

# COLLEGE OF HEALTH AND LIFE SCIENCES (CHLS)

The College of Health and Life Sciences (CHLS) provides essential educational and research training to future leaders in the fields of biomedical sciences, genomics, and precision medicine. The college embodies a multidisciplinary learning approach to research and discovery, and aims to become a dedicated hub of knowledge-sharing in the area of health and life sciences. Its programs integrate scientific expertise by combining a seasoned collective of research partners within the university with esteemed external clinical and health science partners.

For more information, click here (<https://www.hbku.edu.qa/en/chls/>).

## Programs

- Biological and Biomedical Sciences (<https://catalog.hbku.edu.qa/academic-degrees/chls/bbs/>)
  - Biological and Biomedical Sciences, Master of Science (<https://catalog.hbku.edu.qa/academic-degrees/chls/bbs/bbs-ms/>)
  - Biological and Biomedical Sciences, PhD (<https://catalog.hbku.edu.qa/academic-degrees/chls/bbs/bbs-phd/>)
  - Biopsychology and Neuroscience, PhD (<https://catalog.hbku.edu.qa/academic-degrees/chls/bbs/phd-bns/>)
- Exercise Science (<https://catalog.hbku.edu.qa/academic-degrees/chls/ekpt/>)
  - Exercise Science, Master of Science (<https://catalog.hbku.edu.qa/academic-degrees/chls/ekpt/exercise-science-ms/>)
- Genomics and Precision Medicine (<https://catalog.hbku.edu.qa/academic-degrees/chls/gtb/>)
  - Genomics and Precision Medicine, Master of Science (<https://catalog.hbku.edu.qa/academic-degrees/chls/gtb/gpm-ms/>)
  - Genomics and Precision Medicine, PhD (<https://catalog.hbku.edu.qa/academic-degrees/chls/gtb/gpm-phd/>)

## Courses

### Core Life Sciences

**CLS 600 Techniques in Biochemistry** **3 Credits**  
Grade Mode: Standard Letter, Audit/Non Audit

This course is designed to train students in a range of standard biochemical and cellular biology techniques that are in routine use in a functioning biochemistry laboratory. The course combines lectures illustrating the scientific principles underlying a particular technique with hands-on experience of the methodology in the laboratory. Techniques include protein expression, purification, gel analysis, protein structure and cell culture.

**CLS 625 Applied Biostatistics** **3 Credits**  
Grade Mode: Standard Letter, Audit/Non Audit

The aim of this course is to introduce the fundamental biostatistical concepts to life science students. It aims to give an overview of the statistical and computational ideas required for analysis methods in biological sciences, and provide hands-on experience in analysis. This course does not assume that the student has a background in mathematics and computer science, but introduces all necessary background during the course. The course is appropriate for graduate students and researchers in health and life sciences.

**CLS 661 Special Topics in Biosensors** **3 Credits**  
Grade Mode: Standard Letter, Audit/Non Audit

Over the past 20 years, the field of bio-sensing technology has had a profound impact on both laboratory research as well as commercial activities. With the advance of semiconductor and nanofabrication technologies, bio-technological application-specific integrated circuits (ASICs) have become a major trend in research as well as industry. Examples include DNA sensing, microelectrode measurement array systems for in-vitro and in-vivo physiological research at the cellular level. Bio-sensing has had a major impact on different fields including, E-health systems, genome research and drug development.

**CLS 706 Independent Studies** **3 Credits**  
Grade Mode: Standard Letter

Independent Studies allow students to examine a variety of timely, cutting-edge research areas in life sciences. Taught by our faculty, research scientists from our research institutes or associated industries, this course allows students to keep up with novel trends and topics in the field.

**CLS 711 Development and Diseases of The Nervous System** **3 Credits**  
Grade Mode: Standard Letter, Audit/Non Audit

The aim of the course is to unfold the processes that underlie the formation and disorders the nervous system at the molecular, cellular and circuitry levels. The course will focus on genes/proteins and signaling pathways involved in neural induction, neural tube closure, patterning of the nervous system, neurogenesis, neuronal migration, axon pathfinding, as well as formation and refinement of synapses. Both physiological and pathological conditions will be addressed.

**CLS 726 Proteomics in Precision Medicine** **3 Credits**  
Grade Mode: Standard Letter, Audit/Non Audit

Personalized medicine has revolutionized the medical practice, and to achieve its goals today we are not only dependent on genomics but also on the proteomics for accurate diagnosis and efficient treatments. Thus, there is a growing demand for proteomics-based learning and applications in the field of basic and clinical research. The course 'Proteomics in precision medicine' will bridge this knowledge gap in the GPM program by teaching the students key concepts of proteomics and the overall applications and limitations.

**CLS 751 Molecular Mechanisms of Cancer and Their Applications** **3 Credits**  
Grade Mode: Standard Letter, Audit/Non Audit

This course will introduce students to the molecular mechanisms that lead to cancer development. It will describe the methods used to study these mechanisms and how they can be exploited in cancer diagnostics and therapy.

## Epidemiology

**EPID 700 Introduction to Epidemiology** **3 Credits**  
Grade Mode: Standard Letter, Audit/Non Audit

The major purpose of this core course is to introduce students to the discipline of epidemiology and its application to public health issues and practice.

## Exercise Science

**EXSC 695 Master's Thesis Hours** 0-6 Credits  
Grade Mode: Pass/Non Pass

Full time work in a laboratory to perform experiments related to the MS Thesis dissertation. Thesis research is an essential component of the graduate degree in Exercise Science at HBKU. All students are required to engage in thesis research.

**EXSC 700 Physical Activity and Health: Epidemiology, Research and Practice** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

An introduction to physical activity epidemiology with an emphasis on the relationships between exercise and health for promotion of physical activity in clinical and public health settings.

**EXSC 710 Behavioral Aspects of Physical Activity** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

The major goal of this course is to increase your understanding of the role that behavioral factors play in physical activity and exercise.

The first part of the course covers major behavioral and psychological theories that have been applied to exercise and physical activity. The second part of the course covers behaviorally oriented interventions to promote physical activity and exercise. Issues unique to children, older adults, women, and people of color will be highlighted. The final part of the course covers the impact of physical activity and exercise on mental health outcomes. This section includes an overview of the role that depression plays in morbidity and mortality.

**EXSC 731 Mechanisms of Motor Skill Performance** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

A study of theories and mechanisms in human movement. Focus is on analysis of principles and systems of gross motor control and learning.

**EXSC 732 Applied Biomechanics** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

The focus of this course is to apply general principles of mechanics and physics to analyze human movement. Students will develop an understanding of forces within muscles, the strength properties of bones, the variety of joint designs and resulting different degrees of freedom, and how these initiate and control human movement. Basic mechanics (statics, kinematics, and kinetics) will be studied in two and three dimensions. The biomechanics of human walking and running gait will be investigated

**EXSC 742 Clinical Exercise Testing** 1 Credit  
Grade Mode: Standard Letter, Audit/Non Audit

This course is a clinical exercise laboratory course intended for the student with little or no exercise science laboratory experience. In this course students will acquire the basic knowledge of clinical exercise testing with an overall emphasis on physiological measurement and interpretation of data.

**EXSC 743 Lab Measurements for Exercise Testing** 1 Credit  
Grade Mode: Standard Letter, Audit/Non Audit

This course expands the student's knowledge of exercise testing through the biochemical determination of plasma variables and how these variables may change during or following exercise. The course emphasizes the importance of matching a biochemical response to the physiological measurements during exercise testing.

**EXSC 780 Physiology of Exercise** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

Physiological responses to exercise: skeletal muscle structure and function, cardiorespiratory function, physiological determinants of exercise performance, and training adaptations.

**EXSC 781 Physiology, Exercise and Disease** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

This course is designed to provide students with the basic understanding of physiological adaptations to exercise and disease as it relates to the study of the nervous system, the skeletal muscular system, the cardiovascular system and the gastrointestinal system.

**EXSC 784 Cardiopulmonary Exercise Testing and Prescription** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

This course will instruct the students in the physiological background and theory underlying cardiopulmonary exercise testing, and provide hands on practical experience in laboratory methods of cardiopulmonary exercise testing, lung function and ECG. General principles of exercise prescription and programming will also be covered

**EXSC 787 Research Methods and Design for Exercise Science** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

The major goal of this course is to provide an in-depth examination of research concepts, terminology, experimental, non-experimental, and epidemiological designs, internal and external validity, methods for establishing causality and investigating associations, and application of designs to test hypotheses in research of exercise science-related outcomes. Examples will be drawn from numerous disciplines, with the primary emphasis placed on those dealing with topics directly related to exercise science. Students will be required to read, critically evaluate, and discuss research articles and conceptual papers. Issues unique to different research designs will be highlighted. Students should have a basic understanding of statistics (e.g., variance, correlation). While statistics will not be discussed in this class, the overlay of statistics and research design cannot be separated.

## Genomics & Precision Medicine

**GPM 601 Research Methods and Ethics in Health and Genomics** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

This course aims to provide a comprehensive overview on research ethics, scientific thinking, and academic writing as well as guidelines for study design and good research practice. The course will also offer state-of-the-art knowledge relating to novel methods in genomics, precision medicine, and health analytics.

**GPM 602 Clinical Applications in Genomics and Precision Medicine** 3 Credits  
Grade Mode: Standard Letter, Audit/Non Audit

This course covers fundamental concepts in the application of genomic and precision medicine in a clinical context. Included are modules on relevant technologies with emphasis on data interpretation for clinical outcome, drug design, as well as problem based learning components in clinical genomics and precision medicine

**GPM 604 Advanced Genetics 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

The course covers important concepts and principles in genetics, such as inheritance, developmental processes, genetic variability, genetic mapping of diseases as well as genetic testing, DNA sequencing technologies, and treatment approaches to genetically inherited diseases.

**GPM 607 Molecular Pathology 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course covers current concepts in molecular pathology and their application in translational research and diagnostics, with particular emphasis on the molecular pathology of cancer, cardiovascular, neurological and infectious disease.

**GPM 695 Master's Thesis Hours 0-6 Credits**

Grade Mode: Pass/Non Pass

Full time work in a laboratory to perform experiments related to the MS Thesis dissertation. Thesis research is an essential component of the graduate degree in Biological and Biomedical Sciences at HBKU. All students are required to engage in thesis research.

**GPM 705 Introduction to Data Science 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

Genomics and precision medicine require handling, exploring and understanding large data sets. This course aims to introduce students to basic concepts from probability, statistical inference, linear regression and machine learning using R. No previous knowledge of programming is required, as the course will introduce basic programming concepts and through examples will enable students to ask the right questions, perform their own analyses and visualize the results effectively. The course will provide the students with hands-on programming experience.

**GPM 720 Pharmacogenomics 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course covers fundamental concepts in the field of Pharmacogenomics and how it will help in the realization of personalized medicine. It will include the basic principles of drug discovery and design, pharmacology, pharmacogenetics and pharmacogenomics applied to several disease conditions.

**GPM 721 Bioinformatics 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

The course will convey the fundamentals of bioinformatics methods for genomics data analysis to life science students. It aims to communicate the computational ideas behind key analysis methods in genomics and to provide practical training in using web-based tools and bioinformatics software packages in R. It will enable students to perform basic analysis steps for sequencing data. This course does not assume that the student has a background in mathematics and computer science, but rather introduces mathematical concepts and/or programming languages, as they are needed.

**GPM 733 Epigenetics 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

GPM 733 is an elective epigenetic course. The course will provide an introduction to various epigenetic mechanisms and explain how they determine chromatin architecture and control gene expression. This is important to understand transcriptional regulation particularly during development, as well as during stem cell (re)programming. In addition, the course will cover how epigenetic alterations can cause aberrant silencing or activation of genes that can have an influence on health and disease. An acquaintance with the field of epigenetics is essential for a major in Genomics and Precision Medicine.

**GPM 890 Dissertation Hours 0-9 Credits**

Grade Mode: Pass/Non Pass

Full time work in a laboratory to perform experiments related to the PhD Thesis dissertation. Thesis research is an essential component of the graduate degree in Biological and Biomedical Sciences at HBKU. All students are required to engage in thesis research.

**Life Sciences****LS 601 Research Methods and Ethics 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course is a foundational course for graduate students who will be engaged in research with a focus on health sciences and precision medicine. It provides students with advanced discussions on ethics and ethical misconduct, intellectual property and environmental health and safety as well as scientific thought and design of experiments. A focus of the course is to transition students from textbooks to primary literature as their main source of information.

**LS 603 Advanced Molecular Biology 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course covers the important principles in Molecular Biology, including the replication of DNA, how DNA is converted to RNA, how RNA is modified, transported and regulated, and finally how it is converted to protein. Through the use of primary literature papers, students will gain a current understanding of these subjects.

**LS 605 Advanced Cell Biology 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course builds on the knowledge students acquired in Advanced Molecular Biology and covers the important principles of Cell Biology, the study of the basic unit of life. By relying heavily on recently published seminal scientific papers, students will acquire an accurate understanding of the current research progress in key areas in cell biology.

**LS 607 Advanced Human Physiology 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course focuses on how the human body functions as an integrated system in which cells, tissues, and organs interact to maintain a healthy body. It covers the anatomy and physiology of cardiovascular, respiratory, muscle, renal, gut and endocrine systems. The course also highlights the pathophysiology of some disease conditions.

**LS 695 Master's Thesis Hours 0-6 Credits**

Grade Mode: Pass/Non Pass

Full time work in a laboratory to perform experiments related to the MS Thesis dissertation. Thesis research is an essential component of the graduate degree in Biological and Biomedical Sciences at HBKU. All students are required to engage in thesis research.

**LS 701 Research Seminar****0 Credits**

Grade Mode: Pass/Non Pass

The HBKU Life Science Seminar Series engages students, local researchers, and scientists to catalyze information exchange and networking among researchers for the advancement of life science research in Qatar.

**LS 704 Metabolism and drug discovery****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

The course will provide an in-depth analysis of the relationships between metabolism and important human diseases. It will focus on the pathways of intermediary metabolism by which all cells synthesize and degrade carbohydrates, lipids (fats), and proteins; and discuss how these pathways are regulated by effector molecules and hormones, and how this can be translated into drug design and development. Emphasis will be on how obesity, diabetes, cardiovascular disease, metabolic syndrome, and defects in metabolic pathways lead to cancer.

**LS 708 Advanced Neuroscience****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This graduate course will provide knowledge on fundamental principles that encompass the multidisciplinary field of neuroscience. This will include basic principles of membrane excitability, neuronal information transfer and storage, neuropharmacology, neurodevelopment, sensory systems physiology, behavior and clinical manifestations. Focus on each of these topic areas will include interactive lectures together with development of critical thinking via review and discussion of recent scientific articles that are advancing the field. The course material encompasses molecular, cellular tissue and systems level physiology in each of the sub-discipline areas. Emphasis will be on providing a solid foundation in basic principles to prepare those conducting research in neuroscience to implement the transdisciplinary information in innovative ways.

**LS 709 Molecular and Cellular Biology of Neurodegenerative Diseases****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course will engage students in a detailed exploration of the most important neurological disorders, including Alzheimer's disease (AD), Parkinson's disease (PD), Huntington's disease (HD) and prion diseases. With an initial focus on clinical descriptions for each condition, an in-depth discussion on current hypotheses about the mechanisms underlying these diseases will constitute the bulk of this course.

**LS 710 Cancer Biology****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

During this course students will be exposed to the latest findings in the molecular mechanisms that underlie the genesis and progression of human cancers. Lectures and discussions will be based entirely upon the current scientific literature. These papers will highlight how perturbation of the cell cycle, DNA damage checkpoints, and repair machinery can both promote cancer and be capitalized upon for cancer treatment.

**LS 712 Cancer Immunology****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

Cancer Immunotherapy was selected by "Science" journal as the breakthrough of the year for 2013, which placed it in the company of the first cloned mammal and the complete sequencing of the human genome. Cancer immunology is now one of the most active areas of cancer research and has prompted the development of several important novel therapies currently in use, including cytokine-based therapies, vaccine therapies, and monoclonal antibody therapies. It aims to understand the interaction between immune system and cancer cells, and to discover innovative cancer immunotherapies to treat and retard progression of the disease. This course covers the important aspects of cancer immunology including immune surveillance/editing theory, immune evasion, immunopathogenesis of cancer and tumor antigens. In addition, the different immunotherapeutic approaches of cancer, including T-cell therapy, antibody-based therapies and cancer vaccines will be covered.

**LS 713 Behavior, Learning and Memory****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course will provide the knowledge on multidisciplinary field of neuroscience and build the foundation for understanding the biological basis of behavior, learning and memory. This course will cover the perspectives, questions, and techniques related to neural and molecular systems responsible for behavior, learning, memory, emotions, consciousness and neurodevelopmental basis of behaviors like addiction, fear and anxiety and Alzheimer's disease. Students will learn neuroanatomy, and how the activity of few neurons can yield simple motor action and complex behavioral/psychological functions such as learning and memory.

**LS 714 Scientific Communication and Professional Development****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course will cover key concepts in effective scientific communication, both written and oral. It will also address aspects of CV and cover letter preparation for academia and industry. In addition, it will provide the skills needed in mentoring, establishing collaborations and getting funded in academia.

**LS 715 Physiopathological Mechanisms of Neurogenetic Diseases****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course is intended for graduate students interested in gaining a detailed understanding of molecular mechanisms underlying physiopathological mechanism of genetic diseases related to synapses and muscles. Throughout the course, the focus will be on understanding the experimental approaches that produced current knowledge. Students will be assigned recent research papers as their primary reading materials. About 2/3 of the classes will be lectures by the instructor and 1/3 will be student led discussions of papers.

**LS 730 Mechanobiology in Health and Disease****3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

Prerequisite(s): LS 605

This course covers key principles in mechanobiology, the study of how mechanical environment and cues affect cellular behavior, and how these signals are communicated through mechanotransduction. This course will focus on our most up-to-date understanding of this rapidly growing area of biology and rely heavily on recently published seminal publications.

**LS 740 Stem Cell Biology 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course is intended as an introduction and in-depth discussion focused on the biology of stem cells. The course will introduce the features of stem cells and basic mechanisms regulating their self-renewal and pluripotency. In addition, the course will focus on selected examples of adult stem cells with an introduction to translational medicine approaches involving stem cell biology. Major emphasis will be placed on how advances in stem cell biology and tissue engineering can be applied to the use of embryonic and adult stem cells in regenerative medicine. In addition to these topics, students will be introduced to the ethical, regulatory, and legal issues related to stem cell research.

**LS 741 Signal Transduction in Health and Diseases 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

The course will engage students in the concepts of signal transduction, and how the signaling pathways drive different physiological as well as pathological conditions such as diabetes, cancer, and neurological disorders.

**LS 742 Advances in Human Metabolism and Disease 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

The course will provide an in-depth analysis of the relationships between metabolism and important human diseases. It will focus on the pathways of intermediary metabolism by which all cells synthesize and degrade carbohydrates, lipids (fats) and proteins; and discuss how these pathways are regulated by effector molecules and by hormones in living systems. Much of the emphasis will be on how several human disorders such as obesity, diabetes, cardiovascular disease, the metabolic syndrome and cancer arise from defects in metabolic pathways.

**LS 751 Immunology and Immunogenomics 3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course addresses important concepts in immunology and gives students a broad knowledge base from which they can continue to learn advanced concepts and pursue research in any aspect within the field. The course also covers concepts in immunogenetics including how genetic defects affect immune responses, resulting in diverse phenotypes or consequences. The course will start with lectures 2 hours a week to teach fundamental concepts, then continue starting week 9 with 5 hours/week of hands-on training/practical on experimental methods/tools in immunology as well as student journal club presentations. Lastly, the course will conclude with a workshop on immunogenetics and inborn errors of immunity by guest lecturers from IMAGINE Institute, Paris, France. The course assumes basic knowledge of cell and molecular biology.

**LS 890 Dissertation Hours 0-9 Credits**

Grade Mode: Pass/Non Pass

Full time work in a laboratory to perform experiments related to the PhD Thesis dissertation. Thesis research is an essential component of the graduate degree in Biological and Biomedical Sciences at HBKU. All students are required to engage in thesis research.