Friedman School Course Syllabus

APPLIED NUTRITIONAL BIOCHEMISTRY

Fall, 2018

Time and location of the course: 9:00 AM – 12:00 PM, Thursday

Instructor
Dr. Alice H. Lichtenstein (E-mail: Alice.Lichtenstein@tufts.edu, Phone: 617.556.3127)
Office Hours: Generally available, arrange via e-mail

Teaching Assistant
Simon Ye (E-mail: Shumao.Ye@tufts.edu)

Tufts Graduate Credit: 3 SHU

Prerequisites: NUTR 202 or equivalent, and one undergraduate level biochemistry course taken within the past five years, or instructor consent.

Course Description: The course will focus on human nutrition and metabolism. The functional and regulatory roles of macronutrients and micronutrients will be stressed. Additional components of the course will emphasize how nutrition science relates to nutrition information available to the lay public and drives nutrition policy. Students will be guided through an exploration of recent scientific literature in the areas of nutrition and biochemistry, and ways one informs the other. Opportunities will be available to gain experience in delivering short oral presentations and writing reports. The lecture material will be related to current challenges in the field of nutrition.

Course Objectives:
- Discuss the relationship between intermediary metabolism, and micronutrients and macronutrients.
- Update knowledge about essential nutrients.
- Explore the relationship between nutritional biochemistry and nutrition policy.
- Critically assess the relationship between new research findings and reports in lay venues.

Description of assignments, tests, and other required activities (refer to last section, entitled Assignments, for more detailed information):
- Weekly discussion of timely nutrition related issues that have appeared in lay venues – to be identified by students.
- Weekly oral discussion and written critique of recently published peer reviewed articles related to weekly topic – to be assigned by instructor.
- Written report and oral presentation for one vitamin per student – vitamin to be assigned by instructor.
- Written report and oral presentation for one mineral per student – mineral to be assigned by instructor.
- Written critique and oral class presentation of one emerging topic related to nutritional biochemistry – to be identified by student and approved by instructor.
Summary of Assignments and Grading:

<table>
<thead>
<tr>
<th>Assignments</th>
<th>Grading Weight</th>
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<tbody>
<tr>
<td>In class attendance, participation and written critiques of assigned peer reviewed articles, and class discussions of nutrition related topics appearing in the lay arena (print or electronic).</td>
<td>35%</td>
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<tr>
<td>Oral presentation and written vitamin report.</td>
<td>20%</td>
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<tr>
<td>Oral presentation and written mineral report.</td>
<td>20%</td>
</tr>
<tr>
<td>Oral presentation and written critique of emerging nutrition topic.</td>
<td>25%</td>
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</tbody>
</table>

**Penalties for late or incomplete assignments:** Assignments are expected to be submitted on or before the due dates. Assignments submitted after the due date without explicit prior approval from the course instructor will be graded down, approximately 10% for each day late. Each student will have only one opportunity to complete each assignment. There will be no exceptions.

**E-mail, texting and web surfing during class:** E-mailing, texting and web surfing during class will be considered an indication of disinterest and disengagement with the course material and will be reflected in the credit given for class participation.

**Class Attendance:** Nutr 0315 is structured with a large student participatory component. It is expected all students will attend all classes, for the entire period. Students should contact the instructor with regard to class absences.

**Course Texts and Materials:**
- There is no course textbook. It is expected that each student will have access to a basic biochemistry and nutrition textbook.
- Course material will be posted on CANVAS.

**Instructions for Submission of Written Assignments:**
Completed weekly assignments should be submitted via the drop-box on CANVAS by 12 pm (noon) the Tuesday prior to the Thursday class. Other reports should be submitted via the drop-box on CANVAS by 9 am the day of the presentation. Please submit WORD files and include your last name in the file title.

**Accommodations of Disabilities:**
*Tufts University is committed to providing equal access and support to all students through the provision of reasonable accommodations so that each student may access their curricula and achieve their personal and academic potential. If you have a disability that requires reasonable accommodations please contact the Friedman School Assistant Dean of Student Affairs at 617-636-6719 to make arrangements for determination of appropriate accommodations. Please be aware that accommodations cannot be enacted retroactively, making timeliness a critical aspect for their provision.*
Academic Conduct:
Each student is responsible for upholding the highest standards of academic integrity, as specified in the Friedman School’s Policies and Procedures manual (http://nutrition.tufts.edu/student/documents) and Tufts University policies (http://uss.tufts.edu/studentaffairs/judicialaffairs/Academic Integrity.pdf). It is the responsibility of each student to understand and comply with these standards, as violations will be sanctioned by penalties ranging from failure on an assignment and the course to dismissal from the school.

All assignments will be scanned with plagiarism software.

Diversity Statement:
We believe that the diversity of student experiences and perspectives is essential to the deepening of knowledge in this course. We consider it part of our responsibility as instructors to address the learning needs of all of the students in this course. We will present materials that are respectful of diversity: race, color, ethnicity, gender, age, disability, religious beliefs, political preference, sexual orientation, gender identity, socioeconomic status, citizenship, language, or national origin among other personal characteristics.
Course Topics at a Glance: *This schedule is subject to modification at the instructor’s discretion.*

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
<th>LECTURER(S)</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 6</td>
<td>Introduction to course Basic nutritional biochemistry concepts</td>
<td>Lichtenstein</td>
<td>Jaharis 156</td>
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<tr>
<td>September 13</td>
<td>Glucose and glycogen metabolism</td>
<td>Lichtenstein</td>
<td>Jaharis 156</td>
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<tr>
<td>September 20</td>
<td>TCA cycle and HMS</td>
<td>Lichtenstein</td>
<td>Jaharis 156</td>
</tr>
<tr>
<td>September 27</td>
<td>Amino acid metabolism/urea cycle</td>
<td>Lichtenstein</td>
<td>Sackler 221</td>
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<tr>
<td>October 4</td>
<td>Protein metabolism</td>
<td>Ausman</td>
<td>Sackler 221</td>
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<tr>
<td>October 11</td>
<td>Fatty acid metabolism/Vitamin reports</td>
<td>Lichtenstein/student presentations</td>
<td>Jaharis 156</td>
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<tr>
<td>October 18</td>
<td>Fatty acid metabolism/Vitamin reports</td>
<td>Lichtenstein/student presentations</td>
<td>Jaharis 156</td>
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<tr>
<td>October 25</td>
<td>Lipoprotein metabolism/Vitamin reports</td>
<td>Lichtenstein/student presentations</td>
<td>Jaharis 156</td>
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<tr>
<td>November 1</td>
<td>Lipoprotein metabolism/Mineral reports</td>
<td>Lichtenstein/student presentations</td>
<td>Jaharis 156</td>
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<tr>
<td>November 8</td>
<td>Applied nutritional biochemistry/Mineral reports</td>
<td>Lichtenstein/student presentations</td>
<td>Jaharis 156</td>
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<tr>
<td>November 15</td>
<td>Applied nutritional biochemistry/Mineral reports</td>
<td>Lichtenstein/student presentations</td>
<td>Jaharis 156</td>
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<tr>
<td>November 22</td>
<td>NO CLASS – Thanksgiving</td>
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<tr>
<td>November 29</td>
<td>Emerging nutrition topics</td>
<td>Student presentations</td>
<td>Jaharis 156</td>
</tr>
<tr>
<td>December 6</td>
<td>Emerging nutrition topics presentations</td>
<td>Student presentations</td>
<td>Jaharis 156</td>
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Course Schedule
(Weekly Readings, Learning Objectives and Assignments)

**September 6th:** Introduction to course, basic nutritional biochemistry concepts
Instructor: Lichtenstein

**Learning Objectives:** Upon completion of this class, students will be able to:
- Discuss course goals, structure and assignments
- Review basic concepts of the intersection between *biochemistry and nutrition*
- Review definitions for essential and conditionally essential nutrients, non-nutritive dietary components
- Discuss major metabolic control mechanisms

**Required Readings:** Posted on CANVAS

**September 13th:** Glucose and Glycogen Metabolism
Instructor: Lichtenstein

**Learning Objectives:** Upon completion of this class, students will be able to:
- Discuss needs of different organs for glucose
- Discuss glycogen metabolism
- Discuss glucose metabolism
- Discuss integration of monosaccharides other than glucose into intermediary metabolism
- Discuss capacity of cells for anaerobic glycolysis
- Explore relationship between glycolysis and gluconeogenesis

**Required Readings:** Posted on CANVAS, recent research articles related to lecture topic, identified by instructor.

**September 20th:** Tricarboxylic Acid Cycle (TCA) and Hexose Monophosphate Shunt (HMS)
Instructor: Lichtenstein

**Learning Objectives:** Upon completion of this class, students will be able to:
- List contributions of the pentose phosphate pathway to intermediary metabolism
- Describe the role of the TCA cycle to intermediary metabolism
- List sources of acetyl CoA for the TCA cycle
- List cofactors for the pyruvate dehydrogenase complex and pyruvate carboxylase
• Explain why electron shuttles are a critical component of intermediary metabolism

**Required Readings:** Posted on CANVAS, recent research articles related to lecture topic, identified by instructor.

**September 27th:** Amino acid metabolism/urea metabolism  
Instructor: Lichtenstein

**Learning Objectives:** Upon completion of this class, students will be able to:
• List the major functions of protein in the human body
• Review the definitions for essential/indispensable amino acids and conditionally indispensable amino acids
• Describe the metabolic difference between glucogenic and ketogenic amino acids
• Summarize the major fates of the α-keto acids of dietary amino acids
• Describe the relationship between the urea cycle and the TCA cycle

**Required Readings:** Posted on CANVAS, recent research articles related to lecture topic, identified by instructor.

**October 4th:** Protein Metabolism  
Instructor: Ausman

**Protein – Dr. Ausman**
• Summarize the current food environment in terms of dietary protein
• Discuss protein metabolism
• Review approaches used to estimate protein requirements
• Relate dietary patterns to protein status

**Required Readings:** Posted on CANVAS, recent research articles related to lecture topic, identified by instructor.

**October 11th, October 18th and October 25th:** Fatty Acid Metabolism/Vitamin Reports*  
Instructor: Lichtenstein/Student Presenters

**Learning Objectives:** Upon completion of this class, students will be able to:
• List the major functions of fat in the human body
• Describe the basic steps of fatty acid oxidation
• Describe the basic steps of fatty acid synthesis
• Describe the relationship between the fatty acid, amino acid and carbohydrate metabolism
• Describe the metabolism of ketone bodies
• Discuss phospholipid, triglyceride and cholesterol biosynthesis, and essential fatty acids

**Required Readings:** Posted on CANVAS, recent research articles related to lecture topic, identified by instructor and vitamin articles, identified by students.

*Refer to pages 8-10 for instructions on content and formatting for all written reports and oral presentations

**November 1st, November 8th, and November 15th:** Lipoprotein Metabolism/Minerals Reports*
Instructor: Lichtenstein/Student Presenters

**Learning Objectives:** Upon completion of this class, students will be able to:
• Discuss the difference among lipoprotein particles in terms of composition and function
• Described metabolism of lipoprotein particles
• Describe the relationship of lipoprotein particles to the development of atherosclerosis

**Required Readings:** Posted on CANVAS, recent research articles related to lecture topic, identified by instructor and vitamin and mineral articles, identified by students.

*Refer to pages 8-10 for instructions on content and formatting for all written reports and oral presentations

**November 29th and December 6th:** Emerging Topics in the Field of Nutrition
Instructor: Lichtenstein/Student Presenters *

**Learning Objectives:** Upon completion of this class, students will be able to:
• Expand awareness of emerging topics in the field of nutrition
• Discuss controversial issues related to the topics with fellow students.

**Required Readings:** Selected research article identified by student, posted on CANVAS.

*Refer to pages 8-10 for instructions on content and formatting for all written reports and oral presentations
Assignments:

**Weekly discussion of timely nutrient related issues:**
Students will be responsible for identifying and providing a very brief description of news reports that have appeared in lay venues during the week prior to the class meeting. If the report refers to a recently published article that is accessible students are encouraged to comment on the accurately of the news report relative to the publication. The expectation is each student will have identified at least one news report most weeks. No written report is required.

**Weekly assigned articles:**
Articles will be assigned by the instructor and posted in CANVAS. Each student should be prepared to present a brief summation of the article during class and submit a written critique (approximately 1 single typed page, 1 inch margins, 12 pt font, WORD document [suggested length, not strict limit]) addressing the following points (points may be modified at the discretion of the student depending on nature of the specific paper). The material can be presented as text or bullet format.

- Hypothesis and context (~1 sentence)
- General study design
- Main finding(s)
- Main discussion point(s) related to the study findings
- General comment on some aspect of the findings or interpretation of findings
- Limitations (if relevant)

*Completed weekly assignments should be submitted via the drop-box on CANVAS by 12 pm (noon) the Tuesday prior to the Thursday class.*

**Vitamin/phytochemical and mineral reports:**
One vitamin or phytochemical and one mineral to be randomly assigned to each student during the second week of the course (final schedule will be posted on CANVAS). For the assigned nutrient each student will;

- Identify a research article focused on the assigned nutrient not less than 1 week prior to the presentation date – to be approved by the instructor. If the approval is sought via email please send a pdf version of the article to the instructor as an attachment. Preference should be given to studies involving human subjects published within the past 12 months, or for some nutrients, the past 24 months.
- Oral presentation (10 minutes [~8 minute presentation, ~2 minutes for questions], timing may be modified based on final student enrollment).
- Written report (up to 4 pages, double spaced, 1 inch margins, 12 pt font, citations not included in page count).

*Oral report should contain the following sections;*

- **Very short** opening statement about essential functions/purposed effects
• Prevalent types/forms of supplements commercially available, and their cost per dose.
• Examples of web-based or print-based claims about the nutrient.
• Brief critique of the research article, with specific emphasis on how the new findings relate to current knowledge about the nutrient.

Written report should contain the following sections;
• Brief description of essential functions/purported effects and food sources.
• Prevalent types/forms of supplements commercially available and their cost per dose.
• Examples of web-based or print-based claims about the nutrient.
• Brief critique of the research article, with specific emphasis on how the new findings relate to current knowledge about the nutrient.

Written report, as a WORD file, should be submitted via the drop-box in CANVAS by 9 am the day of the presentation. Please include your last name in the file title.

Emerging Topic in the Field of Nutrition
• Identify a controversial or emerging topic in the field of nutritional biochemistry that has appeared in both the scientific literature and lay arena within the past 12 months. Discuss with instructor and obtain prior approval of topic.
• Oral presentation (12.5 minutes [~10 minute presentation, ~2.5 minutes for questions], timing subject to change depending on final student enrollment).
• Written report (~6 pages, double spaced, 1 inch margins, 12 pt font, citations not included in page count).

Oral report should contain the following elements;
• Brief survey of the topic, both in the scientific literature and lay arena.
• Summary of the current issues associated with the topic.
• Indication how the basic science data supports or does not support the reports intended for the lay audience.

Written report should contain the following elements;
• Brief survey of the topic, in both the scientific literature and lay arena.
• Summary of the current issues associated with the topic.
• Indication of how the basic science data supports or does not support reports intended for the lay audience.

Report, as a WORD file, should be submitted via the drop-box on CANVAS by 9 am the day of the presentation. Please include your last name in the file title.

Citation format for all reports/critiques
• Citation format should correspond to that specified by the American Journal of Clinical Nutrition (Hellerstein MK, Schwarz JM, Neese RA. Regulation of hepatic de novo lipogenesis in humans. Am J Clin Nutr 1996;16:523–57).
• In text identify references by numerals in parenthese (1), not by superscript.
• Insert reference to citations within report and list all citations at the end of the report.
• Please note, use only primary peer reviewed material for factual citations. Avoid textbooks because they tend to be dated. Because web-based material is not always peer reviewed or updated in a timely fashion it is not considered a primary source, even from government or health advocacy websites.

**General tips for written reports**
• Review instructions before you start.
• Obtain approval for research article and topic well in advance of the due date.
• Use subheadings as an organizational structure for the written report.
• Review citation formatting requirements before starting your report.

**General tips for oral presentations**
• Choose a font size that can be read from the back of the room.
• Choose background and font colors that allow viewers to easily read each slide.
• Use a consistent format and font throughout the presentation.
• Avoid crowding slides with too much information. On slides, less is more.