

School of Kinesiology
 Faculty of Health Sciences
 Western University

**KIN 4420B - Impact of Exercise During Pregnancy on Chronic Disease Risk
 Winter 2025**

<p>Instructor: Dr. Michelle Mottola, Director R Samuel McLaughlin Foundation Exercise & Pregnancy Lab</p> <p>Office: Thames Hall Rm. 4187</p> <p>Email: mmottola@uwo.ca</p> <p>Phone: 519/661-2111 x85480</p> <p>Office Hrs: by appointment</p> <p>GTA: TBA</p>	<p>Lectures: Monday 2:30pm – 4:30pm</p> <p>Room: FNB 2220</p> <p>**Please note that if UWO restrictions are put in place due to COVID we will move to live online activities.</p>
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NOTE: All course information including grades, assignment outlines, deadlines, etc. are available via [OWL Brightspace](#). Download the Brightspace Pulse App to stay up-to-date on course communication and enable your notification settings within “Communications” in the top toolbar. Check the website regularly for course announcements.

<p>Calendar Description (including prerequisites/anti-requisites): Discussion of human pregnancy and the impact of exercise to prevent or treat cardiovascular disease, obesity and metabolic syndrome/type 2 diabetes will occur. The theory of the 'Thrifty phenotype' will be discussed and the mother/fetal link to chronic disease risk. Active living during pregnancy and exercise prescription will be emphasized.</p> <p>Antirequisite(s): Kinesiology 4471B (if taken to 2009-10).</p> <p>Prerequisite(s): Kinesiology 2222A/B or Health Sciences 2300A/B or Health Sciences 2330A/B or Anatomy and Cell Biology 2221 or the former Anatomy and Cell Biology 3319; and Kinesiology 3337A/B.</p> <p>Extra Information: 1 lecture hour, 1 seminar hour.</p> <p>Course Format: One lecture hour, followed by one hour seminar discussion</p>

You are responsible for ensuring that you have successfully completed all course pre-requisites, and that you have not taken an anti-requisite course.

Statement on Prerequisite Checking

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Course Description:

This course provides an overview of human pregnancy and the impact of exercise to prevent or treat cardiovascular disease, obesity and metabolic syndrome/type 2 diabetes. The theory of the “Thrifty phenotype” will be discussed and the mother/fetal link to chronic disease risk, including discussion of “Developmental Origins of Health and Disease”. Active living during pregnancy will be emphasized using the *2019 Canadian guideline for physical activity throughout pregnancy* and the *Get Active Questionnaire for Pregnancy* for low-risk pregnant individuals. In addition, exercise prescription for special populations of pregnant individuals across the exercise continuum including those with gestational diabetes or obesity will also be discussed.

Learning Objectives: Upon completion of this course students will:

- 1) Gain knowledge and understanding of different theories of fetal origins of adult diseases.
- 2) Gain knowledge and understanding of current research in the area of exercise during pregnancy for a low-risk pregnant population.
- 3) Gain knowledge and understanding of current research in the area of how exercise during pregnancy can prevent or be used to treat different disease states.
- 4) Engage in seminar discussions, present orally on a research paper to the class and to evaluate the research literature critically.
- 5) Create and implement an exercise and lifestyle intervention for active low risk pregnant individuals and pregnant individuals with disease risk.

Topics for Discussion:

- 1) The “Downside of Upright”
- 2) “Thrifty genotype” and “Thrifty phenotype” – developmental influences of adult diseases. DOHaD – Developmental Origins of Health and Disease.
- 3) DOHaD and adult diseases that may have origin from fetal life.
 - a. Cardiovascular disease
 - b. Obesity
 - c. Type 2 diabetes/Metabolic syndrome
- 4) Impact of exercise during pregnancy on chronic disease risk.
- 5) Importance of active living during pregnancy
 - a. *2019 Canadian Guideline for Physical Activity throughout Pregnancy* and the *Get Active Questionnaire for Pregnancy* – medical screening, exercise guidelines, and safety considerations for low-risk pregnant individuals
 - b. Promoting active living during pregnancy in low-risk individuals
- 6) Designing an exercise program for pregnant individuals across the exercise continuum – from activity restricted to recreational to elite athlete.
- 7) Using an exercise and lifestyle intervention to prevent excessive weight gain and gestational diabetes in pregnant individuals with risk factors.

Course Evaluation Summary:

- 1) Class participation – 5%
- 2) On-line discussion forum using OWL Brightspace – 20%
- 2) Paper Critique – Journal Article Review - 15% **(Due Monday Feb. 10th)**
- 3) Group presentation – 30% **(March 24th, March 31st)**
- 4) Final exam - 30%

Class Participation:

This will be based on attendance, engaging with peers during class discussions, contributing to class discussion topics, and engaging as “group leader” for group discussions to report a summary of group discussions to the class. The quality of contributions made to class discussions should be relevant and promote thought with evidence of engagement with course material.

Discussion Forums on OWL Brightspace:

Students will be divided into groups of around 6 to form a discussion group forum on OWL relating to specific questions regarding special topics relating to the course. Students are expected to contribute to the weekly forums (there will be 10 forums in total) within their own group with two to three posts. Students are also expected to read and post one time in another forum group. Posts should include components of classroom discussion, lecture topics and/or readings to promote further discussion within the forum group. Posting should be done in a timely manner.

Paper Critique - Journal Article Review: (Due Monday Feb. 10th, 2025 at 11:55pm)

Each student will choose a paper from the literature (upon approval of Instructor) related to class and critically evaluate it in one page of assessment.

Group Presentations to the Class:

Each student will work with their group of 3 to choose one research paper from the literature (on approval of Professor) and present it to the class for 10 minutes, followed by 5 minutes of questions. The professor and GTA will evaluate the presentation. Each group of 3 students will pick a time to present on one of the following 2 days:

March 24th and March 31st, will be designated as Student presentation days.

Course Evaluation:

Assignments are due as stated in the course syllabus and will not be accepted late, except under medical or other compassionate circumstances. Submitting a late assignment without appropriate documentation will result in a zero (0) grade. Assignments are due on OWL before the date and time listed. However, there is a 5-minute grace period (i.e., if due at 11:55 pm, students who submit before 12:00 am will not be considered late). Assignments that are submitted late without accommodation will receive a grade of zero (0; i.e., those time-stamped 12:01 am and later will receive a grade of zero). Missing a group presentation without reason will result in a zero (0) grade to the individual who missed. If an academic accommodation/consideration has been granted for an individual who missed their group presentation, an alternative can be discussed with the professor. Acceptable reasons might include hospital stays, serious illness, family emergencies (like serious accidents, illness or death) or similar circumstances.

Mandatory Readings (*Preliminary List*): All required readings will be posted on OWL

Jan. 6, 2025 Topic – Introduction**Jan. 13, 2025 Topic - “Downside of Upright”****Reading(s):**

- 1) Ackerman J. 2006. The downside of upright. *National Geographic*. 210(1):126-145.
- 2) Mitteroecker P, et al. 2016. Cliff-edge model of obstetric selection in humans. *Proc Natl Acad Sci* 113(51):14680–14685.
- 3) Grossman, R. 2017. Are human heads getting larger? *Proc Natl Acad Sci* 114(8):E1304. (Comment to Mitteroecker et al. 2016)
- 4) Mitteroecker P, et al. 2017 The role of natural selection for the increase of Caesarean section rates. *Proc Natl Acad Sci* . 114(8):E1305. (Comment to Grossman 2017)

Jan. 20, 2025 Topic – “Developmental Origins of Health and Disease (DOHaD); thrifty genotype and thrifty phenotypes”**Readings:**

- 5) Prentice AM. 2005. Early influences on human energy regulation: Thrifty genotypes and thrifty phenotypes. *Physiol. Behav.* 640-645.
- 6) Hales CN and Barker DJP. 2001. The thrifty phenotype hypothesis. *Br. Med. Bull.* 60:5-20.
- 7) Prentice AM, Rayco-Solon P, and Moore S.E. 2005. Insights from the developing world: thrifty genotypes and thrifty phenotypes.
- 8) Barker DJP 2004. The developmental origins of adult disease. *J. Am. Coll. Nutr.* 23:588S-595S.

Jan. 27, 2025 Topic – “DOHaD and adult diseases that may have origin from fetal life” – Cardiovascular disease”**Readings:**

- 9) Hanson MA, Gluckman PD. 2011 Developmental origins of health and disease: moving from biological concepts to interventions and policy. *Int J Gynaecol Obstet.* Nov;115 Suppl 1:S3-5.
- 10) Martin-Gronert MS, Ozanne SE. 2012 Mechanisms underlying the developmental origins of disease. *Rev Endocr Metab Disord.* Jun;13(2):85-92.

- 11) Wiener SL, Wolfe DS. 2021 Links between maternal cardiovascular disease and the health of offspring. *Can J Cardiol* 37(12):2035-2044.
- 12) Henry SL et al. 2012 Developmental origins of obesity-related hypertension. *Clin. Exper. Pharm. Physiol.* 39 (9), 799-806.

Feb. 3, 2025 Topic – “DOHaD and adult diseases that may have origin from fetal life” – Obesity”

Readings:

- 13) Martin-Gronert M, Ozanne SE. 2013. Early life programming of obesity. *Dev Period Med* 17:7-12.
- 14) Comas-Armangue G, Makharadze L, Gomez-Velazquez M, Teperino R. 2022. The legacy of parental obesity: mechanisms of non-genetic transmission and reversibility. *Biomedicines.* 10:2461-2482.
- 15) Scheidl et al. 2023. Maternal obesity and programming of metabolic syndrome in offspring: searching for mechanisms in the adipocyte progenitor pool. *BMC Med* 21:50-63.
- 16) Penkler et al. 2018. DOHaD in science and society: emergent opportunities and novel responsibilities. *J Dev Orig Health Dis* doi:10.1017/S2040174418000892.

Feb. 10, 2025 Topic – “DOHaD and adult diseases that may have origin from fetal life” – Type 2 diabetes/metabolic syndrome”

Readings:

- 17) Neilsen et al. 2014 Impact of fetal and neonatal environment on beta cell function and development of diabetes. *Acta Obst Gynecol Scand* 93:1109-1122.
- 18) Hajj et al. 2022 Epigenetics and life-long consequences of an adverse nutritional and diabetic intrauterine environment. *Reproduction* 148:R111-R120.
- 19) Armengaud et al. 2018. Offspring of mothers with hyperglycaemia in pregnancy: The short term and long-term impact. What is new? *Diab Res Clin Pract* 145:155-166.
- 20) Hattersley AT, Tooke JE. 1999. The fetal insulin hypothesis: an alternative explanation of the association of low birthweight with diabetes and vascular disease. *Lancet.* 353:1789-1792.

Feb. 24, 2025 Topic – “Impact of exercise during pregnancy on chronic disease risk”

Readings:

- 21) Wojtyła A, et al. 2012 Epidemiological studies in Poland on effect of physical activity of pregnant women on the health of offspring and future generations – adaptation of the hypothesis DOHaD. *Ann Agric Environ Med.* 19(2): 315-326.
- 22) Nagpal TS, Mottola MF 2020 Physical activity throughout pregnancy is key to preventing chronic disease. *Reproduction* 160:R111-118.
- 23) Weissgerber T, Wolfe L, Davies G, Mottola MF. 2006. Exercise in the prevention and treatment of maternal-fetal disease: a review of the literature. *Appl Physiol Nutr Metab* 31:661-674.
- 24) Brislane A, Steinback C, Davenport MH. 2021 The 9-month stress test: pregnancy and exercise – similarities and interactions. *Can J Cardiol In Press.*

Mar. 3, 2025 Topic – “Importance of active living during pregnancy and evidence-based exercise guidelines”

Readings:

- 25) Bo K, et al. 2016. Exercise and pregnancy in recreational and elite athletes: 2016 evidence summary from the IOC expert group meeting, Lausanne. Part 1 - Exercise in women planning pregnancy and those who are pregnant. *Br J Sports Med* 50:571–89
- 26) Mottola MF, Davenport MH, Ruchat SM et al. 2019 *Canadian guideline for physical activity throughout pregnancy.* *Br J Sports Med* 2018;52:1339–1346.
- 27) *Get Active Questionnaire for Pregnancy* and companion document *Health Care Provider Consultation Form for Prenatal Physical Activity*
<https://csep.ca/2021/05/27/get-active-questionnaire-for-pregnancy/>

- 28) Hassan et al. Modify, don't stop! Time to reconsider the 'relative' and 'absolute' contraindications to physical activity in pregnancy: an opinion piece. BJOG 2022;129:331-335.

Mar. 10, 2025 Topic "Designing an exercise program across the continuum – from activity restricted to recreational to the elite athlete and using exercise and lifestyle interventions to prevent excessive weight gain and gestational diabetes in pregnant women with risk factors"

Readings:

- 29) Palacio M, Mottola MF. 2023. Activity restriction and hospitalization in pregnancy: Can bed-rest exercise prevent deconditioning? A narrative review. Int J Environ Res Public Health 20:1454-1464.
- 30) Anderson J, Pudwell J, McAuslan C, et al. 2021 Acute fetal response to high-intensity interval training in the second and third trimesters of pregnancy. Appl Physiol Nutr Metab 46:1552-1558.
- 31) Mottola, MF 2015. Pregnancy, physical activity and weight control to prevent obesity and future chronic disease risk in both mother and child. Curr Wom Health Rev 11:31-40.
- 32) Bø K, Artal R, Barakat R et al. 2018. Exercise and pregnancy in recreational and elite athletes: 2016/2017 evidence summary from the IOC expert group meeting, Lausanne. Part 5. Recommendations for health professionals and active women. Br J Sports Med 52(17):1080-1085.

March 17th, 2025 Topics:

What influence does paternity have on chronic disease risk in the offspring?

What influence did the pandemic have on pregnancy and physical activity?

Readings:

- 33) Soubry A. 2018. POHaD: why we should study future fathers. Environ Epigenetics. 4(2):1-7.
- 34) Davenport MH, Meyer S, Meah V, Strynadka M, Khurana R. 2020. Moms are not OK: COVID-19 and maternal mental health. Front Glob Womens Health 1(1):1-6.
- 35) Silva-Jose C, Nagpal TS, Coteron J, Barakat R, Mottola MF. 2022. The 'new normal' includes online prenatal exercise: exploring pregnant women's experiences during the pandemic and the role of virtual group fitness on maternal mental health. BMC Preg Childbirth. 22:251-262.

Course/University Policies

1. The website for **Registrarial Services** is <http://www.registrar.uwo.ca> .

In accordance with policy, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

2. **Academic offences:** They are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

A) Plagiarism

Students must write their essays and assignments in their own words and is expected to be original. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar). You are plagiarizing if you insert a phrase, sentence or paragraph taken directly from another author without acknowledging that the work belongs to him/her. Similarly, you are plagiarizing if you paraphrase or summarize another author's ideas without acknowledging that the ideas belong to someone else. All required papers may be subject to submission for textual

similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between Western University and Turnitin.com <http://www.turnitin.com>

B) Use of AI

Within this course, students are permitted to use AI tools exclusively for information gathering and preliminary research purposes. These tools are intended to enhance the learning experience by providing access to diverse information sources. However, **it is essential that students critically evaluate the obtained information, exercise independent thinking, and engage in original research to synthesize and develop their own ideas, arguments, and perspectives.** The use of AI tools can serve as a starting point for exploration, with students expected to uphold academic integrity by appropriately attributing all sources and avoiding plagiarism. **Assignments should reflect the student's own thoughts and independent written work.** By adhering to these guidelines, students contribute to a responsible and ethical learning environment that promotes critical thinking, independent inquiry and allows them to produce original written contributions.

C) Re-submission of Previously Graded Material

Without the explicit written permission of the instructor, you may not submit any academic work for which credit has been obtained previously, or for which credit is being sought, in another course or program of study in the University or elsewhere.

3. Electronic Device Usage:

During Exams - Unless you have medical accommodations that require you to do so, or explicit permission from the instructor of the course, you may not use any electronic device during ANY tests, quizzes, midterms, examinations, or other in-class evaluations.

During Lectures and Tutorials: Although you are welcome to use a computer during lecture and tutorial periods, you are expected to use the computer for scholastic purposes only, and refrain from engaging in any activities that may distract other students from learning. From time to time, your professor may ask the class to turn off all computers, to facilitate learning or discussion of the material presented in a particular class. **Unless explicitly noted otherwise, you may not make audio or video recordings of lectures – nor may you edit, re-use, distribute, or re-broadcast any of the material posted to the course website.**

4. Academic Considerations and Absences from Lectures and Assessments

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request (in writing) any necessary academic considerations at least two weeks prior to the holiday to the academic counsellors in their Home Department. Additional information is provided in the [Western Multicultural Calendar](#).

Academic Accommodation

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. Students with ongoing accommodation needs within this course are also encouraged to contact [Accessible Education](#), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found [here](#).

Academic Consideration

The University recognizes that a student's ability to meet their academic responsibilities may, on occasion, be impaired by extenuating circumstances that are medical or compassionate in nature. These extenuating circumstances may be acute (short term), or it may be chronic (long term), or

chronic with acute episodes. In all cases, students are advised to consult with the academic counsellors in their home units, at their earliest opportunity. Academic counsellors may refer students to Accessible Education for ongoing academic accommodations.

Most forms of academic consideration require documentation, and this documentation is to be submitted to academic counsellors within five (5) business days of their return to academic responsibilities. Any such documents will be retained in the student's file, and will be held in confidence in accordance with the University's Official Student Record Information Privacy Policy. Once the petition and supporting documents have been received and assessed, appropriate academic considerations shall be determined by academic counseling, in consultation with the student's instructor(s). Academic considerations may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, arranging Special Exams or Incompletes, re-weighting course requirements, or granting late withdrawals without academic penalty. Academic considerations shall be granted only where the documentation indicates that the onset, duration and severity of the illness are such that the student could not reasonably be expected to complete their academic responsibilities. (Note – it will not be sufficient to provide documentation indicating simply that the student “was seen for a medical reason” or “was ill.”).

Whenever possible, students who require academic considerations should provide notification and documentation in advance of due dates, examinations, etc. Under no circumstances are students expected to submit rationales for (or documentation of) any absences, to course instructors. Students are, however, required to follow-up with course instructors, in a timely fashion, to identify the ways in which the academic consideration will be implemented.

Examination Conflicts

A student completing tests or examinations with flexible submission times (e.g., where one or more evaluation is a take-home assessment) cannot request alternative arrangements unless a conflict cannot be avoided by rescheduling writing the exam to a different time within the window specified by the instructor. This applies to direct conflicts as well as “heavy load” conflicts (e.g., three exams within a 23-hour period). The student should discuss any concerns about a potential conflict and/or request academic considerations with their academic counselling unit prior to the deadline to drop a course without academic penalty.

In the case of online tests and examinations, use of a “Conflict Room,” wherein student can write two proctored exams concurrently, will be interpreted as arrangements for continuous proctoring.

5. Contingency Plan for an In-Person Class Pivoting to 100% Online Learning

In the event of a situation that requires this course to pivot to online content delivery, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online as determined by the course instructor.

Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.

6. Online Proctoring

Tests and examinations in this course may be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: <https://remoteproctoring.uwo.ca> .

7. **Grades:** Where possible assignment objectives and rubrics will be posted on OWL. Generally, students can expect some form of feedback on their performance in a course before the drop date.

□ March 7th, 2025 (for second term half-or full year courses)

A+	90-100	<i>One could scarcely expect better from a student at this level</i>
A	80-89	<i>Superior work that is clearly above average</i>
B	70-79	<i>Good work, meeting all requirements and eminently satisfactory</i>
C	60-69	<i>Competent work, meeting requirements</i>
D	50-59	<i>Fair work, minimally acceptable.</i>
F	below 50	<i>Fail</i>

Rounding of Grades (for example, bumping a 79 to 80%):

This is a practice some students request. **This practice will not occur here.** The final grade documented is the grade that you have achieved. There is no rounding to the next grade level, or 'giving away' of marks. Please don't ask me to do this for you; the response will be "please review the course outline where this is presented".

Appealing a Grade Within this Course

You have the right to appeal any grade within this course. The grounds for a grade appeal may be one or more of: medical or compassionate circumstances, extenuating circumstances beyond the student's control, bias, inaccuracy, or unfairness. All grounds advanced in a request for relief must be supported by a clear and detailed explanation of the reasons for the request together with all supporting documentation.

Appeals generally proceed in this order:

1. Course instructor (informal consultation)
2. Department Chair (submission of written request)
3. The Dean of the Faculty (submission of written request)

In the case of perceived procedural unfairness, steps 2 and 3 are carried out within the Department and Faculty offering the course. In the case of extenuating medical or compassionate circumstances that impact on a grade, steps 2 and 3 are carried out within a student's Home Department and Faculty.

A request for relief against a mark or grade must be initiated with the instructor as soon as possible after the mark is issued. In the event that the instructor is not available to the student, or fails to act, or if the matter is not resolved satisfactorily with the instructor, a written request for relief must be submitted to the Chair of the Department within three weeks of the date that the mark was issued. In the case of a final grade in a course, the written request for relief must be submitted to the Chair of the department by January 31st (for first-term half courses) or June 30th (for second-term half courses or full-year courses)

8. Support Services

Health and Wellness:

Information regarding health and wellness-related services available to students may be found at <http://www.health.uwo.ca/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/>) for a complete list of options about how to obtain help.

There are various support services around campus and these include, but are not limited to:
Student Development Centre -- <http://www.sdc.uwo.ca/ssd/>
Ombudsperson Office -- <http://www.uwo.ca/ombuds/>

9. Student Code of Conduct

The purpose of the Code of Student Conduct is to define the general standard of conduct expected of students registered at Western University, provide examples of behaviour that constitutes a breach of this standard of conduct, provide examples of sanctions that may be imposed and set out the disciplinary procedures that the University will follow. For more information, visit <https://www.uwo.ca/univsec/pdf/board/code.pdf>