

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

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəyəm (Musqueam) people. The land it is situated on 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.

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 physiology (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
Josh Bovard, PhD(c), MSc, CSEP-CEP	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. **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 DESCRIPTION AND STRUCTURE

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.

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Althetic and clinical applications in bioenergetics and ergogenic aids will be discussed throughout the course.

General schedule: The course will consist of asynchronous and synchronous content.

There is ~1.5-2.5 hours of asynchronous learning content associated with each week of the course. All of this content will be posted on Canvas at the beginning of the course, and you are encouraged to go through the content in alignment with the *Schedule of Topics* below. This content may be discussed in synchronous sessions (during the posted class time).

Synchronous sessions (i.e., classes) will be typically be ~2 hours (with breaks), but may be up to 3 hours during weeks with student presentations (depending on the number of students in the course). 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 are unable to attend class in-person (e.g., due to illness), please send an email as soon as possible. A Zoom link will be provided at the start of the course and will be used for those who are still able to participate virtually. This Zoom link is not intended to replace in-person attendance, but instead to facilitate participation when students have a legitate reason for not being able to attend class in-person. Please note that attendance will be recorded at the beginning of each class.

SCHEDULE OF TOPICS

Week	Date	Synchronous content	Asynchronous content
1	September 4	NO CLASS – Labour Day Monday, term starts Tuesday, September 5	Introduction to bioenergetics
2	September 11	<i>Discussion:</i> Syllabus review (KIN 562 and KIN 500H); Introductions; Experiences from the field part 1	Regulation and control of bioenergetic systems
3	September 18	<i>Discussion:</i> Experiences from the field part 2 (Dr. Robert Boushel)	<i>“General information and presentations” survey to be completed by September 14 (6:00pm). Presentation topics and dates to be posted after.</i>
4	September 25		
5	October 2	<i>Ergogenic aids presentations</i>	Phosphocreatine-creatine kinase system and VO ₂ kinetics

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6	October 9	NO CLASS – Thanksgiving	VO ₂ kinetics and the power-duration relationship
	October 12	(Make-up Monday) <i>Discussion</i> : Quiz 1 review **Location TBD	
7	October 16	<i>Ergogenic aids presentations</i>	Anaerobic glycolysis, lactate, and threshold <i>Quiz #1 (weeks 1-4): Friday, October 20 (8:00am) – Sunday, October 22 (8:00pm)</i>
8	October 23	<i>Ergogenic aids presentations</i>	VO ₂ MAX
9	October 30	<i>Ergogenic aids presentations</i>	Efficiency: from mitochondria to whole body
10	November 6	<i>Ergogenic aids presentations</i>	Substrate utilization
11	November 13	NO CLASS – MIDTERM BREAK Nov 13-15	Fatigue <i>Quiz #2 (weeks 5-8): Friday, November 17 (8:00am) – Sunday, November 19 (8:00pm)</i>
12	November 20	NO CLASS	Determinants of human performance
13	November 27	<i>Ergogenic aid presentations</i>	
14	December 4	<i>Ergogenic aid presentations</i> <i>Discussion</i> : Course wrap-up, final thoughts, and main takeaways	<i>“Knowledge translation assignment” due Friday, December 8 at 11:59pm.</i> <i>“Attendance”, “Professionalism”, and “Participation” self-assessments due Friday, December 8 at 11:59pm.</i>
	December 11-22	Final exam – date and time TBD	

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



LEARNING OUTCOMES

General aims and outcomes: The primary learning objective is for students to gain a greater understanding of the bioenergetics of physical activity, and knowledge that can be applied 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?)
- 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” $\text{VO}_{2\text{MAX}}$?
- 8) Why are some people more (in)efficient than others?
- 9) What fuels the exercise fire?
- 10) Why does one stop exercising?
- 11) 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.

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.

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Quizzes	20%
Ergogenic aid presentation	30%
Knowledge translation assignment	10%
Performance	10%
Final exam	30%

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

Specific breakdown:

Quizzes	Two quizzes, equally-weighted (i.e., 10% 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 10 multiple choice questions (1 mark each; 10 marks total). When possible, questions will be grouped into “case studies”. You will be provided 45 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 focus on asynchronous content from the weeks outlined as per the “Schedule of Topics”. While quizzes won’t be cumulative <i>per se</i> , knowledge from prior weeks will likely be required.
Ergogenic aid presentation	<p>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 instructor. Students will select preferences through the “<i>General information and presentations</i>” survey, with topics announced shortly thereafter.</p> <p>Presentations will be 15 minutes (followed by up to 30 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.</p> <p>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</p>

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(1) questions and (2) answers on the “Ergogenic aids review questions” discussion.

Each presentation will be recorded and posted on Canvas for the benefit of your classmates and fair assessment. The presentation will be worth 30 marks, as follows:

- *Quality of slides presented* (9 marks) – the slides are clear, concise, and provide reference to appropriate source materials (including references on slides, which is essential for tables and figures and used as appropriate for text). When images and tables are presented, they are thoroughly explained (e.g., introduce the axes and legends for images, rows and columns for tables, abbreviations, etc.). As appropriate, text and information is introduced sequentially to effectively guide the observer through the information (e.g., using animations or an effective alternative). Content on slides is discussed, and presenters speak to the audience and content (instead of reading notes ad verbatim). If you aren’t able to take the time to appropriately describe the table, figure, or text, then it should not be included.
- *Organization of presentation* (9 marks) – the presentation follows a logical structure, with a clear flow from background to mechanisms to applications and strategies. There should be an “Overview” (or “Learning outcomes” or similar) slide at the beginning of the presentation that is referred to throughout the remainder of the presentation to guide the observer through the main sections of your presentation. Where helpful, sections can be numbered or colour-coded (e.g., Section 1 – xxx, Section 2 – yyy, etc.). Additionally, include 1-2 summary slides at the end of the presentation that appropriately captures the key takeaways from the presentations (note, summary slides *summarize* information; this is not the time to introduce *new* information) – i.e., if you could only share one slide (or two), what key background and application takeaways would you put on it? Lastly, an appropriate number of slides should be used (e.g., “1-minute, 1-slide” for each slide with content). Marks may be deducted if the presentation is too short (e.g., <12 minutes) or long (e.g., >18 minutes).
- *Description of appropriate physiological mechanisms* (9 marks) – relevant physiological mechanisms are discussed in detail and clearly explained, demonstrating an integration of course content (as appropriate).
- *Quality of multiple choice questions* (3 marks) – clearly-worded multiple choice questions integrate material throughout the

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presentation. All options should appear plausible, but only one is correct.

- ***While not a specific criterion, engaging the audience always helps! (e.g., open discussion, ask-the-audience, poll questions)*

Knowledge translation assignment

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 assignment you will provide a 2-3-sentence answer to each of the "big picture" questions presented in the *Learning Outcomes* above as well as each of ergogenic aids presented in class. The questions should be answered as if you are describing them to a general audience (think of it like an elevator pitch; if you had 30-60 seconds to communicate your most important points, what would you say?). The purpose is to prepare you for translating knowledge about complex bioenergetic topics and ergogenic aids to a general audience. The purpose is NOT to provide a detailed, multi-page, graduate-level response.

Each "big picture" question is worth 2 points. 1 point is for answering the question. The other point is to ensure your answer relates to the question (e.g., if the big picture question is "What limits VO_{2MAX} ", the answer should relate to oxygen transport and utilization but probably should not talk about how peanut butter is the greatest thing since (or on) sliced bread). Each ergogenic aid is worth 1 point; 0.5 points for completion, 0.5 points to ensure relevance.

The assignment will be completed on Canvas and due at the end of the semester (due date indicated in the *Schedule of Topics*). The assignment will be made available after the ergogenic aid presentation topics are confirmed. After the submission date, de-identified answers can be posted (if desired) for the benefit of your classmates.

Performance

Attendance, Professionalism, and Participation, will be assessed on an ongoing basis throughout the term, as below. Near the end of the term, students will submit a self-assessment (with justification) of their performance through Canvas. These self-assessments will be reviewed and a final performance mark provided.

- *Attendance (2.5%)* – attendance will be recorded at the start of each class, and unexcused absences will be deducted
- *Professionalism (2.5%)* – punctuality, preparation, respectful language, responsibility for actions

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- *Participation (5%)* – engagement in discussions, enthusiasm, initiative, pro-active work ethic
- ***Note that there is not one specific definition of “participation”. Instead, course participation varies by student. You have the opportunity to advocate for your performance, but you will need to provide evidence and examples to support your self-assessment.*

Final exam

The final exam will be 30 marks total, consisting of 30 multiple choice questions (1 mark each). 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. The exam will include questions about the ergogenic aids presented in class, but will not include questions about the “Experiences from the field”. The exam will be completed on Canvas.

The final exam date will be determined based on your input. In the past, this has occurred in late October or early November, and has been based on due dates for term projects in other classes, exam dates for other classes, and travel dates. Similar to the quizzes, the exam will be available for 3-4 days. Once you start the exam, you will have 120 minutes to complete it.

GRADING SYSTEM – FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES

PERCENTAGE (%)	LETTER GRADE
90-100	A+
85-89	A
80-84	A-
76-79	B+
72-75	B
68-71	B-
64-67	C+
60-63	C
0-59	F (Fail)

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A minimum mark of 68% must be obtained in all courses taken by a student enrolled in a doctoral program.

The minimum passing grade in any course taken by a student enrolled in a master's program is 60%. However, only 6 credits of courses with grades in the C to C+ range (60-67%) may be counted towards a master's program. For all other courses, a minimum of 68% must be obtained.

[Academic progress and grading practices](#) are outlined on G+PS policies and procedures website.

UBC POLICY ON PLAGIARISM

All students should be aware of and follow [UBC's Guidelines regarding Plagiarism](#). Please read and familiarize yourself with these guidelines. These policies are taken seriously by course instructors and program administrators.

POLICY ON LATE ASSIGNMENTS

Students are required to notify instructors at least 24 hours in advance if they are unable to meet deadlines for assignments. Students must then negotiate with the instructor a reasonable deadline for completion of course work.

ETHICAL AND PROFESSIONAL CONDUCT

Students are expected to adhere to standards of professional practice and ethics in their interactions with faculty, peers, and the public.

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](#) and [Discrimination policy](#). For student accommodations, please see [Access and Diversity](#).

ACADEMIC INTEGRITY



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Students are expected to follow UBC policies for academic integrity and academic misconduct, which includes practices around plagiarism, referencing and citation, and copyright. For more see, UBC's [Learning Commons Academic Integrity resources](#) and graduate student misconduct in [Graduate and Postdoctoral Studies](#).

POLICY ON TEXT-MATCHING SOFTWARE

UBC subscribes to Turnitin, an online system that compares written material with the Web and with other material submitted to its database. Faculty, staff and students can upload submissions and check for duplication of material in other sources and possible plagiarism.

ACCESSIBILITY

If you have any challenges accessing materials that will impact your success in this course, UBC's Centre for Accessibility can support your needs by providing appropriate accommodations to support you.

- Web: [UBC's Centre for Accessibility website](#)
- Email: accessibility@ubc.ca

RESOURCES

Students requiring counselling services may contact [UBC counselling services](#)

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