BIOCHEM/NUTR SCI 510 – *Nutritional Biochemistry and Metabolism*
University of Wisconsin-Madison

Spring Semester 2020
Lectures in nutrition for students with a substantial background in biochemistry. Emphasis on biochemical and physiological fundamentals of nutrition. Discussion of protein, fat, carbohydrate, energy, minerals and vitamins and their roles and interrelationships in nutrition and metabolism.

Instructors: Professor Brian Parks, Professor David Eide (course director)
Credits: 3
Instructional Mode: In-Person
Day: MWF **Time:** 8:50 AM – 9:40 AM
Course Attribute: Biological Sciences; LAS Advanced Credit; graduate attribute
Prerequisites: (BMOLCHEM 314 or 503) or (BIOCHEM 501 or 507) or graduate/professional standing

Location: Microbial Sciences 1520

Website (Learn@UW): https://canvas.wisc.edu

COURSE LEARNING OUTCOMES:
After completing this course you will:

Learning Outcome	Level
1. Understand nutrient metabolism in normal and disease states	Undergraduate and Graduate
2. Be able to integrate the regulation of metabolism of nutrients under normal and disease state conditions	Undergraduate and Graduate
3. Understand the biochemical and molecular functions of nutrients we consume	Undergraduate and Graduate
4. Apply how nutrients affect pathogenesis and health.	Graduate Only
5. Be able to think critically about nutrient claims and fads using your knowledge of nutritional biochemistry.	Undergraduate and Graduate
6. Integrate current research in the area of metabolism and micronutrient function into existing knowledge and formulate new hypotheses to guide future research.	Graduate Only

ACEND REQUIREMENT for DIDACTIC PROGRAM IN DIETETICS: This course provides for learning activities to satisfy core knowledge requirement KRDN 3.5: Describe basic concepts of nutritional genomics. The specific learning activity is completion of a Nutritional Genomics Assignment illustrating how personalized modifications in dietary carbohydrate intake may improve glycemic response for patients at genetic risk for diabetes.

REQUIRED TEXT:

Advanced Nutrition & Human Metabolism, 5th ed. Gropper, Smith and Groff. Thomson/Wadsworth (2009).
THE 6TH AND 7TH EDITIONS ARE ALSO ACCEPTABLE BUT NOTE THAT THE ASSIGNED PAGE NUMBERS DIFFER. We will provide page numbers for 6th AND 7th edition readings separately.

Many students find it useful to have available a biochemistry text such as *Biochemistry* by Nelson, Cox and Lehninger.
Lecture powerpoint files will be available on the course website prior to lectures.

MP3 audio recordings of the lectures will be posted on the website after the lectures.

GRADING POLICY:

Point Distribution for Undergraduate Students		Grade Distribution	
100 pts	Exam 1	A	90% and above
100 pts	Exam 2	AB	88-89%
100 pts	Exam 3	B	80-87%
100 pts	Exam 4	BC	78-79%
125 pts	Final Exam	C	70-77%
60 pts	Quizzes (3)	D	61-69%
20 pts	Take Home Assignment	F	< 61%

Exam points, quiz points, and take-home assignment points are weighted equally. Exams will be held in class and worth 100 points each. Make-up exams are only given with prior notification and permission from Prof. Eide or Parks; we reserve the right to request written documentation of the absence reason. Exam regrades are permissible within 2 weeks of an exam/quiz but the entire exam/quiz will be regraded (exception: math errors made by the instructors will be corrected without regrading). The final exam will be worth 125 points and will be cumulative.

Exam	Covers (approx.)	Given
1	Sept 4 – Sept 27	Wednesday, Oct 2
2	Sept 30 – Oct 18	Wednesday, Oct 23
3	Oct 21 – Nov 11	Friday, Nov 15
4	Nov 13 – Dec 4	Friday, Dec 6
Final	~80% on material from Exams 1-4, ~20% on material from Dec 9 – Dec 11	

QUIZZES: Three announced quizzes (20 pts each) will be given and they will cover glycolysis, the TCA cycle, and redox concepts. There are no make-up quizzes without prior arrangement with the faculty.

TAKE HOME ASSIGNEMENT ON NUTRITIONAL GENOMICS (20 pts): One assignment will be given based on the following paper: *Personalized Nutrition by Prediction of Glycemic Responses, Zeevie D. et. al. Cell. 2015 Nov 19.* The assignment will consist of 10 short answer questions about the article. The assignment must be turned in class on March 15

ASSUMED KNOWLEDGE: An introductory biochemistry course is a REQUIRED prerequisite for enrollment in NS/Biochem 510 and the instructors expect you to already have a working knowledge of biochemical pathways and structures. You'll need to review/remember the following: glycolysis, the TCA cycle, the electron transport system, and the urea cycle. The emphasis of the course is on INTEGRATION of knowledge you have acquired in this and previous courses.

ATTENDANCE: We do not take attendance. However, you are expected to prepare for, attend, and participate fully in all lectures and you are responsible for obtaining material from any missed lectures. It is our experience that regular attendance is a good predictor of success in this course due to the volume and complexity of the material that we cover.

CREDIT HOUR POLICY: This class meets for three 50-minute class period each week over the spring semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc) for about 2 hours out of classroom for every class period. The syllabus includes additional information about meeting times and expectations for student work.

GRADUATE ATTRIBUTE: Graduate students will be assigned 4 research papers during the course of the semester that are related to the lecture material and will be required to provide written answers to questions posed by the instructors. Each assignment will be worth 20 points each totaling and addition 80 points to be factored into the final grade. Feedback will be provided in written form.

Point Distribution for Graduate Students

100 pts	Exam 1
100 pts	Exam 2
100 pts	Exam 3
100 pts	Exam 4
125 pts	Final Exam
60 pts	Quizzes (3)
20 pts	Take Home Assignment
20 pts	Research paper 1
20 pts	Research paper 2
20 pts	Research paper 3
20 pts	Research paper 4

Grade Distribution

A	90% and above
AB	88-89%
B	80-87%
BC	78-79%
C	70-77%
D	61-69%
F	< 61%

CONTACT INFORMATION:

Dr. Brian Parks (262-3445)
340C Nutritional Sciences
brian.w.parks@wisc.edu

Dr. David Eide (263-1613), Course Director
340B Nutritional Sciences
deide@wisc.edu

Lecture schedule

Week	Date	Topic	Assigned Reading (6th ed)
1	9/4	Digestion I: The gastrointestinal tract (Parks)	pp. 33-54
	9/6	Digestion II: Nutrient absorption and diseases of digestion (Parks)	pp. 59-61
	9/9	CHO 1: Intro to Metabolism; CHO structures; CHO digestion; Absorption; (Parks)	pp. 251-254, 63-78
2	9/11	CHO 2: Glycolysis; TCA Cycle; [**In class quiz on glycolysis**] (Parks)	pp. 78-90
	9/13	CHO 3: Gluconeogenesis; Other key pathways; Regulation of metabolism; (Parks)	pp. 95-99
	9/16	CHO 4: Regulation of CHO metabolism; [**In class quiz/TCA cycle**] (Parks)	pp. 99-104
3	9/18	Lipid 1: Lipid structures; Fatty acid synthesis; (Parks)	pp. 131-134,161-6
	9/20	Lipid 2: Fatty Acid oxidation; Other key pathways; (Parks)	pp. 157-161
	9/23	Lipid 3: Lipid structures; Digestion and Lipid Absorption (Parks)	pp. 131-44
4	9/25	Lipid 4: Lipoprotein metabolism (Parks)	pp. 144-57
	9/27	Lipid 5: Lipid metabolism & Heart Disease (Parks)	pp. 157-70
	9/30	Protein 1: Amino acids; Digestion; Transport; General reactions of amino acids (Parks)	pp. 179-194
	10/2	**EXAM 1 (through Lipid 5; 11 lectures)**	**--**
	10/4	Protein 2: AA uptake; AA catabolism; Plasma AA; Urea cycle and Regulation (Parks)	pp. 208-226
	10/7	Metabolism 1: Overview/review of metabolism (Parks)	pp. 251-256
6	10/9	Metabolism 2: Fed-Fast Cycle/Starvation (Parks)	pp. 256-61
	10/11	Metabolism 3: Integration of Metabolism/Endocrinology (Parks)	pp. 261-63
	10/14	Metabolism 4: Cellular regulators of metabolism (Parks)	--
7	10/16	Metabolism 5: Loss of Metabolic Integration/Diabetes (Parks)	pp. 264-65, 276-77
	10/18	Metabolism 6: Obesity & Nutritional Genomics (Parks) **Take home assignment on Nutritional Genomics (Due Nov 4)**	--
	10/21	Intro to Vitamins and energy metabolism: Acyl/acetyl transfers (pantothenate) (Eide)	pp. 309-11, 338-42
8	**10/23**	**EXAM 2 (Protein 1 through Metabolism 6; 8 lectures)**	**--**
	10/25	no class	
	10/28	Vitamins and energy metabolism 2: Redox cofactors (niacin, riboflavin) (Eide)	pp. 329-38
9	10/30	Vitamins and energy metabolism 3: Niacin and alcohol metabolism (Eide)	pp. 170-3
	11/1	Vitamins and energy metabolism 4: Decarboxylations (thiamin) (Eide)	pp. 323-8
	11/4	Vitamins and energy metabolism 5: Carboxylations (biotin) (Eide) **Take home Assignment Due**	pp. 342-8
10	11/6	Vitamins and energy metabolism 6: Decarboxylations, trans- & deaminations (pyridoxine)	pp. 364-9
	11/8	Vitamins and blood function 1: 1-carbon transfer reactions (folate) (Eide)	pp. 348-57
	11/11	Vitamins and blood function 2: 1-carbon transfer reactions (B12) (Eide)	pp. 358-63
11	**11/13**	Vitamins and blood function 3: blood clotting (Vitamin K) (Eide)	pp. 409-16
	11/15	**EXAM 3 (Energy metabolism 1 through B12; 8 lectures)**	**--**
	11/18	Antioxidant nutrients 1: Overview (Eide)	pp. 417-25
12	11/20	Antioxidant nutrients 2: Vitamin E and carotenoids [**in class quiz on redox concepts**] (Eide)	pp. 401-8
	11/22	Antioxidant nutrients 3: Vitamin C and Se (Eide)	pp. 311-21,506-12
	11/25	Metal nutrients 1: Fe Part I (Eide)	pp. 470-87
13	11/27	Metal nutrients 2: Fe Part II (Eide)	pp. 470-87
	11/29	Thanksgiving break	
	12/2	Metal nutrients 3: Cu (Eide)	pp. 488-505
14	12/4	Metal nutrients 4: Zn (Eide)	pp. 488-505
	12/6	**EXAM 4 (Vitamin K through Zn; 8 lectures)**	
	12/9	Nutrients and hormones 1: Vitamin A (Eide)	pp. 373-90

12/11	Nutrients and hormones 2I: Calcium and Vitamin D (Eide)	pp. 392-400, 461-5

12/19 **Final exam 7:45 PM – 9:45 AM** (cumulative, ~80% on Exam 1-4 material, ~20% on new material (2 lectures)