Friedman School Course Syllabus
APPLIED NUTRITIONAL BIOCHEMISTRY
Fall, 2016

Time and location of the course: 9:00 AM – 12:00 PM, Thursday, Jaharis – room 156

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
Maura Walker (E-mail: Maura.Walker@tufts.edu)

Tufts Graduate Credit: 1 credit

Prerequisites: NUTR 201 or 202 and one undergraduate level biochemistry course taken within the past five years.

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 biochemistry and nutrition, and ways in which one informs the other. Opportunities will be available to gain experience in delivering short oral presentations and writing reports. Current challenges in the field of nutrition will be related to the lecture material.

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.
- Assess the relationship between new research findings and news 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 nutrient 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 lecture material – 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 discussions 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>20%</td>
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<tr>
<td>Oral presentation and written vitamin report.</td>
<td>25%</td>
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<tr>
<td>Oral presentation and written mineral report.</td>
<td>25%</td>
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<tr>
<td>Oral presentation and written critique of emerging nutrition topic.</td>
<td>30%</td>
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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 of 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 and texting during class: E-mailing and texting during class will be considered an indication of disinterest and disengagement with the course material and this will be reflected in the credit given for class discussion.

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 TRUNK.

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.
<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
<th>LECTURER(S)</th>
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| September 8 | Introduction to course  
Basic nutritional biochemistry concepts | Lichtenstein                          |
| September 15 | Glucose and glycogen metabolism                                      | Lichtenstein¹                         |
| September 22 | TCA cycle and HMS                                                    | Lichtenstein                          |
| September 29 | Amino acid metabolism/urea cycle                                     | Lichtenstein                          |
| October 6   | Protein metabolism                                                   | Ausman                                |
| October 13  | Fatty acid metabolism/Vitamin reports                                | Lichtenstein/student presentations    |
| October 20  | Fatty acid metabolism/Vitamin reports                                | Lichtenstein/student presentations    |
| October 27  | Lipoprotein metabolism/Vitamin reports                               | Lichtenstein/student presentations    |
| November 3  | Lipoprotein metabolism/Vitamin and Mineral reports                    | Lichtenstein/student presentations    |
| November 10 | Applied nutritional biochemistry/Mineral reports                     | Lichtenstein/student presentations    |
| November 17 | Applied nutritional biochemistry/Mineral reports                     | Lichtenstein/student presentations    |
| November 24 | NO CLASS – Thanksgiving                                              |                                       |
| December 1  | Emerging nutrition topics                                            | Student presentations                 |
| December 8  | Emerging nutrition topics presentations                              | Student presentations                 |

¹ Assignments will be made in class, manuscripts will be posted on TRUNK.

This schedule is subject to modifications at the discretion of the instructor.
# Course Schedule

*(Weekly Readings, Learning Objectives and Assignments)*

**September 8th:** Introduction to course, basic nutritional biochemistry concepts  
Instructor: Lichtenstein

<table>
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<tr>
<th><strong>Learning Objectives:</strong> Upon completion of this class, students will be able to:</th>
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<tr>
<td>• Discuss course goals, structure and assignments</td>
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<tr>
<td>• Review basic concepts of the intersection between <em>biochemistry and nutrition</em></td>
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<td>• Review definitions for essential and conditionally essential nutrients, non-nutritive dietary components</td>
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<td>• Discuss major metabolic control mechanisms</td>
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| **Required Readings:** Posted on TRUNK |

**September 15th:** Glucose and Glycogen Metabolism  
Instructor: Lichtenstein

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<th><strong>Learning Objectives:</strong> Upon completion of this class, students will be able to:</th>
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<tr>
<td>• Discuss needs of different organs for glucose</td>
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<td>• Discuss glycogen metabolism</td>
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<td>• Discuss glucose metabolism</td>
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<tr>
<td>• Discuss integration of monosaccharides other than glucose into intermediary metabolism</td>
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<td>• Discuss capacity of cells for anaerobic glycolysis</td>
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<td>• Explore relationship between glycolysis and gluconeogenesis</td>
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| **Required Readings:** Posted on TRUNK, recent research articles related to lecture topic, identified by instructor. |

**September 22nd:** Tricarboxylic Acid Cycle (TCA) and Hexose Monophosphate Shunt (HMS)  
/Vitamin Reports  
Instructor: Lichtenstein

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

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

### September 29th: 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 TRUNK, recent research articles related to lecture topic, identified by instructor.

### October 6th: 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 TRUNK, recent research articles related to lecture topic, identified by instructor.

### October 13th, October 20th and October 27th: Fatty Acid Metabolism/Vitamin and Mineral 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 TRUNK, recent research articles related to lecture topic, identified by instructor and vitamin articles, identified by students.

**November 3rd, November 10th, and November 17th:** Lipoprotein Metabolism/Vitamin and 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 TRUNK, recent research articles related to lecture topic, identified by instructor and vitamin and mineral articles, identified by students.

**December 1st and December 8th:** 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 TRUNK.
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 a news report most weeks. No written report is required.

Weekly assigned articles:
Articles will be assigned by the instructor and posted in TRUNK. Each student should be prepared to present a brief summation of the article during class and submit a written critique (~ 1 single typed page, 1 inch margins, 12 pt font, WORD document) addressing the following points (points may be modified depending on the specific paper). The material can be presented as text or bullet format.

- Central thesis of article
- 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 assignments should be submitted via the drop-box on TRUNK 24-hours prior to the scheduled presentation and contain your last name in the file title.

Vitamin and mineral reports:
One vitamin and one mineral to be assigned to each student during the second week of the course (final schedule will be posted on TRUNK). For the assigned nutrient students 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 (20 minutes [~15 minute presentation, ~5 minutes for questions], timing subject to change depending on final student enrollment).
- Written report (2-3 pages, double spaced, 1 inch margins, 12 pt font, citations not included in page count).

Oral and written reports should contain the following sections;

- Brief description of the nutrient’s basic functions and food sources.
- Prevalent types/forms of supplements commercially available and their dose and cost.
- Examples of web-based or print-based claims about the nutrient, if appropriate.
- 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 on TRUNK 24-hours prior to the scheduled presentation and contain 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 approval.
- Oral presentation (20 minutes [~15 minute presentation, ~5 minutes for questions], timing subject to change depending on final student enrollment).
- Written report (4-5 pages, double spaced, 1 inch margins, 12 pt font, citations not included in page count).
- Report, as a WORD file, should be submitted via the drop-box on TRUNK 24-hours prior to the scheduled presentation and contain your last name in the file title.

**Oral and written reports 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 how the basic science data supports or does not support reports intended for the lay audience.

**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).
- Insert reference to citations within report and list all citations at the end of the report.
- Please note, use only primary peer reviewed or textbook material for factual citations. Because web-based material is not always peer reviewed or updated in a timely fashion it is not considered a primary source.

**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 in the written report.