **BCH 4501 Structure et fonction du génome humain (3 crédits)**

La première moitié du cours se concentre sur les chromosomes humains, la structure de la chromatine, l'organisation du génome, la cartographie génétique et physique et le projet du génome humain. La deuxième moitié du cours examine le génome au niveau du gène, et couvre la structure des gènes, la régulation des gènes, l'épissage des gènes, le transport de l'ARNm et la synthèse des protéines. Des exemples de maladies génétiques héritées et acquises seront discutés. Les cours BCH 4501 et BPS 4501 sont mutuellement exclusifs.

**Volet :** Cours magistral

Préalable : BCH 3570 ou BIO 3570.

### **BCH 4522 Biologie structurale des protéines (3 crédits)**

Cours avancé sur les récents progrès relatifs à la structure moléculaire et aux relations structure-fonction des protéines, avec accent sur le repliement des protéines et les interactions des protéines avec les protéines, les glucides, les lipides, les acides nucléiques, et d'autres molécules.

**Volet :** Cours magistral

Préalable : BCH 3525.

### **BCH 4525 Contrôle et régulation cellulaires (3 crédits)**

Un cours avancé sur la biochimie des hormones et des facteurs de croissance et ainsi que de leur action moléculaire dans la régulation métabolique et physiologique, incluant la structure des membranes biologiques et leur rôle dans des processus tels que la transduction du signal.

**Volet :** Cours magistral

Préalable : BCH 3520 ou BIO 3553.

### **BCH 4526 Biologie structurale des membranes (3 crédits)**

Cours avancé sur les principes régissant l'organisation structurale et fonctionnelle des membranes biologiques et les approches expérimentales utilisées pour leur étude. Incursions au cœur de la recherche récente dans des domaines choisis tels que la biogenèse des protéines membranaires, les pathologies liées aux membranes, la biologie structurale des protéines membranaires, la biophysique des membranes, la signalisation cellulaire.

**Volet :** Cours magistral

Préalable : BCH 3525.

### **BCH 4588 Biologie synthétique (3 crédits)**

Cours avancé sur l'utilisation d'outils moléculaires pour contrôler la réplication, la transcription, la traduction et la régulation de l'expression du matériel génétique dans les systèmes prokaryotes, eucaryotes ou viraux, pour la conception et le remodelage des systèmes biologiques.

**Volet :** Cours magistral

Préalables : BCH 3525, (BCH 3570 ou BIO 3570).

### **BCH 4700 Sujets choisis en biochimie (3 crédits)**

Cours et séminaires sur un sujet choisi en biochimie.

**Volet :** Cours magistral

Préalable : 9 crédits de cours théorique en BCH.

**BCH 4900 Études dirigées en biochimie / Directed Studies in Biochemistry (3 crédits / 3 units)**

Revue de la littérature sur un sujet d'actualité dans le domaine. Les résultats de l'étude sont présentés lors d'un séminaire. Les étudiants choisissent le sujet de l'étude en consultation avec un professeur assigné par le directeur du programme. Pour les étudiants dans leur dernière année du B.Sc. spécialisé en biochimie. / This course involves a major literature review of a topic of current interest in the field. Upon completion of the written review, the students will present and defend the key findings in a seminar. Students will choose their review subject in consultation with a professor assigned by the Program Director. For students in the last year of a Biochemistry Honours program.

**Volet / Course Component:** Recherche / Research

**BCH 4932 Séminaire de biochimie / Biochemistry Seminar (3 crédits / 3 units)**

Les étudiants du programme spécialisé en biochimie présentent des séminaires sur des sujets choisis. Les sections du cours sont offertes selon la discipline et/ou la langue d'enseignement. / Students in the Honours in Biochemistry will present seminars on selected topics. Course sections are created by discipline and/or language of instruction.

**Volet / Course Component:** Séminaire / Seminar

Préalables: BCH 3520, BCH 3525, BCH 3746, (BCH 3570 ou BIO 3570), (BCH 3756 ou BIO 3551). / Prerequisites: BCH 3120, BCH 3125, BCH 3346, (BCH 3170 or BIO 3170), (BCH 3356 or BIO 3151).

**BCH 49321 Séminaire de biochimie (Partie 1 de 2) / Biochemistry Seminar (Part 1 of 2)**

Les étudiants du programme spécialisé en biochimie présentent des séminaires sur des sujets choisis. Les sections du cours sont offertes selon la discipline et/ou la langue d'enseignement. (Partie 1 de 2) / Students in the Honours in Biochemistry will present seminars on selected topics. Course sections are created by discipline and/or language of instruction. (Part 1 of 2)

**Volet / Course Component:** Séminaire / Seminar

Préalables : BCH 3520, BCH 3525, BCH 3746, (BCH 3570 ou BIO 3570), (BCH 3756 ou BIO 3551). / Prerequisites: BCH 3120, BCH 3125, BCH 3346, (BCH 3170 or BIO 3170), (BCH 3356 or BIO3151).

**BCH 49322 Séminaire de biochimie (Partie 2 de 2) / Biochemistry Seminar (Part 2 of 2) (3 crédits / 3 units)**

Les étudiants du programme spécialisé en biochimie présentent des séminaires sur des sujets choisis. Les sections du cours sont offertes selon la discipline et/ou la langue d'enseignement. (Partie 2 de 2) / Students in the Honours in Biochemistry will present seminars on selected topics. Course sections are created by discipline and/or language of instruction. (Part 2 of 2)

**Volet / Course Component:** Séminaire / Seminar

Préalable: BCH 49321. / Prerequisite: BCH 49321.

**BCH 5101 Analysis of -Omics Data (3 units)**

Theoretical and practical aspects of various methods currently used to analyze the plethora mountain of omics data. Methods: sequence alignment and database searches; sequence analysis and bioinformatics of gene regulation; DNA microarray and sequencing technologies to identify transcription factor binding sites; analysis of proteomics data; statistical analysis of preprocessed gene expression and protein/metabolite abundance data; epidemiology applications. Critical reading of the literature and strategies for making informed choices of methods for the analysis of students' own data.

**Course Component:** Lecture

**BCH 5102 Principles of Biomanufacturing (3 units)**

This course will cover the fundamental biological principles impacting the development and efficacy of biotherapeutics. The course will also include topics such as the steps related to biomanufacturing processes, analytical development, quality control and assurance.

**Course Component:** Lecture

**BCH 5103 Seminar in Biomanufacturing and Commercialization (3 units)**

Seminars on topics of current interest in biomanufacturing and related subjects. Seminars will consist of visiting lectures from entrepreneurs and speakers from industry, regulatory agencies and patient advocate organizations with real-life experience, who will share their stories on the path to production, clinical implementation and commercialization of biological therapeutics.

**Course Component:** Seminar

**BCH 5366 MSc Seminar (3 units)**

Attendance and participation in the annual BMI Student Symposium and BMI Poster Day, attendance at BMI seminars relevant to Biochemistry. Students must present at least one poster and one oral presentation during the course of their program. Graded S (Satisfactory) / NS (Not Satisfactory).

**Course Component:** Seminar

**BCH 5501 Analyse des données omiques (3 crédits)**

Les aspects théoriques et pratiques des méthodes actuellement utilisées pour l'analyse des données omiques. Méthodes : alignement des séquences et recherche dans les bases de données; analyse des séquences et bioinformatique de l'expression génique; micro puces d'ADN et technologies de séquençage utilisées pour l'identification des sites de liaison des facteurs de transcription; l'analyse des données protéomiques; l'analyse statistique de l'expression génique prétraitée; et applications aux données protéine/abondance de métabolites, épidémiologie. Lecture critique de la littérature et stratégies pour faire des choix informés quant à la sélection des méthodes pour l'analyse des données.

**Volet :** Cours magistral

**BCH 8101 Physical and Chemical Methods in Biochemistry (3 units)**

Current applications of physical and chemical methods to the study of macromolecule structure-function relationships.

**Course Component:** Lecture

**BCH 8102 Selected Topics in Protein Structure and Function (3 units)**

An advanced study of recent literature dealing with structure-function relationships in selected proteins.

**Course Component:** Lecture

**BCH 8103 Advanced Topics in Gene Expression and Protein Synthesis (3 units)**

An advanced study of the recent literature dealing with the chemistry, metabolism and function of nucleic acids, the biosynthesis of proteins, biochemical and genetic control mechanisms, genetic engineering and the control of gene expression. Offered every second year in alternation with BCH 8105.

**Course Component:** Lecture

**BCH 8104 Advanced Topics in Cell Regulation (3 units)**

An advanced study of recent literature dealing with signal transduction processes and the regulation of metabolism, cell proliferation and differentiation.

**Course Component:** Lecture

Offered in alternate years.



**BCH 8105 Advanced Topics in Molecular Biology of Human Diseases (3 units)**

Topics will be selected and representative of current developments in the field. The course consists of a repeated series of a 3 hour lecture by an expert in the field one week, followed by student presentations, discussions and critique of assigned papers on that topic the following week. Topics on selected diseases will focus on various aspects of cancer, apoptosis, disease gene identification and gene therapy. In the past these topics have included the molecular aspects of various cancers, spinal muscular atrophy, tissue regeneration, the discovery of disease genes, infectious disease (HIV) and gene therapy. Students will write a grant proposal and participate in mock grant review panels. Depending on enrolment, the course may be limited to HMG students only.

**Course Component:** Lecture

**BCH 8106 Mitochondrial Medicine: Theory and Approaches (3 units)**

An advanced study of the recent literature dealing with metabolism, nutrition and metabolic control theory, with emphasis on both whole body and cell metabolism in metabolic and nutritional disorders such as obesity and non-insulin-dependent diabetes mellitus (NIDDM).

**Course Component:** Lecture

**BCH 8107 Advanced Topics in Lipid Metabolism and Disease (3 units)**

An advanced study of the recent literature dealing with the role of lipids in both normal physiology and pathophysiology, with a focus on the mechanisms underlying the regulation of both lipid signaling and lipid metabolism in disease processes.

**Course Component:** Lecture

**BCH 8108 Advanced Methods of Macro-Molecular Structure Determination (3 units)**

A detailed examination of modern methods used to determine the structures of proteins, nucleic acids, and carbohydrates. May include X-ray crystallography, electron diffraction, nuclear magnetic resonance, and other spectroscopic methods.

**Course Component:** Lecture

**BCH 8109 Advanced Topics in Cell Death (3 units)**

Molecular mechanisms of cell death. Particular attention to be paid to role of aberrant cell death in human disease. Offered in the Fall of odd numbered years.

**Course Component:** Lecture

**BCH 8110 Advanced Topics in Systems Biology (3 units)**

Recent advances in genomics, proteomics, bioinformatics, and neuroinformatics including functional and chemical genomics, RNA analyses, microarrays, mass spectrometry, and neural imaging. Course requirements include student presentations and writing a mock research proposal based on Canadian Institutes of Health Research (CIHR) guidelines. Limited enrollment. Offered in alternate years with BCH 8101 Physical and Chemical Methods in Biochemistry.

**Course Component:** Lecture

Permission of the Department is required.

**BCH 8111 Chromosome and Chromatin Biology (3 units)**

Higher order chromosome structure and chromatin remodeling and their impact on regulation of gene expression, DNA replication, repair and recombination, and chromosome segregation. Histone modifications and nucleosome positioning and their influence on higher order chromosome structure. Importance of chromosome and chromatin in the context of the cell cycle, development, and disease. Critical reading of the literature on chromosome and chromatin biology.

**Course Component:** Seminar

**BCH 8114 Advanced Topics in the Cell Cycle (3 units)**

Mechanisms of cell cycle regulation. Model systems critical to deciphering the cell cycle in eukaryotes: budding and fission yeast, *Xenopus laevis* egg extracts, *Aspergillus nidulans*, *Drosophila melanogaster*, sea urchin and mouse oocytes and cultured vertebrate cells. Overview of the prokaryotic cell cycle.

**Course Component:** Lecture

**BCH 8116 Model Organisms and Systems Biology (3 units)**

Utilization of model organisms in the development and advancement of the systems biology field. Particular attention will be paid to the use of organisms such as *Saccharomyces cerevisiae* as a model platform for cell cycle progression/cancer. Other models may also be included. The basics of the technology will be discussed along with the application of technology to complex biological questions, in particular relating to the cell cycle. Course offered in alternate years.

**Course Component:** Lecture

**BCH 8117 Advanced Topics Relating to the Cell Cytoskeleton and Membranes (3 units)**

Advanced study of recent literature dealing with the mammalian cellular cytoskeleton and membrane with an emphasis on the regulation of cell motility, adhesion and cell division.

**Course Component:** Lecture

**BCH 8120 ADVANCED TOPICS IN IMMUNOMETABOLISM (3 units)**

An advanced study of the recent literature dealing with the field of immunometabolism, with a focus on both immunometabolic pathways and the specialized techniques that allow for understanding chronic inflammatory/metabolic diseases, such as cancer, type 2 diabetes, obesity, atherosclerosis, neurodegeneration, etc.

**Course Component:** Lecture

**BCH 8134 Structure and Expression of Eukaryotic and Prokaryotic Genomes (3 units)**

Sequencing of eukaryote and prokaryote genomes with emphasis on recent technologies, sequence alignments and databases and assembly of genomes from massively parallel sequencing data. Focus on mapping studies, including linkage disequilibrium-based genome-wide association study (GWAS), to characterize functional variants associated with complex traits. Analysis and structure of microbial metagenomes from environmental and human habitats, including structure-function analysis of microbial communities, microbiota-human disease correlations, and molecular phylogeny. Genome expression, including measures of RNA transcripts and proteins and statistical analysis of data. Combination of various -omics data to understand gene-environment interactions.

**Course Component:** Lecture

**BCH 8165 Special Topics in Biochemistry (3 units)**

A survey of recent advances in selected areas of biochemistry.

**Course Component:** Lecture

**BCH 8166 Special Topics in Biochemistry II (3 units)**

A survey of recent advances in selected areas of biochemistry.

**Course Component:** Lecture

**BCH 8213S Seminars (2 crédits / 2 units)**

Compulsory for second-year graduate students.

**Volet / Course Component:** Cours magistral / Lecture

**BCH 8214S Seminars (2 crédits / 2 units)**

Compulsory for third-year graduate students.

**Volet / Course Component:** Cours magistral / Lecture

**BCH 8310 Current Topics in RNA Molecular Biology (3 units)**

Properties, mechanisms associated with regulation and the functions of RNAs and Ribonucleoprotein (RNPs) as well as RNA organisms. Current knowledge on RNA expression (synthesis, processing, transport and localization), the structure-function relationship and molecular mechanisms associated with RNAs and RNA genomes, RNA in evolution and in the origin of life, and RNA as therapeutic agents.

**Course Component:** Lecture

Courses CMM 8310, BCH 8310 cannot be combined for units.

**BCH 8366 PhD Seminar (3 units)**

Attendance and participation in the annual BMI Student Symposium and BMI Poster Day, attendance at BMI seminars relevant to Biochemistry. Students will present a poster in their first and every alternate year, and an oral presentation the second and every alternate year until they have permission to write their thesis. Graded S (Satisfactory) / NS (Not satisfactory).

**Course Component:** Seminar

**BCH 8511 Biologie des chromosomes et de la chromatine (3 crédits)**

Organisation de la structure des chromosomes et le remodelage de la chromatine ainsi que l'impact de ceux-ci sur la régulation de l'expression génique, la réplication, la réparation et la recombinaison de l'ADN ainsi que sur la ségrégation des chromosomes. Les modifications histoniques et le positionnement des nucléosomes ainsi que leur influence sur la structure organisée des chromosomes. Importance des chromosomes et de la chromatine dans le contexte du cycle cellulaire, du développement et des maladies. Lecture critique de la littérature portant sur la biologie des chromosomes et de la chromatine.

**Volet :** Cours magistral

**BCH 8534 Structure et expression des génomes procaryotes et eucaryotes (3 crédits)**

Le séquençage des génomes eucaryotes et procaryotes, avec un accent particulier sur les technologies récentes, l'alignement des séquences et les bases de données, et l'assemblage des génomes à partir de données générées par séquençage haut débit. Les études de cartographie comparée incluant les études d'associations pangénomiques basées sur le déséquilibre de liaison pour caractériser les variantes fonctionnelles associées aux traits complexes. L'analyse et la structure de métagénomes microbiens issus d'habitats humains et environnementaux incluant l'analyse structure-fonction des communautés microbiennes, les corrélations entre les maladies humaines et le microbiome ainsi que la phylogénie moléculaire. L'expression génique incluant les mesures de transcriptomes et de protéomes ainsi que l'analyse statistique des données. La combinaison des différentes -données omiques pour comprendre les interactions gène-environnement.

**Volet :** Cours magistral

**BCH 9998 Examen de synthèse (doctorat) / Comprehensive-Examination (PhD)**

À l'intention des étudiants inscrits au programme de Ph.D. L'inscription à ce cours est limitée à trois sessions consécutives. / For students enrolled in the doctoral program. Enrollement in this course is limited to three consecutive academic sessions.

**Volet / Course Component:** Recherche / Research