Course number: HHNS*6440

Title: 'Nutrition and Gene Expression'

Semester offered: Winter 2013

Course instructor: Dr. Marica Bakovic
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Time: Thurs 9:00-11:50

Evaluation:

Participation	25%
Seminar	25%
Grant Review	5%
Research proposal	45%

MAJOR COURSE THEMES OR CONCEPTS: The role of nutrients in the regulation of gene expression and cell signalling will be examined. Specific examples of nutrients acting at multiple levels of gene regulation including signal transduction from the cell membrane to the nucleus, gene transcription, translation and post-translational modification will be presented. Control of cell fate, metabolism, growth and development and disease in humans will be some of the areas covered as the course proceeds.

The main objective of this course is to provide graduate students with an understanding of the role of nutrients in the regulation of gene expression and in controlling cell signalling cascades. As well, students will have a good understanding of the molecular biology methodology used when Nutritional Scientists address these questions. Upon completion of the course, students should be able to evaluate relevant literature in this field as well as design experiments to address questions in this area.

CONTENT OF LECTURES: Materials will be presented by classical-style lectures and students-leading lecture/discussions and seminars. The first two lectures will focus on review of basic material and in depth examination of the techniques and research approaches that will be discussed in the following lectures. The first part of the course includes general principles and methodologies for gene expression and the second part focus on the role of nutrients in the transcriptional, post-transcriptional regulation and signalling. Students will present a 40-minute seminar where their subject is most appropriate to the lecture material. Specific papers to be covered need not take place after the second week of classes. Students will also prepare an 11 pages (single-space) research proposal (see below).

READING MATERIALS: There is no required text for this course however a number of review articles and primary research articles will form the basis for much of the presentation and discussion in lecture material. These materials will be posted on the coarse web site a week before the lecture time. Bakovic will periodically update the site with new articles. You should check the site weekly for updates. The lecture material, presentations and the assigned readings available in electronic format will be held two weeks at the web course site.

In addition to the posted articles, there are several useful texts that will provide background and supplementary material. Some suggested texts follow:

Nutrition-Gene Interactions in Health and Disease, Ed.: Naima Moustaid-Moussa and Carolyn Berdanier, CRC Press, 2001

Recombinant DNA, 2nd Edition, Ed.: James Watson, Michael Gilman, Han Witkowski, Mark Zoller, 1992

LECTURES/SEMINARS: Students are asked to present a lecture/seminar directly related to the course material on a subject appropriate to the lecture material being covered at the time of their presentation. The lecture should focus on one or two key review papers and you will lead further class discussions on two/three research papers covering the same topic (they all will be provided by Dr. Bakovic and posted on Web CT for download). Students in the class will be asked to read the key paper(s) you will present in advance of your lecture/seminar. You should allow approximately 20 minutes for discussion, which could occur at the end or throughout your lecture.

RESEARCH GRANT PROPOSAL: The style and format for the grant proposal should conform to the guidelines for a research proposal to the Canadian Institutes of Health Research (CIHR). Dr Bakovic will also provide you with additional instructions when time comes. The parts to be completed are the Scientific Abstract and Detailed Proposal *without* Budget sections of the grant. Students should clear their proposed topics with Dr. Bakovic before materials for the grant are collected. If you are not able to find a suitable proposal, please discuss this with Dr. Bakovic who should be able to provide you with some helpful guidelines. Grant proposals will be evaluated by Dr. Bakovic for final assessment although proposals will also proceed through "peer review" (see below) for purposes of the Mock Grant Review.

PARTICIPATION: The way for this course to be most effective is if each individual in the class ensures that they are prepared for class by reading relevant course materials well in advance of class and formulating questions that may be helpful to class discussions. Each of you has a unique background and experience that can give us new perspectives on the course material. While it is realized that personality type can often influence a student's willingness to speak out in class, it is important for scientists to freely exchange ideas in oral form as well as written formats. If this does not come naturally to you, then hopefully this can improve with your graduate experience in this class. However, if you do not feel that you can express yourself during class but want to participate in the generation of questions, then an option would be to provide questions or points for discussion to Dr. Bakovic before class and these points can then be raised by her at the appropriate point in the lecture/seminar. It is also recognized that it is the nature of the contributions that is important, not how many times a person opens their mouth in class. It is quality, not quantity that is important here.

A second way students will participate in this class is in the form of grant reviews. Grants should be completed and distributed for reviewing on March 22. Each student will be asked to review one/two of the grants from the class and write a written evaluation (1 page for each) of the grant, much like we do for real research grants. Reviewers will have two weeks to prepare their reviews. On the last day of classes, each grant will be assessed by the panel and a ranking of grants compiled. The review process will be used for experience only. No portion of the grade will be dependent on the success in this mock competition.

TENTATIVE SCHEDULE:

January 10	**Introduction:** Stem cells**,** DNA, Genomics, Characterizing DNA, RNA, and Proteins; PCR, Microarrays, and Bioinfromatics
January 17	**Transcriptional Regulation:** Purposes, General principles and techniques; Transcription initiation, RNA Polymerase II, Promoters, Transcription factors
January 24	**Nuclear Receptors,** Genetic Mapping of Mutations, Single-nuclear polymorphisms, Allele frequencies
January 31	**Signaling Mechanisms:** Synthesis and targeting, Phosphorylation, Glycosylation
February 7	**Regulation by Fatty Acids:** Lipids as second-mesangers, DAG/PKC and IP-3K/Akt signalling; Fatty acids and PPAR receptors
February 14	**Regulation by Cholesterol:** Cholesterol and SREBP transcription factors
February 21	**WINTER BREAK WEEK**
February 28	**Regulation by Carbohydrates:** Glucose/insulin signalling; Receptors, Links between lipid and CHO metabolism.
March 7	**Regulation by Vitamins:** Retinoic acid receptor RXR , vitamin D receptor VDR, Calcium homeostasis, genomic and nongenomic actions.
March 14	**Epigenetics and Methyl-group donors (choline, folate, methionine):** S-adenosyl methionine (SAM), homocysteine, DNA-methylation
March 21	**Nutrigenomics I** : The genetics of cardiovascular disease
March 28	**Nutrigenomics II:** The genetics of obesity and diabetes
April 4	**Research Project Discussions**