

York University
Kinesiology and Health Science
KINE 4516 3.0: Mitochondria in Health and Disease
Fall 2023

Objectives of the Course

This course will analyze the function and biogenesis of mitochondria with an emphasis on skeletal muscle. Mitochondrial function and adaptation in health 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; Protein import into mitochondria; 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.

Many skills are developed by taking this course that will hopefully help you now and in the future:

1. Learning about mitochondria and metabolism and the topics described above
2. Developing enhanced presentation skills
3. Analyzing original research papers critically
4. Using powerpoint effectively to transmit scientific information
5. Moving effectively to the highest level of undergraduate education

Prerequisites: Kine 4010 or equivalent

Required References: The **hard-copy Course Kit is required** and available through the Bookstore. The course kit contains all of the lecture images presented, unless otherwise noted. Papers for discussion will be available on eClass for your download.

Recommended background readings: Posted on eClass

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 2:30-3:45 pm (75 mins), **Room 1152A Vari Hall**
Wednesday: 2:30-3:45 (75 mins), **Room 035 HNE**

Office Hours: via Zoom, after class MW at 4:00 pm, or by appointment using the Zoom link on eClass
Please note that this is a course that is delivered in person, with a few exceptions when the instructor may be required to be absent. The lectures are not recorded, but you are welcome to bring your own recording device. Class attendance and the course kit are essential for your success.

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STUDENT EVALUATION

Discussion topic presentation and diagram	15%
First Quiz (On Wed. Oct. 18 , covering Sept. 6-Oct. 4)	20%
Second Quiz (On Mon Nov. 13 , covering Oct 16-Nov. 8)	20%
Final Quiz (Exam period, covering Nov. 15-Dec 4)	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. You may be required to write sentences, draw diagrams or graphs, and fill-in blank spaces with specific answers. No long essay questions will be asked. 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 posted. 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 10 minutes for questions). The presentation must be done in Powerpoint. You can use 10-12 slides for your presentation, but you must draw the main explanatory figure of your topic using Powerpoint drawing tools. There are 3 parts to the project: **1)** the main powerpoint illustration; **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 (7.5% for both); and **3)** the presentation itself and answers to questions (7.5%).

Hand-in requirements: 1) the complete PPT presentation to the CD/TA prior to the start of class for grading; 2) a 2-slide PPT presentation of the main figure and figure legend to the CD/TA for distribution to the class for review purposes. You are expected to use and document at least 3 scientific journal resources (not general internet sites or textbooks) as sources of information. You will be assessed on the **quality** of each aspect of the project: organization, clarity, timing of the presentation, drawing complexity, apparent effort, ability to teach the class about the topic, and its relevance to Muscle. **All members of the group will receive the same grade and all are expected to contribute equally. A statement of equal participation must be printed on the handout, and it must be labelled with all group members full names. If you miss the presentation of your group, you get 0 for the assignment.**

3. **Paper presentation:**-- An original literature scientific paper will be assigned to your group. You will present the Introduction, Methods, Results and Discussion of the paper in detail over 15 minutes, using a Powerpoint format. All members of the group are expected to participate verbally, and all will get the same grade. Questions of, and discussion with, the group members will follow the presentation (10 mins).

Hand-in requirements: 1) the complete PPT presentation prior to class for grading, 2) the presenting group must supply the class with a **1 page (single-sided, 12 pt font) 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?), timing of your presentation, 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, and a statement as above must be typed on the handout.

Please note that 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 each presentation day.

Lecture and Exam Schedule: KINE 4516 3.0 (Fall 2023)

WEEK #	<u>Mon</u>		<u>Wed</u>	<u>Comments</u>
1			Sept. 6 Introduction	
2	11		13	
3	18		20	
4	25		27 Disc Topics	
5	Oct. 2 Disc. Topics		4 Integration of Disc Topics	Last day to enrol with permission is Tues. Oct. 6
6	9 Thanksgiving		11	Reading week, Oct. 10-16
7	16		18 Quiz # 1	
8	23		25	
9	Oct. 30		1	Lab Day will be scheduled this week
10	6		8	Last day to drop without a grade is Friday Nov. 8
11	13 Quiz # 2		15	
12	20		22 Papers	
13	27 Papers		29 Papers	
14	Dec. 4 Integration			