

York University
Kinesiology and Health Science
KINE 4516 3.0: Mitochondria in Health and Disease
Fall 2019

Objectives of the Course

This course will analyze the function and biogenesis of mitochondria with an emphasis on skeletal muscle. Apoptosis, autophagy, mitochondrial adaptation and disease, as well as the effects of exercise, training and muscle disuse are examined at the molecular level. Current original literature is read and discussed in lecture and class presentation format.

The following topics will be discussed in detail:

Historical aspects of mitochondrial biogenesis (MB); Experimental techniques used to study MB; Mechanisms of ATP synthesis during mitochondrial respiration; Effect of acute and chronic exercise on MB in muscle; Molecular basis of the expression of nuclear genes encoding mitochondrial proteins; Regulation of mtDNA replication and expression; Protein import into mitochondria; mRNA stability; Mitochondrially-mediated apoptosis; Mitophagy; Mitochondrial reactive oxygen species production and the effect of exercise; Mitochondrial diseases; Tissue-specific differences in MB; Effect of thyroid hormone on MB; Signals and kinases leading to MB in muscle; Impact of MB on lipid and carbohydrate metabolism during exercise: effect on performance; MB during the aging process; Future directions in MB. Current, original literature is read and discussed in lecture and class presentation format.

Required References: Course notebook and papers

Recommended background readings: Posted on Moodle

Tryon, L.D., M. Colavecchia and D.A. Hood. Exercise, muscle and mitochondria: signaling mechanisms, health consequences and new challenges for the future. J. Student Science and Tech. 8: 83-92, 2015.

Hood, D.A., J.M. Memme, A.N. Oliveira and M. Triolo. Maintenance of skeletal muscle mitochondria in health, exercise, and aging. Ann. Rev. Physiol. 81:19-41, 2019.

Lectures: Monday and Wednesday 2:30 until about 3:45 pm; Room: CLH 110

Instructor: David A. Hood, Ph.D.

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STUDENT EVALUATION

Discussion topic presentation	20%
First Quiz (On Wed. Oct. 9 , covering Sept. 4-Oct. 7)	15%
Second Quiz (On Mon Nov. 11 , covering Oct 21-Nov. 6)	20%
Final Quiz (Exam period, covering Nov. 13-Dec 2)	25%
Paper presentation	20%

TOTAL	100

Explanation of Assignments

1. **Quizzes / final exam:** - will be of the short-answer question variety. Quizzes will be 45 minutes in length. This means sentences, diagrams, graphs, fill-in types of questions. No essay questions. Expect “thinking” questions, not just direct recall of the material presented. The Quizzes will **not** be cumulative. Material covered in the **Discussion Topics** will be evaluated in Quiz # 1. Attendance at all quizzes is mandatory. **If you miss a Quiz, you must provide appropriate documentation to avoid a grade of 0. Make-up quizzes will be held during the final exam period time, along with the final exam. The final exam will be 1½ hours in length (also, not cumulative, and of the same format).**

2. **Discussion topics:** -- A list of discussion topics will be circulated in class. You and your group members will be assigned a topic and you must teach the class about it in a manner which is relevant to Mitochondria in Health and Disease over no more than 15 minutes (followed by 5 minutes for questions). The presentation must be done in Powerpoint, using Powerpoint drawing tools. There are 3 parts to the project: **1)** the powerpoint illustration (5%); **2)** an explanatory figure legend using proper sentences (not point form; at least ½ page with >3 references) describing the figure and its relevance to the topic (5%); and **3)** the presentation itself and answers to questions (10%) > 3 references.

You must provide the class and the course director with a **single page handout** (one side: illustration, other side figure legend). You are expected to use and document at least 3 scientific journal resources (not general internet sites or textbooks) as sources of information. I expect you to draw the illustration yourself based on the references you provide (not cut and paste it from the source). You will be assessed on the **quality** of each aspect of the project: organization, clarity, drawing complexity, apparent effort, ability to teach the class about the topic, and its relevance to Mitochondria. **All members of the group will receive the same grade and all are expected to contribute equally, and attend the presentation.**

3. **Paper presentation:**-- your group will present the Introduction, Methods, Results and Discussion of an assigned paper in detail over about 20 minutes, using a Powerpoint format. All members of the group are expected to participate verbally, and all will get the same grade, provided all are in attendance. Questions of, and discussion with, the group members will be interjected or will follow the presentation (5-10 mins). The presenting group must supply the class with a **1 page (single-sided) study page** outline of the paper with the following items:

- a) Title of the paper and reference along with the names of the presenters in the group;
- b) Rationale for the study (i.e. why did they do it);
- c) Experimental design (eg. T vs. UT subjects, animals, general protocol employed and list of main items measured);
- d) Main results;
- e) Main discussion points;
- f) Summary of what the class should learn from this paper (in no more than 5 points).

Your group **grade** will be based on your organization, clarity, completeness (i.e. did you hit the main/important points?), your ability to teach the class about the main take-home points of the paper, the quality of your handout, and your ability to answer questions. Equal participation among group members is expected.

Marks will be deducted from your group paper presentation (5%) if you do not attend, and be on time for, the presentations of your colleagues. Attendance will be taken at 2:30 pm on the presentation day.

Lecture and Exam Schedule: KINE 4516 3.0 (Fall 2018)

WEEK #	<u>Mon</u>	<u>Tues</u>	<u>Wed</u>	<u>Comments</u>
1			Sept. 4 Introduction	
2	9		11	
3	16		18	
4	23 Disc Topics		25	
5	30 Disc. Topics		Oct. 2 Disc. Topics	Last day to enrol with permission is Tues. Oct. 1
6	7 Integration		9 Quiz #1	
7	14 Thanksgiving		16	Reading week, Oct. 12-18
8	21		23	
9	28		30	
10	Nov. 4		6	Last day to drop without a grade is Friday Nov. 8
11	11 Quiz #2		13 Lab Day	
12	18		20 Papers	
13	25 Papers		27 Papers	
14	Dec. 2 Integration		4 Study Day	