BIOC 5853 – Metabolism – Spring 2019

Instructors:

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Office Hours: By appointment

Classroom Schedule: MWF, 11:30AM – 12:20AM; meets in 248H NRC
Class time will be spent through a combination of lectures by the instructors and open discussions by you and your classmates. Exams will also be held during class time (see below).


Internet Resources:

1. Course Website: Desire2Learn (D2L) https://oc.okstate.edu. Use your okey username and password to access this website. Call 744-HELP if you have a problem.


3. BIOCYC: Pathway and Genome Database http://biocyc.org/

Course Prerequisites: BIOC 5753 or BIOC 4113 or consent of the instructors. You need to refresh on your organic chemistry, amino acids, protein structures, and enzyme kinetics. This course is intended for graduate students in biochemistry or related disciplines.

Course Description: Reaction sequences and cycles in the enzymatic transformations of fats, proteins, and carbohydrates; energy transfer, biosynthesis, and integration in the metabolic pathways.
Learning Objectives:

1. You will develop an appreciation for the processes that fuel life. You will gain an understanding of the mechanism and chemical logic of some of the underlying principles and reactions in metabolism. Topics will include the most important reaction pathways that are shared in microbial, plant, and animal systems. We certainly will not cover every pathway or detail in metabolism in this course.

2. You should be able to extrapolate knowledge that is presented in lectures, discussions, and the textbook. This does not mean that you must memorize every bit of information, but rather that you should understand the underlying logic of metabolism so that you can solve related problems.

3. More generally, this course aims to prepare you to be a scientist. As a graduate student, you will develop skills in seeking more advanced information in the scientific literature and in your own lab work. For this course, this means that you should be able to appreciate the experimental foundations of metabolism. You should be able to critically assess the limits of this knowledge, and to creatively think about how you could gain further information through new experimentation. Finally, it is vital that you can communicate your own thoughts effectively, both in written and oral forms.

4. To stimulate your growth as a scientist, this course will not simply present an advanced version of undergraduate metabolism. Rather, we will try to help you see how difficult it is to understand metabolism and how many issues remain unsolved. We will use research papers to illustrate trends in current biochemical approaches designed to improve our understanding of metabolism. We will also discuss current concepts and approaches of synthetic biology (how metabolism can be engineered to make artificial cells for human benefits).

Course Outline: (Instructors reserve the right to make schedule changes at any time during course)


1. Introduction (Chapter 16)
   A. General Concepts of Metabolism: Overall metabolic processes in nature
   B. Roles of Thermodynamics and Kinetics in Metabolism
   C. Roles of cofactors acting as co-enzymes or as substrates (Vitamins/NAD/ATP ..)
   D. Roles of Gene Expression, Covalent Modifications and Allosteric Interactions
   E. Hormones, Signal Transduction Pathways and the regulation of metabolism (Chapter 19): short and long term effects
   F. Case studies: Insulin, glucagon and β-adrenergic receptors and associated signal transduction pathways.
   G. Experimental Approaches to Study Metabolism

2. Glycolysis (Chapter 17), Pentose Phosphate Pathway and Gluconeogenesis (Chapter 23)
   A. Reactions of Glycolysis
   B. Tissue Dependent Differences in Glucose Transporters, Hormonal Receptors and Glycolytic Enzymes
   C. Regulation of Glycolysis in erythrocytes, liver and muscle
   D. Gluconeogenesis: Reactions, Substrates and Regulation
   E. Pentose Phosphate Pathway (PPP): Reactions, Roles in Different Tissues
   F. Regulation of Glucose Metabolism in: 1) Feeding, Fasting and Starvation; 2) Diabetes
   G. Metabolism of Other Sugars
   H. 1) Roles of transporters (GLUT-4), enzymes (Hexokinases); Insulin, glucagon and epinephrine signaling and the metabolism of glucose; 2) Effect of ethanol on gluconeogenesis; 3) Role of Carbohydrate Element Binding protein in glucose metabolism.
3. Glycogen Metabolism (Chapter 18)
   A. Breakdown
   B. Synthesis
   C. Differences between Liver and Muscle
   D. Interactions between Glycogenolytic, Glycolytic and Gluconeogenic Pathways
   E. Case Studies: Diseases linked to glycogen metabolism

4. Integration of Metabolism: Chapter 27: Metabolic Regulation at the Organismal Level
   A. Organs (Brain, Muscle, Liver, Kidney)
   B. Case studies: Metabolism during Fed, Fasted and Starved States, 2) Diabetes, 3) Alcoholism

5. **Exam 1 (Chapters 16-19, 23, 27) Feb 13, 2019**

Part 2: Feb 15-March 15; Instructor: Robert Matts

6. Citric Acid Cycle (Chapter 21)
   A. Reactions
   B. Metabolic Sources of Acetyl-CoA
   C. Enzyme Mechanisms
   D. Regulation

7. Lipid Metabolism (Chapter 25)
   A. Fatty Acid Oxidation
   B. Fatty Acid Synthesis
   C. Cholesterol Metabolism
   D. Phospholipid and Glycolipid Metabolism

8. Amino Acid Metabolism (Chapter 26)
   A. Amino Acid Deamination
   B. Urea Cycle
   C. Amino Acid Synthesis
   D. Nitrogen Fixation

9. Nucleotide Metabolism (Chapter 28)
   A. Purine Synthesis
   B. Pyrimidine Synthesis
   C. Nucleotide Degradation
   D. Synthesis of Nucleotide Coenzymes

10. Current Research Topics in Metabolism
    A. Systems Biology
    B. Synthetic Biology

11. **Exam 2 March 25th**
12. Membrane Transport (Chapter 20)
   A. Passive Transporters
   B. Ion Channels and Ionophores
   C. ATP Driven Active Transporters
   D. Secondary (Coupled) Transporters
   E. Neurotransmission

13. Oxidative Phosphorylation (Chapter 22)
   A. Mitochondria (Anatomy and Transport Systems)
   B. Enzymes of Electron Transport
   C. ATP Synthesis

14. Photosynthesis (Chapter 24)
   A. Chloroplasts
   B. Light Reactions
   C. Dark Reactions

15. Exam 3 April 26, 2019

16. Pre-Finals Week (April 29-May 3)

17. Final Exam (Cumulative; Wednesday May 8th at 10:00-11:50AM)

Exams: You will be tested on material discussed in class. The book chapters mentioned above are important but only a partial reference of the materials that will be discussed. Additional material will also come from the research and review papers covered in class or assigned (non-graded homework problems).

The final exam will include all material covered in class. In addition, this exam may also include general material from current research topics (systems and synthetic biology) and from the student presentations.

Grading Scheme: All sections of the course have similar weights. The final exam represents 33% of the course grade.

You must earn at least 80% of the points to make an A
   at least 70% of the points to make a B
   at least 55% of the points to make a C.
OKLAHOMA STATE UNIVERSITY
SYLLABUS ATTACHMENT
Spring 2019
http://academicaffairs.okstate.edu

YOUR SUCCESS AS A STUDENT IS OUR TOP PRIORITY.

THIS INFORMATION IS PROVIDED TO ANSWER QUESTIONS MOST OFTEN ASKED BY STUDENTS.

IMPORTANT DATES

Last day to add a class (without instructor permission) 1/22/2019
Last day to drop a course with no grade and 100% refund 1/22/2019
Last day to add a class (requires instructor & advisor permission) 1/25/2019
Last day to drop a course or withdraw from the University with an automatic “W” and receive a partial refund (requires advisor signature) 1/25/2019
Last day to post 6 week grades 2/27/2019
Last day to drop a course or withdraw from the University with an automatic “W” 4/12/2019
Last day to drop a class or withdraw from the University with an assigned grade of “W” or “F” 4/26/2019
Final examinations 5/6/2019-5/10/2019
Final grades due from faculty 5/15/2019

Note: Outreach, Internet, and short courses have unique drop/add and refund deadlines; lookup the specific deadlines for these courses on the Short, Internet, and Outreach Class Schedules page of the Registrar’s website http://registrar.okstate.edu/SIO-Schedule.

Fall Semester Holidays

University Holiday 1/21/2019
Student’s Spring Break 3/18/2019-3/22/2019

DROPPING A COURSE AND WITHDRAWING FROM THE UNIVERSITY. students often confuse these terms.

Dropping a Course (or courses) may occur during the first twelve weeks of the semester. This means, however, that you are still enrolled in at least one other OSU course. Exceptions to the deadlines above may only be considered by petition due to documented extraordinary circumstances and committee approval. The Retroactive Drop/Withdraw Petition and the Petition for a Refund of Tuition and Fees forms are available on the Registrar’s website http://registrar.okstate.edu/Forms.

Withdrawing from the university means dropping all courses and you are no longer enrolled for the current semester. This may occur until the Friday before pre-finals week. The withdrawal process is initiated with your academic advisor. For additional information and dates, go to: http://academicaffairs.okstate.edu/content/adding-dropping-and-withdrawing-courses.

ALERTS AND RESCHEDULING

If the OSU campus officially closes due to inclement weather or other emergencies, alerts are provided to local news media and posted on the OSU website. Missed exams, classes, or assignments may be rescheduled at times outside the normal meeting schedule. If valid, documented circumstances prohibit students from attending the rescheduled classes, instructors should provide reasonable alternative means for makeup.

SEEK ANSWERS TO YOUR QUESTIONS

The OSU faculty and staff want you to be successful in your educational pursuits. If you have questions or concerns, seek help EARLY. We are here to assist you.

ACADEMIC INTEGRITY

101 Whitehurst/405-744-3627 http://academicintegrity.okstate.edu

OSU is committed to maintaining the highest standards of integrity and ethical conduct. This level of ethical behavior and integrity will be maintained in this course. Participating in a behavior that violates academic integrity (e.g., unauthorized collaboration, plagiarism, multiple submissions, cheating on examinations, fabricating information, helping another person cheat, unauthorized advance access to examinations, altering or destroying the work of others, and altering academic records) will result in an official academic sanction. Violations may subject you to disciplinary action including the following: receiving a failing grade on an assignment, examination or course, receiving a notation of a violation of academic integrity on your transcript, and being suspended from the University. You have the right to appeal the charge.

COPYRIGHT & FAIR USE POLICY OF COURSE MATERIALS

Course materials may not be published, leased, sold to others, or used for any purpose other than appropriate OSU-related individual or group study without the written permission of the faculty member in charge of the course and other copyright holders. This paragraph grants you a limited license
By enrolling at Oklahoma State University, you accept responsibility for complying with all University policies and contracts, and for local, state and federal laws on- or off-campus that relate to the University’s mission. The Student Code of Conduct educates students about their civic and social
responsibilities including policies and procedures involving student misconduct.

In general, the University expects students to aspire to follow and promote the Cowboy Community Standards or integrity, community, social justice, respect, and responsibility.

EDMON LOW LIBRARY HOURS  www.library.okstate.edu
405-744-9775 or 405-744-9741  Text 405-592-4128
Sunday  Opens at 9:00 AM
Monday-Thursday  Open 24 hours
Friday  Closes at 10:00 PM
Saturday  9:00 AM-10:00 PM
*For holiday and intersession hours, check http://library.okstate.edu/about/hours

*Contact the following for information on hours of operation:
  Architecture Library  405-744-6047
  Curriculum Materials Library  405-744-6310
  Veterinary Medicine Library  405-744-6655

WHERE TO GO FOR HELP

Academic Related Services

Instructor - If you have questions regarding your class, talk to your instructor. Faculty members usually include their office hours and/or phone number in the class syllabus. If you cannot locate this information, set a time to meet with your instructor by speaking with him/her prior to or immediately following your class session or check with the departmental office on when the instructor may be available.

Academic Advisor - All students will benefit by conferring with an advisor on a regular basis. If you do not know your advisor or would like to learn more, talk to the Student Academic Services Director for your college.

Bursar
113 Student Union/405-744-5993
http://bursar.okstate.edu/
The Bursar Office bills and collects tuition, fees, campus housing, and other university related charges. The Bursar Office also processes and disburses all federal and campus-based funds to students’ bursar accounts and refunds any overpayments on students’ bursar accounts.

Career Services
360 Student Union/405-744-5253
http://hireosugrads.com

Concurrent Student Services and Advising
University College/040 Student Union/405-744-1389
http://universitycollege.okstate.edu/concurrent/index.html
Find out about academic services for concurrent students or to schedule your next advising appointment.

Foreign Language Placement Test
206 Gunderson Hall/405-744-9547
http://languages.okstate.edu/
Students with prior foreign language experience in French, German, or Spanish who take the placement exam and then score a ‘B’ or higher in a more advanced class, will get up to 6 credit hours for the classes below it. Schedule your free test by emailing Nick Howland at nick.howland@okstate.edu.

Multicultural Affairs
240 Student Union/405-744-5481
http://oma.okstate.edu/
Academic, career, and personal success programs are available. Student organizations representing diverse communities and annual events are offered.

Pre-Professional Student Services
University College/040 Student Union/405-744-1389
http://universitycollege.okstate.edu/
Pre-professional services for students from any major on campus, including coordination of contacts with health care professional schools and
student interview processes.

Registrar
322 Student Union/405-744-6876
http://registrar.okstate.edu/
The Registrar’s Office provides services related to the creation and maintenance of student academic records, including assisting students with enrollment, official transcript requests, degree and enrollment verification, updating personal information in the Student Information System, graduation, and other services.

Scholarships & Financial Aid
119 Student Union/405-744-6604
http://financialaid.okstate.edu
Over 80 percent of Oklahoma State University students received scholarships, grants, work, and low-interest loans totaling over $320 million last year. Contact the Office of Scholarships & Financial Aid to apply for financial aid or to meet with a financial aid counselor.

Transfer Students Services
University College/104 North Classroom Building/405-744-1392
http://universitycollege.okstate.edu/transfer/index.html
This office provides undergraduate transfer students with a seamless transition to OSU by collaborating with various departments on campus, including the Undergraduate Admissions, the LASSO Center, the Registrar’s Office, and Scholarships & Financial Aid.

University Assessment and Testing
107 University Assessment and Testing Building/405-744-5958
http://uat.okstate.edu/
Campus and national tests as well as testing accommodations are provided.

Veteran Benefit Services
322 Student Union/405-744-6343
http://registrar.okstate.edu/Veteran-Benefit-Services
This office provides information and assistance in completing the appropriate forms to apply for educational benefits through the U.S. Department of Veterans Affairs and through the State of Oklahoma.

Veteran Student Academic Services
University College/104 North Classroom Building/405-744-1390
http://universitycollege.okstate.edu/veteran/index.html
This office works with veteran and military-affiliated students to aid in their transition from military service to successful careers by ensuring they succeed academically through coordination of support services from both on- and off-campus entities.

Health Related Services

Counseling Psychology Clinic
107 Public Information Office/405-744-6980
https://education.okstate.edu/cpsy/clinic
Faculty and graduate students offer high quality and cost efficient psychological and mental health services to students Monday through Friday.

University Counseling Services
320 Student Union/405-744-5458
http://www.okstate.edu/ucs/
Services include personal counseling, the Alcohol & Substance Abuse Center, and stress management through the Reboot Center.

University Health Services
1202 W. Farm Road/405-744-7665
http://uhs.okstate.edu/
An allergy clinic, lab services, x-ray, travel clinic, women’s clinic and pharmacy are among the services offered at this campus outpatient medical clinic.

Wellness Department
405-744-5510
http://wellness.okstate.edu/
Intramurals, group fitness and sports clubs are among the many programs and services available through the Wellness Department.
Campus Life Related Services

Fraternity & Sorority Affairs
211J Student Union/405-744-5490
http://gogreek.okstate.edu/
For questions and comments about Greek life opportunities, contact Fraternity and Sorority Affairs.

Housing & Residential Life
100 Iba Hall/405-744-5592
http://reslife.okstate.edu
For questions and comments about housing and residential life, contact the Housing administration office.

Leadership and Campus Life
211 Student Union/405-744-5488
http://lcl.okstate.edu
Get involved through student organizations; the Center for Ethical Leadership; International Students & Scholars; Non-traditional Student Services; and Parent & Family Relations.

Service-Learning Volunteer Center
211G Student Union/405-744-5145
http://volunteer.okstate.edu/
Find volunteer opportunities and earn the recognition C.O.R.D. to wear at graduation.

University Dining Services
076 Student Union/405-744-4424
http://dining.okstate.edu/
For questions and comments about meal plans or university dining operations, contact University Dining Services.

ACADEMIC SUPPORT RESOURCES AND TUTORING

Learning and Student Success Opportunity (LASSO) Tutoring Center
021 Classroom Building/405-744-3309
https://lasso.okstate.edu/
LASSO offers free individual and group tutoring for a variety of courses.

Student Academic Services Centers

Agricultural Sciences & Natural Resources
136 Agricultural Hall/405-744-5395
Contact: Dr. Deb VanOverbeke
http://casnr.okstate.edu/students/ssc
Academic support and career guidance resources are available for CASNR students.

Arts & Sciences
213 Life Sciences East/405-744-5658
Contact: Dr. Amy Martindale
http://casstudents.okstate.edu/
Academic support and career guidance resources are available for Arts & Sciences students.

Education, Health & Aviation
106 Willard Hall/405-744-6350
Contact: Ms. Amy Gazaway
http://education.okstate.edu/watson
Academic support, advisement and career counseling is available to all education majors.

Engineering, Architecture & Technology
110 Engineering North/405-744-5276
Contact: Mr. Lance Millis
https://studentservices.okstate.edu/advising
Academic advising and career services are available for all CEAT students. Tutoring is offered for general math, science, and engineering courses.

Human Sciences
101 Human Sciences/405-744-2772
Contact: Ms. Kristi Seuhs
http://humansciences.okstate.edu/current-students
Academic support and career guidance resources are available for Human Sciences students.

**Spears School of Business**  
155 Business Building/405-744-2772  
Contact: Ms. Marissa McIntyre  
http://spears.okstate.edu/ss/  
Academic advisement is provided for freshmen through seniors in all business major areas.

**University College Advising**  
214 Student Union/405-744-5333  
Contact: Ms. Missy Wikle  
https://uca.okstate.edu/  
University College Advising has academic advisors to help with your academic needs, whether planning your semester schedule, teaching your First-Year Seminar class, looking at degree options, or helping to bridge the gap between student life and academic success. Call or visit the office anytime Monday through Friday, between 8:00 a.m. and 5:00 p.m.

**Discipline Specific Tutoring**

**Academic Development Center**  
Kerr-Drummond Mezzanine/405-744-5905  
http://reslife.ostate.edu/vac  
Tutoring and supplemental instruction are available on select weekday, weekend, and evening hours.

**Accounting**  
416 Business Building/405-744-2863  
Walk-in tutoring is available for ACCT 2103, 2203, and 3103. See https://spears.okstate.edu/accounting/ace/ for hours.

**Biology & Zoology**  
303 Life Sciences West  
http://biol1114.okstate.edu  
Tutoring is provided for BIOL 1114.

**Chemistry**  
453 Physical Science/405-744-9046  
Tutoring for chemistry classes is available.

**Civil & Environmental Engineering**  
315 Engineering South/405-744-9308  
Tutoring for Statistics and Strength of Materials is available. Contact for more information.

**Eta Kappa Nu Electrical and Computer Engineering Honor Society**  
010 Engineering South/405-744-4910  
https://campuslink.okstate.edu/organization/eta-kappa-nu  
Tutoring is provided by Eta Kappa Nu membership for Circuits, Network Analysis, and Electronic Devices.

**The Language Lab**  
206 Gunderson Hall/405-744-9547  
http://languages.okstate.edu  
Two 28-user labs fully equipped with personal computers and listening/recording devices are available. Students may practice vocabulary building and grammar in the target language.

**Graduate Research and Writing Lab**  
Contact: Victor D. Baeza/victor.baeza@okstate.edu/405-744-1241  
http://info.library.okstate.edu/RLS/grads  
Tutoring is available evenings from 5:00 p.m.-8:00 p.m. on Monday and Tuesday for current OSU graduate students.

**History**  
101 S Murray Hall/405-744-5680  
http://history.okstate.edu/contact  
Tutoring is given for Survey of History and upper division courses.

**Mathematics Learning Success Center**  
5th Floor Edmon Low Library/405-744-5818  
http://www.math.okstate.edu/  
Tutors are available to answer questions for classes ranging from Beginning Algebra through Calculus II. Tutoring for Differential Equations and Linear Algebra is offered at specific times.
Writing Outpost
102 Q, R, S Edmon Low/405-744-6671
http://osuwritingcenter.okstate.edu
30-minute walk-in consultations for writing projects are offered on a first come-first served basis on Monday-Thursday evenings 7:00 p.m.-10:00 p.m.

Writing Center
440 Student Union/405-744-6671
http://osuwritingcenter.okstate.edu
The Writing Center helps writers throughout the composing process; plan to visit early and often throughout the semester, not just the day before an assignment is due. Tutors work with students to improve brainstorming, organizational, and composing techniques.

Writing Center West
103 Ag Hall/405-744-6671
http://osuwritingcenter.okstate.edu
30-minute walk-in consultations for writing projects are available Monday-Friday from 11:30 a.m.-2:30 p.m.

FOR MORE INFORMATION

go.okstate.edu/apps
The OState app is your link to campus departments, OSU news, and maps. The Orange Shield app is the official safety app of OSU.

my.okstate.edu
This portal connects students to a wide range of campus services including links to student email, the library, and the Online Classroom and Community (D2L).

For other comments and inquiries, please contact academics@okstate.edu.