



ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəyəm (Musqueam) people. The land has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site. We (the instructors) would also like to acknowledge that you are joining us for this course from many places, near and far, and acknowledge the traditional owners and caretakers of those lands.

COURSE INFORMATION

Course Title	Course Code Number	Credit Value
Bioenergetics of Physical Activity	KIN 562	3

PREREQUISITES

Students should have a strong background in exercise physiology. This background could comprise undergraduate course(s) in exercise (e.g., KIN 235 (formerly 275), 335 (formerly 375), and 435 (formerly 475) at UBC) or human physiology. Familiarity with first-year biology and chemistry is an asset.

CONTACTS

Course Instructor(s)	Contact Details	Office Location	Office Hours
Dr. Robert Boushel	robert.boushel@ubc.ca	War Memorial Gym room 32	By appointment
Josh Bovard	josh.bovard@ubc.ca	Chan Gunn Pavilion 221	By appointment

Please include "KIN 562" in the subject line of all email communication.

General questions about course material should be posted as discussion topics on Canvas rather than sent via email. Attempting to teach or explain material over email can be difficult and ineffective. If you have detailed questions about course material or concepts, questions should be addressed in person (e.g., during or after synchronous sessions). Email should be used for a limited number of reasons, such as scheduling meeting times, in cases of emergency (e.g., that may cause you to miss an exam), or situations otherwise detailed in class. Please include both instructors in all emails. **It may take up to 48 hours to respond to your email during the week and emails will not be checked on weekends.** Please keep these in mind around important dates (e.g., assignment due dates).

COURSE STRUCTURE

**Bioenergetics of Physical Activity (KIN 562)****Syllabus**

This course will initially provide foundational knowledge by exploring basic energy systems powering muscular work, skeletal muscle properties, and energy system regulation and control. The second part of the course will further explore each energy system, highlighting how they are measured. Part three will explore efficiency, substrate utilization, fatigue, and long-term consequences of energy homeostasis. Finally, all concepts will be integrated through the description of the determinants of human performance determinants. Bioenergetic clinical applications and ergogenic aids will be discussed throughout.

General schedule: The course will consist of asynchronous and synchronous content. Each week, ~2 hours of asynchronous learning content will be posted on Canvas. This content will be reviewed and discussed in synchronous sessions (during the posted class time). Synchronous sessions will be typically be ~2 hours (with breaks), but may be longer during weeks with student presentations. They will take place in WMG 206/208.

You are required to attend all classes. You are responsible for all material covered in synchronous and asynchronous sessions and any information given whether in attendance or not. You are also responsible for getting your own notes, as well as information pertaining to changes in the course outline, readings, assignments, and information related to lectures. If you will not be in class due to travel for varsity sport you must email BEFORE the class takes place to notify us of your absence, and then provide documentation to the instructors.

SCHEDULE OF TOPICS

Week	Date	Synchronous content	Asynchronous content
1	September 6	NO CLASS – Labour Day Monday, term starts Tuesday, September 7	Introduction to bioenergetics
2	September 13	<i>Discussion:</i> Introductions; Bioenergetics: applications, experiences, and questions? <i>Big picture question:</i> What is energy, why do we need it, and how does the cell “produce” it?	Skeletal muscle structure, content, location, and function: a 2021 perspective
3	September 20	<i>Big picture question:</i> How does structure vs. function (vs. content vs. location) apply to muscle? <i>Discussion:</i> General questions	Regulation and control of bioenergetic systems <i>“General information and presentations” survey to be completed by September 21 (6:00pm).</i>
4	September 27	<i>Big picture question:</i> What regulates and controls bioenergetic systems (1) at the	<i>Presentation groups to be posted after.</i>



Bioenergetics of Physical Activity (KIN 562)

Syllabus

5	October 4	onset of physical activity and (2) as exercise intensity increases? <i>Discussion:</i> General questions	Phosphocreatine-creatine kinase system and VO ₂ kinetics
6	October 11	NO CLASS – Thanksgiving	VO ₂ kinetics and the power-duration relationship <i>Quiz #1 (weeks 1-4): Friday, October 15 (8:00am) – Sunday, October 17 (8:00pm)</i>
7	October 18	<i>Ergogenic aids presentation(s)</i> <i>Big picture question:</i> Why should everyone care about the rate at which OXPHOS “turns up”? <i>Discussion:</i> Why kinetics matter	Anaerobic glycolysis, lactate, and threshold
8	October 25	<i>Ergogenic aids presentation(s)</i> <i>Big picture question:</i> Why does blood lactate increase with progressive exercise? <i>Discussion:</i> Lactate: changing perceptions	VO _{2MAX}
9	November 1	<i>Ergogenic aids presentation(s)</i> <i>Big picture question:</i> What “limits” VO _{2MAX} ? <i>Discussion:</i> Clinical and cardiopulmonary exercise testing	Efficiency: from mitochondria to whole body
10	November 8	MIDTERM BREAK Nov 10-12 <i>Ergogenic aids presentation(s)</i> <i>Big picture question:</i> Why are some people more (in)efficient than others? <i>Discussion:</i> When efficiency matters	Substrate utilization
11	November 15	<i>Ergogenic aids presentation(s)</i>	Fatigue



Bioenergetics of Physical Activity (KIN 562)

Syllabus

		<p><i>Big picture question:</i> What fuels the exercise fire?</p> <p><i>Discussion:</i> Fueling the exercise fire</p>	<p><i>Quiz #2 (weeks 5-8):</i> Friday, November 19 (8:00am) – Sunday, November 21 (8:00pm)</p>
12	November 22	<p><i>Ergogenic aids presentation(s)</i></p> <p><i>Big picture question:</i> Why does one stop exercising?</p> <p><i>Discussion:</i> Fatigue and performance</p>	<p>Rats! And energy: a longitudinal perspective</p>
13	November 29	<p><i>Knowledge translation projects</i></p> <p><i>Big picture question:</i> What can rats teach us about long-term energy homeostasis?</p>	<p>Determinants of human performance</p>
14	December 6	<p><i>Knowledge translation projects</i></p> <p><i>Discussion:</i> What determines performance?</p> <p>Course wrap-up, final thoughts, and main takeaways</p>	
	December 11-22	<p>Final exam – date and time TBD</p>	

Note: topics and dates are subject to change as needed.

LEARNING OUTCOMES

General aims and outcomes: The primary learning objective is for you to *learn!* The aim is for students to gain a greater understanding of the bioenergetics of physical activity, with takeaways for application in research, clinical, and/or athletic settings. The point of the course is *not* to memorize reactions, enzymes, and metabolic pathways (e.g., all 9 steps of glycolysis). Instead, the intended outcome is to appreciate important reactions, enzymes, and metabolic pathways and understand their role in (1) determining the capacity to perform physical activity, (2) measuring parameters of aerobic fitness, and (3) prescribing physical activity for clinical or performance benefits (e.g., understanding how and why glycolysis contributes to exercise tolerance).

“Big picture” questions:

- 1) What is energy, why do we need it, and how does the cell “produce” it?
- 2) How does structure vs. function (vs. content vs. location) apply to muscle?
- 3) What regulates and controls bioenergetic systems at the onset of physical activity?
- 4) What regulates and controls bioenergetic systems as exercise intensity increases? (specifically: how is a 100-fold increase in metabolic rate achieved with almost perfectly homeostatic ATP and relatively homeostatic metabolites?)

**Bioenergetics of Physical Activity (KIN 562)****Syllabus**

- 5) Why should everyone care about the rate at which OXPHOS “turns up”?
- 6) Why does blood lactate increase with progressive exercise?
- 7) What “limits” VO_{2MAX} ?
- 8) Why are some people more (in)efficient than others?
- 9) What fuels the exercise fire?
- 10) Why does one stop exercising?
- 11) What can rats teach us about long-term energy homeostasis?
- 12) What determines performance?

“Big picture” questions are not necessarily addressed solely in 1 lecture; instead, their answers are intended to be an integration of concepts discussed across many lectures.

LEARNING MATERIALS

Course text: No specific textbook is mandatory; however, students should have access to a basic exercise physiology textbook for reference, such as:

McArdle, William D., Frank I. Katch, and Victor L. Katch. Exercise physiology: nutrition, energy, and human performance. Lippincott Williams & Wilkins, 2015. (8th edition). Available from campus bookstore or UBC Library reserves.

For complementary learning and more details on specific content, a list of *complementary* readings will be provided for each week. Exam questions will be made from course content and *not* directly based on complementary readings.

Canvas: Information about this course, asynchronous content, presentation slides, important reminders, and other reading and course notes will be posted on Canvas. Please check the site regularly, as *you are responsible for the information posted to Canvas*. Course notes will provide an overview of learning material but may not include all details and examples covered in asynchronous and synchronous sessions.

ASSESSMENTS OF LEARNING

Quizzes	30%
Ergogenic aid presentation	10%
Knowledge translation project	10%
Performance	10%
Final exam	40%

***the assessment of learning is subject to change*

Specific breakdown:

Quizzes Two quizzes, equally-weighted (i.e., 15% each). **Each quiz will be completed on Canvas in the 60-hour time period outlined in the**



“Schedule of Topics”. The quiz will open on Friday at 8am and close on Sunday at 8pm, as specified in the “Schedule of Topics”. Quizzes will consist of 15 multiple choice questions (1 mark each; 15 marks total) and short answer questions (totaling 15 marks). When possible, questions will be grouped into “case studies”. You will be provided 90 minutes to complete the quiz. Answers will be made reviewable ~1-2 weeks after the due date (please check the “Quiz” page on Canvas for viewing dates). Quiz content will include asynchronous and synchronous content from the weeks outlined as per the “Schedule of Topics”. While quizzes won’t be cumulative *per se*, knowledge from prior weeks will likely be required.

Ergogenic aid presentation

Each student will present on an ergogenic aid related to course content. A list of ergogenic aids will be provided on Canvas; however, if you want to present on an ergogenic aid not listed, please contact the course instructors. Students will select preferences through the “*General information and presentations*” survey, with topics announced shortly thereafter.

Presentations will be 15-20 minutes (followed by 10-15 minutes for questions and discussion). It should include background information about the ergogenic aid. It should then focus on mechanisms of action, clearly highlighting how it connects to bioenergetic concepts presented in the course. Applications, strategies, and other practical information should also be included during the presentation.

Initial resources will be provided in the list of ergogenic aids, but you are not confined to these resources. You can include visual aids from these resources, presentation slides shown in class, or other sources including your own creation if you wish. It will be helpful for other students if you reference the original source of the content, as appropriate. In association with the presentation, each student will create and post 5 multiple choice questions related to the topic; for this, upload separate documents for the (1) questions and (2) answers on the “Ergogenic aids review questions” discussion. The presentation will be worth 20 marks, as follows:

- *Quality of slides presented* (5 marks) – the slides are clear, concise, and provide reference to appropriate source materials.
- *Organization of presentation* (5 marks) – the presentation follows a logical structure, with a clear flow from background to mechanisms to applications and strategies.
- *Description of appropriate physiological mechanisms* (5 marks) – relevant physiological mechanisms are discussed in detail and

**Bioenergetics of Physical Activity (KIN 562)****Syllabus**

clearly explained, demonstrating an integration of course content (as appropriate).

- *Quality of multiple choice questions* (5 marks) – clearly-worded multiple choice questions integrate material throughout the presentation. All options should appear plausible, but only one is correct.
- **While not a specific criterion, marks may be deducted if the presentation is too short (e.g., <13 minutes) or long (e.g., >22 minutes).

Knowledge translation project This course will cover many detailed and complex bioenergetic topics. However, as future researchers, clinicians, and sports scientists, effectively synthesizing and communicating these topics to a general audience is essential. Thus, for this project you will work in groups of 2-3 students to create a knowledge translation resource for one of the “Big picture” questions listed in the “Learning Outcomes” section. Students will select topic preferences through the “*General information and presentations*” survey, with topics announced shortly thereafter.

Knowledge translation media may include, but is not limited to, the following. We encourage you to think of other creative ways to translate knowledge. Please contact the course instructors with your idea(s).

- Infographic
- 3-5-minute video
- 3-5-minute digital whiteboard video (e.g., using [VideoScribe](#))

Knowledge translation projects will be presented during synchronous sessions as outlined in the “Schedule of Topics”. Students will be provided up to 15 minutes to share the project, with some additional time for questions and discussion. In association with the project, each group will create and post 1 case study related to the topics. The case study should consist of long answer questions totalling 20 (hypothetical) marks. For this, upload separate documents for the (1) case study (and questions) and (2) answers on the “Knowledge translation case studies” discussion. The project will be worth 20 marks, as follows:

- *Quality* (5 marks) – content is clear, concise, and provide reference to appropriate source materials.
- *Organization* (5 marks) – content follows a logical structure, with a clear flow (e.g., from background to mechanisms to applications and strategies).

**Bioenergetics of Physical Activity (KIN 562)****Syllabus**

- *Description of appropriate physiological mechanisms* (5 marks) – relevant physiological mechanisms are clearly communicated, demonstrating an integration of course content (as appropriate).
- *Quality of case study* (5 marks) – clearly-worded case study and associated long answer questions. It integrates material related to the “Big picture” question. Answers should provide key points.

Performance

Attendance, Professionalism, Participation, and Responsiveness to feedback will be graded on an ongoing basis throughout the term and will each be worth 2.5% (***Interim grades will be posted approximately halfway through the course.*):

- *Attendance* – unexcused absences will be deducted
- *Professionalism* – punctuality, preparation, respectful language, responsibility for actions
- *Participation* – engagement in discussions, enthusiasm, initiative, pro-active work ethic
- *Responsiveness to feedback* – actions/behavior changed based on instructors’ feedback

Final exam

The final exam will be 80 marks total, consisting of 40 multiple choice questions (1 mark each) and short answer questions (40 marks total). Format and content will be similar to the quizzes described above, with questions grouped into “case studies” as possible. The exam will be cumulative with relatively equal weighting to all content covered.

UNIVERSITY POLICIES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on [the UBC Senate website](#).

Any requests for academic concessions will be considered only according to the School of Kinesiology academic concession policy. <https://kin.educ.ubc.ca/current-students/bkin/academic-concession/>

COPYRIGHT



Bioenergetics of Physical Activity (KIN 562)

Syllabus

All materials of this course (course handouts, lecture slides, assessments, course readings, etc.) are the intellectual property of the Course Instructor and teaching assistant or licensed to be used in this course by the copyright owner. Redistribution of these materials by any means without permission of the copyright holder(s) constitutes a breach of copyright and may lead to academic discipline. It is not permitted to record classes.