FNH 451 Nutrient Metabolism and Implications for Health 2022/2023

ASSIGNMENT GUIDELINE FOR THE GROUP RESEARCH PROJECT

(Original version by Dr Zhaoming Xu, 2021/2022)

1. General information

Students will work in randomly assigned groups on a topic of current interest in the field of nutrient metabolism and metabolic regulation. The assigned topic provides a general framework for the group to develop a meaningful research question, that **MUST** be formulated to explain the metabolic mechanisms involved at biochemical, cellular and/or molecular levels. Each group will conduct an in-depth literature research to address the research question using original research papers published in peer-reviewed scientific journals during the last 10 years. Each group will present their research findings as an oral presentation to the class and through a written synopsis or research report. Oral presentation and synopsis prepared using information from textbook, review articles, and articles from Internet, such as Wikipedia will **NOT** be accepted.

2. Objectives

The objectives of this course are to provide an opportunity for students to:

- sharpen research and critical thinking skills;
- improve written and oral communication skills;
- become familiar with current knowledge and issues in the field of nutrient metabolism and its implications for health; and
- strengthen teamwork skills, including cooperation, leadership, and providing constructive feedbacks.

3. Letter of Intent

3.1 *Overview.* Letter of Intent (LOI) is an outline of your group's plan for conducting the research. A sample LOI is provided at the end of this document (Appendix 1).

3.2 The LOI consists of:

- a brief background highlighting relevant current knowledge in the field of interest;
- your group's research question;
- a carefully developed research plan outlining **HOW** your group is going to address the research question fully;
- in-text citation of up to 10 key references should be provided. A list of the references cited should be provided at the end of the LOI.

3.3 *Format.* The LOI must be prepared as a Word document using the format specified as following:

- a cover page consists of the course number and name, title of your research project, group number, names and ID numbers of all group members, and the date of submission;

- double-spaced with a margin of 1 inch (2.54 cm) all around;
- Times New Roman, font size of 12 points;
- letter-size paper (21.25 x 27.5 cm or 8.5" x 11");
- a maximum of 2 pages, excluding the cover page and references;
- consecutive page numbers;
- in-text citations are shown as superscripts in consecutive number according to the sequence of its appearance;
- refer to Nutrition Review for the list of references (http://nutritionreviews.oxfordjournals.org/for_authors/index.html).

3.4 *Assessment criteria and weight*. The LOI will be assessed for:

- a sufficient background that is a brief summary of the relevant current knowledge in the field of interest with sufficient depth and breadth. The background should set the stage for launching the research question (15%);
- a well-articulated and meaningful research question that **MUST** be formulated to explain the metabolic mechanisms involved at biochemical, cellular and/or molecular levels (15%).
- a carefully developed research plan that clearly outlined narrative showing **HOW** your group is going to address the research question effectively, fully, and logically (55%);
- conciseness. The LOI is written in such way that it is terse, but comprehensive (5%);
- effectiveness. Sentences and paragraphs are well link with a logic flow and are written in a cohesive manner (5%); and
- format. The LOI must be in compliance with the format, including the format of references, outlined in section 3.2 above (5%).

4. Abstract

4.1 Each group is required to prepare an Abstract for your group's presentation. The Abstract should consist of:

- a brief, but sufficient background highlighting the relevant current knowledge;
- your group's research question;
- main findings of your group's research;
- a clear take-home message; and
- a list of all references and art credits.

NOTE: The Abstract contains **NO** in-text citation.

4.2 *Format*

The Abstract must be prepared as a Word document using the same format outlined in Section 3.3 above, with the following exceptions:

- **NO** cover page;
- **NO** in-text citation for the Abstract;
- group number **ONLY** with **NO** group members' names and ID numbers; and
- limited to 500 words.

A template for the Abstract is shown in Appendix 2.

4.3 *Assessment Criteria and Weight*.

- A brief background that provides a sufficient relevant current knowledge in your group's research topic and sets the stage for launching the research question (10%);
- Your group's research question (5%);
- A well-articulated and organized summary of findings that highlights your group's main research findings with adequate depth and breadth (40%);
- Accuracy of the information presented must be consistent with and well supported by the available literature (15%);
- Conciseness. The Abstract is written in such way that it is terse, but comprehensive (10%);
- Effectiveness. Sentences and paragraphs are in a logic flow and a cohesive manner (10%);
- A clear and appropriate take-home message that is well supported by the findings presented (5%); and
- Format. The Abstract must be in compliance with the format, including the format of references, outlined in section 4.2 above (5%).

5. Oral Presentation

5.1 *Overview.* Each group will present their research findings to the class in a 15 min oral presentation (no less than 13 min) followed by a 15 min question-and-answer (Q&A) period. Your group's research findings must be the focus of the presentation. The instructor and your TA will meet the presenting group immediately after the Q&A period. The meeting provides an opportunity for you to reflect on your experience in the research project and for the instructor and your TA to give you their feedback on your group's presentation.

5.2 *Format.* The presentation must be prepared using PowerPoint. The presentation should consist of:

- a brief, but sufficient background highlighting the current knowledge;
- your group's research question;
- main findings of your group's research;
- a clear take-home message; and
- a list of all references and art credits.
- The oral presentation is limited to 15 - 18 slides (1 slide per minute), including the title slide.

5.3 *Assessment Criteria and Weight*.

- An introduction that provides a brief summary of relevant current knowledge in your group's research topic and sets the stage for launching the research question (10%);
- Your group's research question (5%);
- Discussion that highlights your group's main research findings with adequate depth and breadth. The discussion must not be a simple

compile of information. Instead, it is well-articulated and logically organized demonstrating an in-depth understanding of the topic and critical evaluation of the information presented (45%);
- A clear and appropriate take-home message that is well supported by the findings presented (10%);
- Responses to questions during Q&A that demonstrates your group's level of knowledge in /understanding of the research topic (15%);
- Effectiveness of audio/visual aids and delivery (10%); and
- Adherence to slides and time limits. Your group's presentation must neither be too short (< 13 min) nor exceed the maximum allowable time of 15 min (5%).

6. Research Synopsis

6.1 *Overview.* The synopsis of your research must consist of:
- an introduction that provides a brief introduction to the research topic;
- your group's research question;
- main findings of your research that is a **CRITICAL REVIEW** of current knowledge in the field of your group's research project. It is of key importance to critique the available literature (e.g., thinking about the strength, weakness, and limitations of the articles) with sufficient depth and breadth. This section of the synopsis is where you discuss your group's findings and synthesize the information gathered to formulate your independent views on the topic; and
- a conclusion that includes a concise summary of your main research findings and clear and appropriate take-home messages.

6.2 *Format.* The Synopsis must be prepared as a Word document using the same format outlined in Section 3.2 above except that:
- the synopsis is limited to 5,000 - 6,000 words;
- tables and figures must be on separate pages with one table or figure per page. Place tables and pages between the main body of the synopsis and the list of references; and
- there is no page limit on tables, figures, and references; however, the text should not entirely depend on an excessive number of tables and figures for comprehension.

6.3 *Assessment Criteria and Weight*.
The synopsis will be assessed for:
- understanding of the topic, which is demonstrated through a critical analysis, rational interpretation of available literature, and a well-organized discussion (30%);
- accuracy. Information presented must be consistent with and well supported by the current literature (10%);
- sufficient depth and breadth. Information presented and discussion developed are consistent with the scope and span of the current literature and the expectations for a 4th year course in Nutritional Sciences (15%);

- critical evaluation of the literature. A clear demonstration of critique of the literature, instead of a simple compile and reiteration of the literature. Aspects to be considered include strengths, weaknesses, and limitations of the experimental design and methodologies, interpretation of the results, and appropriateness of the conclusion (15%);
- organization. The synopsis is organized in a well-thought out, coherent, and logical fashion (10%);
- conclusion that is an accurate and concise summary of your main research findings along with a clear and appropriate take-home message (5%);
- conciseness. The synopsis is written in such way that is terse, but comprehensive, and carefully crafted (5%);
- effectiveness. Sentences and paragraphs are in a logic flow and a cohesive manner (5%); and;
- format. The synopsis must be in compliance with the format outlined in section 5.2 above (5%).

7. Peer evaluation

Your individual mark for the LOI, abstract, oral presentation, and synopsis will be calculated by multiplying the group mark by the mean peer-evaluation-factor (PEF). PEF should reflect your contribution in your group's research and towards the preparation of the LOI, oral presentation, and synopsis.

Criteria for peer evaluation include:

- Cooperation;
- Dependability;
- Contribution of ideas;
- Understanding of the topic;
- Communication; and
- Leadership.

Each criterion will be evaluated on an equal weight basis.

Each student is assigned a PEF of 1. The PEFs are normally between 0.70 - 1.30 (0.70 for an exceptionally lack of contribution and 1.30 for exceptional contribution and leadership). The sum of your group's PEF must be equal to the number of students in the group. Evaluations that fall outside of these rules will be disregarded. (Refer to the Instruction for PEF on Canvas for details.). The minimum PEF could be reduced to below 0.70 depending on the severity of the lack of participation. In the case of a total lack of participation, the PEF for the student will be reduced to 0. Your PEF is the average of all your peers' evaluations.

All students are asked to complete two peer evaluation forms: 1) for the work on the LOI, and 2) for the work on the abstract, oral presentation and synopsis.

APPENDIX 1. SAMPLE LETTER OF INTENT (LOI)

FNH 451: Nutrient Metabolism and Implications for Health

Letter of Intent

The interdependency between TRPV6 and Cav1.3 and its influence on the regulation of intestinal calcium absorption in response to varying physiological environments

GROUP 5

Group member 1 (ID #)
Group member 2 (ID #)
Group member 3 (ID #)
Group member 4 (ID #)
Group member 5 (ID #)
Group member 6 (ID #)

February 2, 2012

Background

Calcium plays a critical role in the development and maintenance of healthy bones and teeth. It is tightly controlled via bone remodelling and kidney reabsorption to maintain homeostasis[1]. Extensive research has been conducted on intestinal calcium absorption to achieve a greater understanding of the mechanisms involved in the uptake of this important micronutrient.

Calcium is absorbed in the mammal along two routes: an active transcellular mechanism dependent on vitamin D_3, predominantly occurring in the duodenum, and a paracellular mechanism that is concentration-dependent and contributes to calcium absorption throughout the entire length of the intestine[1]. Alternating depolarizing and hyperpolarizing conditions brought about by the digestion and absorption of nutrients, as well as fluctuating levels of calcium, are some of the many factors that affect calcium uptake[1,2]. These varying conditions regulate the activation of the transcellular proteins transient receptor potential vanilloid type 6 (TRPV6) and voltage dependent L-type Ca^{2+} channel 1.3 (Cav1.3), both of which are embedded within the apical membrane of the enterocyte[3].

Research question

How does the interdependency between TRPV6 and Cav1.3 contribute to the regulation of intestinal calcium absorption under varying physiopathological conditions?

Rationale

Previously, only one transcellular intestinal calcium absorption pathway was known, the mechanism of which depended on TRPV6 channels, to transport luminal calcium across

the brush border, and calbindin-D9k, to transport cytosolic Ca^{2+} to the basolateral membrane[4]. However, this has been challenged by TRPV6 knockout studies where calcium absorption was still observed, indicating that another absorption mechanism was present[5]. A newly proposed mechanism is the possibility of Cav1.3's contribution to glucose and Ca^{2+} uptake. Thus, the rationale for our research question stems from our interest in further exploring Cav1.3's role in calcium absorption and its relationship with TRPV6. The interactions between these brush border proteins are critical in the regulation of blood calcium levels, which if imbalanced, may cause detrimental physiological effects.

Research plan

Intestinal calcium absorption involves complex processes occurring at the apical membrane of the enterocyte. To augment our understanding of the subject and its contribution to calcium homeostasis, paracellular and transcellular pathways of Ca absorption will be reviewed, with a discussion of TRPV6's involvement and vitamin D_3's influential role in calcium transport[4]. Our main focus shall be on how Cav1.3 executes its role in calcium absorption across the intestinal brush border, with an emphasis on the interdependent and complementary relationship between TRPV6 and Cav1.3. Intestinal lumen polarities (depolarization and hyperpolarization) and their direct effects on the efficiency of calcium absorption will be addressed to supplement our discussion. Recommendations for future research pertaining to the reciprocal roles of TRPV6 and Cav1.3 in intestinal calcium absorption will be proposed. The importance of developing a detailed understanding of intestinal calcium absorption mechanisms will be emphasized by summarizing its critical role in calcium homeostasis and ultimately in the prevention of calcium- related diseases.

Key references

1. Kellett GL. Alternative perspective on intestinal calcium absorption: Proposed complementary actions of Cav1.3 and TRPV6. Nutr Rev. 2011;69:347-370.

2. Mace OJ, Affleck J, Patel N, et al. Sweet taste receptors in rat small intestine stimulate glucose absorption through apical GLUT2. J Physiol. 2007;582:379-92.

3. Morgan EL, Mace OJ, Affleck J, et al. Apical GLUT2 and Cav 1.3: regulation of rat intestinal glucose and calcium absorption. J Physiol. 2007;580: 593–604.

4. Van Abel M, Hoenderop JGJ, Bindels RJM. The epithelial calcium channels TRPV5 and TRPV6: regulation and implications for disease. Naunyn-Schmiedeberg's Arch Pharmacol. 2005;371:295-306.

5. Benn S, Ajibade D, Porta A, et al. Active intestinal calcium transport in the absence of transient receptor potential vanilloid type 6 and calbindin-D9k. Endocrinol. 2008;149:3196-3205.

APPENDIX 2. ABSTRACT TEMPLATE

20XX FNH 451 Group Presentations Title of your group's presentation Your group number

ABSTRACT*

Background: Start with a background that highlights relevant current knowledge to set a stage for launching the research question.

Research Question A clearly stated, well-worded, meaningful specific question that is formulated to explain the metabolic mechanisms involved at biochemical, cellular and/or molecular levels.

Findings Highlight of well-articulated summary of main findings.

Conclusion Provide a clear and appropriate conclusion that should be well supported by your research findings and remembered from your group's presentation.

Key references

1. Author(s). Title of the article. Journal. Year published; volume: first page- last page.

***Up to 500 words with NO in-text citation for the Abstract.**