

KIN 4Y03

Cognitive Neuroscience of Exercise

Department of Kinesiology, McMaster University

Term: 2, Winter 2018

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Office hours: By appointment

Class Meetings: See page 2 for detailed meeting schedule

Thursday classes will be held Ivor Wynne Centre 224, 10:30 to 12:20pm

Friday labs will be held in Ivor Wynne Centre A102K, 11:30 to 1:20pm

Course Description

This experiential learning course requires active participation by students to develop research and professional skills while exploring contemporary issues in the cognitive neuroscience of exercise field.

Objectives

1. Develop a comprehensive understanding of the impact of exercise on the structure and function of the brain
2. Identify the pros and cons of different neuroimaging techniques
3. Learn to critically evaluate and present scientific literature
4. Acquire the skills needed to conduct and analyze data from experiments examining the impact of exercise on brain function
5. Design a research study to examine the impact of exercise on brain function

Required Readings

Students will be required to read the research articles found on Page 5.

Topic to be covered

Topics related to the impact of exercise on the structure and function of the brain in healthy and disease states. A detailed schedule is provided on Page 3.

Evaluation

Attendance and participation 30%

- I-clicker quiz presentations and labs (2, 5% each)
- I-clicker quiz articles (5, 2% each)
- Attendance and participation (10%)

Presentations (2) 20%

Article critique (1) 10%

Lab Assignments (1) 15%

Research Proposal 25%

- Written 1 Page Summary (5%)
- Presentation (10%)
- Final Report (10%)

ACADEMIC INTEGRITY

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences (e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript reading "Grade of F assigned for academic dishonesty", and/or suspension or expulsion from the university). It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at: <http://www.mcmaster.ca/univsec/policy/AcademicIntegrity.pdf>

The following illustrates only three forms of academic dishonesty:

1. Plagiarism (e.g. the submission of work that is not one's own or for which other credit has been obtained)
2. Improper collaboration in group work
3. Copying or using unauthorized aids in tests and examinations

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone (905) 525-9140 ext. 28652 or email sas@mcmaster.ca. For further information, consult McMaster University's Policy of Academic Accommodation of Students with Disabilities.

<http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf>

ON-LINE LEARNING RESOURCES

In this course, we will be using **Avenue**. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

USE OF COURSE MATERIAL

Course materials provided by the instructor are for use by students registered in this class only. Under no circumstances are these materials to be shared, posted or sold to a third party without permission from the instructor. This includes, but not limited to, online posting of instructor provided lecture/lab notes, online lectures, recordings of lectures, or any lab materials on a website other than the Avenue site designed for this course.

TURNITIN.COM

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to www.mcmaster.ca/academicintegrity

MODIFICATIONS TO COURSE

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

MISSED STUDENT ABSENT FORM

If you are absent from the university for a minor medical reason, lasting fewer than 3 days, you may report your absence, without documentation, using the McMaster Student Absence Form. Absences for a longer duration or for other reasons (e.g., Religious, personal) must be reported to your Faculty/Program office, with documentation, and relief from term work may not necessarily be granted. When using the MSAF, report your absence to heiszji@mcmaster.ca. Then contact the instructor immediately (within 2 working days) by email/telephone/in person to learn what relief may be granted for the work you have missed, and relevant details such as revised deadlines, or time and location of a make-up exam. Please note MSAF regulations have changed beginning Fall 2015.

Date	Time/Location	Format	Topic	Assignment
04-Jan	IWC 224	Lecture	An introduction to the cognitive neuroscience of exercise	Sign up for groups A, B, C, and D
11-Jan	IWC 224	Skill Building Workshop	How to give an effective presentation	Work on class presentation
12-Jan	IWC A102K	Feedback and Practice	Understanding the function of select brain regions and how those regions respond to exercise.	Work on class presentation
18-Jan	IWC 224	Class Presentation #1 by grads	Understanding the function of select brain regions and how those regions respond to exercise.	I-clicker quiz
19-Jan	IWC A102K	Feedback and Practice	Understanding the function of select brain regions and how those regions respond to exercise.	Work on class presentation
25-Jan	IWC 224	Class Presentation #1	Understanding the function of select brain regions and how those regions respond to exercise.	Prepare 15 min presentation or discussion questions on topic 1 with group A
26-Jan	No Lab			
01-Feb	IWC 224	Lecture	Before cognitive neuroscience: The brain as a black box. Learning about healthy function from diseased states	I-clicker quiz
02-Feb	Anatomy Lab	Lab #1	Sheep brain dissection to understand how exercise impacts the brain	Complete lab workbook #1
08-Feb	IWC 224	Class Presentation #2 by grads	Neuroimaging methods for understanding exercise-cognition interactions	I-clicker quiz
09-Feb	IWC A102K	Feedback and Practice	Neuroimaging methods for understanding exercise-cognition interactions	Work on class presentation
15-Feb	IWC 224	Class Presentation #2	Neuroimaging methods for understanding exercise-cognition interactions	Prepare 15 min presentation or discussion questions on topic 2 with group B
16-Feb	No Lab			
<i>Reading Week</i>				
01-Mar	IWC 224	Skill Building Workshop	How to read and critically evaluate a scientific article; How to present and moderate for your article critique	Read Article 1 (see page 5) prior to class. I-clicker quiz on Article 1
02-Mar	Anatomy Lab	Lab #2	Exercise and Alzheimer's disease Human anatomy lab to understand how exercise may be able to protect the brain from disease	Complete lab workbook #2
08-Mar	IWC 224	Article Critique	Exercise and memory	Read article 2 (see page 5) prior to class I-clicker quiz on Article 2 Article discussion facilitated by group C1
09-Mar	IWC A102K	Lab #3	Exercise and memory	Work on lab workbook #3
15-Mar	IWC 224	Article Critique	Exercise and mental health	Read articles 3 (see page 5) prior to class I-clicker quiz on Article 3 Article discussion facilitated by group C2
16-Mar	IWC A102K	Skill Building Workshop	SPSS lab to analyze exercise and memory data	Work on lab workbook #3 Submit lab workbook #3 by email
22-Mar	IWC 224	Feedback and Practice	Feedback on research proposal	Submit 1 page research proposal
23-Mar	No Lab			Work on class presentation
29-Mar	IWC 224	Article Critique	Exercise and executive functions	Read article 4 (see page 5) prior to class I-clicker quiz on Article 4 Article discussion facilitated by group C3
30-Mar	IWC A102K	Feedback and Practice	Final Research Proposal Presentation	Work on class presentation
5-Apr	IWC 224	Research Proposal Presentation	Final Research Proposal Presentation	Prepare 15 min presentation on proposed research with group D

Note: The Written Research Proposal is due April 16th by 12pm and will be submitted via e-mail.

Overview of Evaluation Components

1. Presentations (2 X 10%)

- *Rubric on page 8*

In two 20-minute group presentations, you will aim to enhance the audience's understanding of your topic and entice viewers to learn more. It is important to keep in mind that although you might have a great deal of knowledge about your topic of interest, your audience may not. Effective use of presentation time is crucial and requires that you anticipate and address questions before they are asked. During your presentation, you should also be enthusiastic, use accessible language, and maintain a natural flow of speech. You have the opportunity to inspire and impact your audience above and beyond the breadth of your topic. This goal can be achieved by providing a "take-home message" with real world significance.

Topic for Presentation #1: Describe the function of the selected brain region and explain how that region responds to exercise. Use at least two empirical studies to back up your claims. You will present in groups of 2-3 (Group A). Each member of the group must contribute to the oral presentation. **Note: These structures will be covered in your first lab assignment.**

1. Amygdala
2. Cerebellum
3. Corpus Striatum (dopamine)
4. Hippocampus
5. Hypothalamus
6. Motor/premotor cortex
7. Parietal cortex
8. Frontal/prefrontal cortex

Topic for Presentation #2: Describe the selected research techniques (along with pros and cons) and discuss the utility of that technique for understanding exercise-cognition interactions. Use at least two empirical studies to back up your claims. You will present in groups of 2-3 (Group B). Each member of the group must contribute to the oral presentation. **Note: These tools can be used for your research proposal later in the term.**

1. Diffusion tensor imaging (DTI)
2. Doppler ultrasound
3. Electroencephalography (EEG)
4. Functional magnetic resonance imaging (fMRI)
5. Functional near infrared spectroscopy (fNIRS)
6. Trans-cranial Magnetic Stimulation (TMS)

2. Article Critique (1 X 10%)

- *Rubric on page 9*

The goals of this activity are to develop a critical approach to research on the cognitive neuroscience of exercise. In the context of small group discussions, you will think critically about their research methods, theory, and application. The first step to any rewarding discussion is to ask meaningful questions, which is one of your core responsibilities for this project.

Note: Your job here is to simply explain the topic and deliver a breakdown of the article. Critical analysis of the author(s)' work (what worked, what didn't, what should have been done differently, etc.) should occur through the thoughtful questions you prepare and facilitation you provide in the discussion period.

The class will be divided into smaller sections, with each group member being responsible for leading an independent discussion with one subgroup and summarizing what was discussed with the rest of the class (approximately 2-minutes for each group to share) after each 5-minute discussion period. The next section will then be discussed and shared. These four conversations will begin with a prepared question about the article. It should be noted that these questions must be deep and thoughtful, with research into the topic and techniques used.

Although critically evaluating a scientific research paper can initially seem intimidating, you are encouraged to look at both the successes and pitfalls of your article. You are also encouraged to move past simply identifying the positive aspects and flaws

to all scientific research, we are covering a wide variety of research throughout the course and the requirements for one type of study may not be the same as another. These critical thinking skills are directly transferable to your role as a student and a scientist.

Journal Reading Presentation Format:

Summary of the article (15 minutes):

- Provide background on the topic to set up the experiment.
- State the purpose of the experiment.
- Explain the experimental methods.
- Present the results – use graphs and tables (create your own from the data).
- State the author's conclusions of the experiment.

Discussion Facilitation (30 minutes):

- As a Facilitator, lead a discussion with a subgroup using 4 prepared questions (~5 minutes each).
- Each group facilitator will summarize their group's analysis with the class after each discussion topic (2 minute period), then rejoin their groups to begin the next area of analysis.
- One facilitator will lead a final class-wide debrief. The main goal of this portion is to summarize, compare the independent subgroup discussions and deliver the class' conclusion of the study (approximately 2 minutes).

Articles:

1. Ten Brinke, L. F., Bolandzadeh, N., Nagamatsu, L. S., Hsu, C. L., Davis, J. C., Miran-Khan, K., & Liu-Ambrose, T. (2015). Aerobic exercise increases hippocampal volume in older women with probable mild cognitive impairment: a 6-month randomised controlled trial. *British journal of sports medicine*, 49(4), 248-254.
2. Weinberg, L., Hasni, A., Shinohara, M., & Duarte, A. (2014). A single bout of resistance exercise can enhance episodic memory performance. *Acta Psychologica*, 153, 13-19.
3. Zschucke, E., Renneberg, B., Dimeo, F., Wüstenberg, T., & Ströhle, A. (2014). The stress-buffering effect of acute exercise: evidence for HPA axis negative feedback. *Psychoneuroendocrinology*.
4. Byun, K., Hyodo, K., Suwabe, K., Ochi, G., Sakairi, Y., Kato, M., . . . Soya, H. (2014). Positive effect of acute mild exercise on executive function via arousal-related prefrontal activations: An fNIRS study. *Neuroimage*.

3. Lab Assignments (20%)

The goal of the laboratory activities is to develop a deeper understanding of the cognitive neuroscience of exercise through hands-on experience communicating complex topics, conducting research, analyzing data, and reporting results. This course has 4 labs. Each lab has a workbook to be filled out during the lab. The content of Labs 1 and 2 will be tested on using the in-class I-clicker quizzes. The workbooks for Labs 3 and 4 are to be submitted for 10% each.

Labs 1 & 2:

Labs 1 & 2 will take place in the anatomy lab (Room TBA), where groups will investigate the relationship between cognitive structure and function. This will occur through dissection of a sheep's brain (Lab 1) along with observing healthy and diseased human specimens (Lab 2). You will work through a series of prepared questions to guide this experience and answer I-clicker quiz on the material covered.

Lab 3 (15%):

Labs 3 will take place in IWC A102/K, where students will both participate in exercise labs and later perform analysis of the results obtained. You should come prepared to exercise with appropriate clothing attire. With 2-3 of your peers, you will be responsible for completing the lab workbook, which includes performing statistical analysis using SPSS (available in IWC computer lab). Groups will submit graphs that illustrate the data, the SPSS output of their analysis, a description of the results (using the template given) and a brief description of what the results mean in layman's terms. These will be submitted in-class as detailed in the schedule.

4. Research Proposal (25%)

The research proposal is the main project of the course that you will work on in teams of 2-3 (Group D) throughout the term. This activity will build critical skills needed to develop a novel research idea and communicate the importance of that research idea to a general audience in both written and oral formats. Pick a topic from the list below and design a novel study that uses exercise to address a critical issue for that population.

Research Proposal Topics:

1. Stroke
2. Concussion

3. Multiple sclerosis
4. Spinal cord injury
5. Depression
6. Chronic stress
7. Attention deficit disorder
8. Parkinson's
9. Schizophrenia
10. Cancer

- *Initial Research Proposal Summary (5%):*

Your group will prepare a 1-page summary that sets up the background research and general problem that your proposed research will use exercise to address. **This intervention must include at least 1 research tool from Presentation 2's list of topics to measure a cognitive change.** The initial proposal should focus on establishing your topic, the gap in the literature and why it should be addressed. That said, you should still spend time developing your experimental approach, as this is a valuable opportunity to receive feedback. *Be sure to refer to the rubric on page 10 to determine what is expected from your research proposal summary.*

- *Final Research Proposal Presentation (10%):*

Your group will prepare a 20-minute presentation at the end of the term that describes your proposed research to the class. This presentation will briefly cover the background of your topic from the previous proposal, however the bulk of the focus should now be the details of your intended intervention. *Be sure to refer to the rubric on page 12 to determine what is expected from your research proposal presentation.*

- *Research Proposal Written Report (10%):*

Your group will prepare a grant proposal for your proposed research. This written report must not exceed **four pages, single-spaced** (plus additional pages for references). If the maximum length is exceeded, students will receive a 2 mark penalty for every half a page. Be sure to refer to the rubric (*page 14-15*) to determine what is expected from your written proposal; these expectations are drawn from and align with requirements found in many grants. The written proposal, **due April 17**, will include all elements outlined in the rubric: rationale and goals, literature review, method, expected results, timeline, and significance of project.

Presentation Rubric

Presenters:		Date:	
Topic:		Score:	/22

Presentation (How it's presented)	Score	Comments
Narrative is engaging and clearly presented with minimal technical issues	/4	
Topic is described in a way that is easy to understand	/4	
All group members participate equally in the presentation	/1	
Content (What is presented)		
Presentation is logically organized both on individual slides and as a narrative	/4	
Images/graphics used are relevant and add value to the topic presented	/4	
Selection and description of two relevant, empirical studies. Include hypotheses, procedures and results	/4	
Take-home message/real world significance of lecture content is discussed	/4	

Article Critique Rubric

Group Members:		Date:	
Article:		Score:	/42

Missing	Poor (Below Expectation)	Fair (Changes needed)	Good (Minor Errors)	Excellent (Meets / Exceeds Expectation)
0	1	2	3	4

Article Debrief	Score	Comments
Provides background information; includes key definitions, terminology and past literature (What is the topic being investigated?)	/4	
Clearly states purpose of the experiment along with the rationale that led to its design (Why was the experiment done?)	/4	
Presents the experimental methods and techniques in a clear, logical manner (What was done?)	/4	
Results of the empirical study were clearly presented through the use of graphs and tables (What were the results? - Highlight them by creating simplified table[s] and/or graphs[s])	/4	
Author(s)' interpretation of the results and their implications are stated briefly (What were the author's conclusions?)	/4	

***Note: Your job here is to simply explain the topic and deliver a breakdown of the article. Critical analysis of the author(s)' work (what worked, what didn't, what should have been done differently, etc.) should occur through the thoughtful questions you prepare and facilitation you provide in the discussion period. Please use the below form to print your questions to submit to the TA on the day of your facilitation.**

Missing	Fair (Changes needed)	Excellent (Meets /Exceeds Expectation)	Score:	/22
0	1	2		
Discussion Period		Comments		
Question #1:				
Quality and originality of question	/2			
Continued discussion through whole 5 min period	/2			
Clear summary of each group's discussion	/1			
Question #2:				
Quality and originality of question	/2			
Continued discussion through whole 5 min period	/2			
Clear summary of each group's discussion	/1			
Question #3:				
Quality and originality of question	/2			
Continued discussion through whole 5 min period	/2			
Clear summary of each group's discussion	/1			
Question #: 4				
Quality and originality of question	/2			
Continued discussion through whole 5 min period	/2			
Clear summary of each group's discussion	/1			
Final Summary and Conclusions	/2			

Initial Research Proposal Summary

Group Members:		Date:	
Title:		Score:	/30

Missing	Poor (Below Expectation)	Fair (Changes needed)	Good (Minor Errors)	Excellent (Meets/Exceeds Expectation)
0	1	2	3	4

Scope of the Topic		Comments
Brief explanation of the topic (What is it?)	/4	
Establishes context and relevance of the topic for their audience (Why should we care?)	/4	
Describes current state of the literature using empirical articles' procedures and results (What has been seen in research conducted thusfar?)	/4	
Clearly describes the gap in the literature on the topic (What is missing?)	/4	
Explains the implications of addressing this knowledge gap (Why is it necessary to do this research?)	/2	
Intervention Proposal		Comments
Specific research hypothesis(es) chosen is/are novel, interesting and clearly stated (What is the specific area of this knowledge gap being targeted?)	/2	

Explains the approach/ techniques that will be used to answer these questions: Who are you going to test? What are you going to measure? How are you going to measure it?	/2 /2 /2	
Explains why this is this the best approach to answer your research question (Justify your approach)	/4	

Additional Comments

Final Research Proposal Presentation Rubric

Group Members:		Date:	
Title:		Score:	/50

Presentation Slides	Score	Comments
Narrative is engaging, concise and informative with minimal technical issues	/4	
Images used are relevant and provide visual appeal	/4	
Slides are used as a complimentary tool without competing with narration	/4	
Scope of the Topic		Comments
Establishes context and relevance of the topic for their audience	/4	
Describes current state of the literature using empirical evidence and/or population statistics	/4	
Identifies the gap in the literature and the implications of addressing it	/4	

Intervention Proposal		Comments
Specific research hypothesis(es) chosen is/are novel, interesting and clearly stated	/2	
Explains the experimental methods in detail:		
Target population + Inclusion and Exclusion Criteria	/3	
Variables to be measured + Measurement tool(s) selected	/3	
Experimental Group(s) Defined	/3	
Protocol/Procedure provided with a clear timeline of the	/4	

intervention's execution		
Reports the expected results, explains how they support the research hypothesis and justifies why these results are expected (Create graph[s] to illustrate the expected trend[s] in your results)	/4	
Discusses the impact/main contribution of the potential findings	/2	

***Note: Budget for your proposal will be included in the written portion of this assignment**

Additional Comments

Research Proposal Written Report Rubric

Group Members:		Date:	
Title:		Score:	/54

Missing	Poor (Below Expectation)	Fair (Changes needed)	Good (Minor Errors)	Excellent (Meets/Exceeds Expectation)
0	1	2	3	4

Grant Proposal – Structure	Score	Comments
Overall, the proposal is written clearly and demonstrates a logical introduction and progression of main points.	/4	
Overall, the grant proposal contains no spelling or grammatical errors and uses appropriate referencing format (APA)	/4	
The grant proposal stays within the page limit (4 pages single spaced) and is written in 12 point Times New Roman font.	/1	

Grant Proposal – Overview	Score	Comments
Overall, the grant proposal uses the appropriate structure and addresses all required areas: background, rationale, methods/timeline, potential pitfalls budget, expected results and implications	/4	
Clearly and concisely introduces a research challenge, its importance, and how it will be addressed with this grant	/4	
Grant Proposal – Content	Score	Comments
Background: Presents thorough background and foundational research to identify what is known about the topic.	/4	

<p>Rationale:</p> <p>Clearly identifies rationale for the proposed project and specific goals that will be accomplished if this research were funded.</p>	/4	
<p>Method: Materials/Procedure</p> <p>Defines the specific tools, resources and personnel required to answer this question in realistic and reasonably priced manner</p>	/4	
<p>Method: Execution</p> <p>Presents the intervention that includes a realistic timeline of when and how the project's objectives will be accomplished.</p>	/4	
<p>Method: Statistics</p> <p>Discusses methods to quantitatively evaluate and disseminate the findings and impacts of this project.</p> <p>(What statistical analysis do you plan to use on the data and for what variables?)</p>	/4	
<p>Expected Results:</p> <p>Proposes anticipated outcomes that would support the hypothesis(es) using evidence from the existing literature</p> <p>(Include graph(s) and/or figure(s) that illustrate these anticipated trends)</p>	/4	
<p>Potential Pitfalls:</p> <p>Identifies potential problems that may arise and proposes alternative protocols to overcome this issue and/or methods to analyze the research question from a different angle should they occur.</p>	/4	
<p>Implications:</p> <p>Discusses the impact of this project and how the effects of this initiative will be sustained and built upon into the future.</p>	/4	