LIFE SCIENCES (LS)

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, Pass/Non Pass

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, Pass/Non Pass

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 **1-6 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 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

This course covers advanced concepts in cancer biology. The course begins with a focus on the cell death pathways, transformation of normal to cancer cells and subcellular changes within cancer cells, including non-coding RNA and epigenetic changes. It then covers the cancer cell environment and how cells metastasize. There is a special focus on how the immune system interacts with cancer cells. Finally, the course will present important tools for cancer research and anti-cancer drug development.

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 explores the biological foundations of behavior, learning, and memory through a multidisciplinary neuroscience approach. Key topics include brain-behavior relationships, neural circuits, synaptic plasticity, and molecular mechanisms of memory formation. Students will engage with both theoretical concepts and demonstration sessions on behavioral neuroscience research. The course features observation-based learning of modern neuroscience techniques including behavioral tracking, optogenetics, and disease modeling approaches. Through evaluation of scientific literature and real-world applications, students will develop critical thinking skills in behavioral neuroscience.

LS 714 Scientific Communication and Professional Development **3 Credits**
Grade Mode: Standard Letter, Audit/Non Audit, Pass/Non Pass

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 716 Advanced Techniques in Biomedical Sciences **3 Credits**
Grade Mode: Standard Letter, Audit/Non Audit

This course aims to provide students with both the theoretical and practical knowledge necessary to apply laboratory techniques to their own research projects. It covers a range of techniques, from conventional methods to advanced approaches and model systems commonly used in biomedical research, including tissue culture, cell imaging, and the analysis of DNA, RNA, and proteins. The course emphasizes how to apply these techniques to specific research questions, as well as the critical analysis of the resulting laboratory data.

LS 730 Mechanobiology in Health and Disease **3 Credits**
Grade Mode: Standard Letter, Audit/Non Audit

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 **1-9 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.