

**DEPARTMENT OF BIOCHEMISTRY****BCHM 462 – Metabolism
Fall Semester, 2020****BCHM 462, Syllabus
Course Information, Grading Policy and Class Schedule**

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COURSE OBJECTIVES

A BCHM 462 class includes undergraduate students with an array of future interests including, but not limited to, careers in human medicine, veterinary medicine, pharmacy and pharmacology, and academic research and teaching. This course will provide students with an understanding of core metabolic pathways and how they are regulated. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural and molecular level. We will cover the detailed metabolic pathways include glucose metabolism, oxidative phosphorylation, photosynthesis, Calvin cycle, and metabolism of lipid, amino acids and nucleotides. The students will learn to appreciate a broad and thorough understanding of how the fundamental biochemical pathways regulate cellular metabolism and relate these to medicine, agriculture, and human disease.

LEARNING OUTCOMES

- BCHM 462 students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics.
- BCHM 462 students will be able to describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids.
- BCHM 462 students will understand how energy is harvested and utilized by biological systems.

- BCHM 462 students will demonstrate knowledge of metabolic enzymes, the reactions they catalyze in various pathways and their regulation.
- BCHM 462 students will understand the relationship between catabolic and anabolic pathways, principles of enzyme catalysis and regulation.
- BCHM 462 students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment.

TEXTBOOK

Required Textbook:

This textbook is recommended.

Biochemistry, (8th Edition) 2015 by J. M. Berg , J. L. Tymoczko, G. J. Gatto Jr. & L. Stryer.
 ISBN-13: 978-1-4641-2610-9

Biochemistry, (5th Edition) can be found online at:

<http://www.ncbi.nlm.nih.gov/books/NBK21154/>

LECTURE TIME AND PLACE

T, TH 10:30-11:45 AM, STEW 320

All lectures will be recorded, and will be available for students who miss a class or who would like to review a lecture. They can be downloaded at <http://www.itap.purdue.edu/learning/tools/boilercast/>. It is not the responsibility of the instructor if the lectures are not clear or are not available for technical reasons. This is not a substitute for class and all students are expected to come to class

BRIGHTSPACE

The syllabus for the course, lecture notes, and grading keys for quizzes and exams will be available via the Purdue University Brightspace site at: <https://purdue.brightspace.com>

ASSESSMENT

Grading Policy: The grading for this course will be as follows:

Points Summary

Activity	Points
Midterm Exam I	80
Midterm Exam II	80
Midterm Exam III	80
Midterm Exam IV	60
Quizzes (3 total)	60
Final assignment	20
Total	380
Optional Honors earned extra	20
Optional Extra Credit detailed below	
7 points each for Study Guide 1, 2 3, and 4	28
Lecture questions and Quiz bonus maximum earned	10

Total Extra Credit	38
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The cutoff values for letter grades

Grade	Percent Range
A+	>100.1% (with bonus points)
A	100 – 90.0
B	89.9 - 75.0
C	74.9 - 65.0
D	64.9 – 50.0
F	<50.0

Letter grades may be accompanied by plusses and minuses with cutoffs to be determined at the end of the semester at the sole discretion of the instructor. The exceptions are: no plusses and minuses are given for letter grades of D or F. In no case will a student receive a higher grade than someone with a higher numerical score.

Exams and Quizzes:

There will be **4 quizzes** and **4 exams**. The exams are *not* cumulative, but do ***require an understanding of the prior material.*** The quizzes and exams will cover assigned reading from textbook and any material covered in lectures and discussions. All quizzes and exams 1, 2 and 3 will be held during normal class period. The date and place of the final exam will be announced when scheduled. This final exam will only be given at the University designated time.

You can find a sample of the types of questions for Exam and Quiz at the end of this syllabus.

Missing an exam or quiz will result in a grade of zero being recorded unless a documented and reasonable justification for the absence is presented. If you are too ill to take an exam/quiz or have a valid reason for being absent, you must notify Dr. Gowher's by e-mail/phone **prior to the examination time.** Any request to be excused from a quiz or exam must include official documentation (doctor's note, request from academic advisor, etc) explaining why the exam was or will be missed. Cases will be handled on an individual basis, at the discretion of the course instructor and makeup tests, if given, will be scheduled in consultation with the instructor. Every effort will be made to grade and return exams/quizzes within a week.

Re-grading of exams:

Requests for re-grades must be submitted no later than the end of the second class period after the graded test or assignment has been returned.

If you feel that grading errors have been made, see the TA first. However, all changes must be approved by Dr. Gowher. See Dr. Gowher to appeal the TA's decisions. Such appeals to the instructor must be in writing. The instructor has the option to re-grade the entire exam/quiz. If the exam/quiz was not completed in ink, the TA and course instructor has the option not to re-grade the exam.

EXTRA CREDIT

At the discretion of the instructor, there may be opportunity for extra credit. Weekly homework assignments and pre-exam study guide assignments will be used to earn extra-credit.

OBTAINING EXTRA HELP

Dr. Gowher will be available to answer your questions immediately after class, or by appointment (arranged in class or by e-mail). Alternatively, you can submit questions by e-mail that can be answered in class or by return e-mail. E-mails will be mainly answered during office hours.

The lecture TA will hold office hours for at least 3 hours per week, and will be able to answer additional hours by appointment.

Study Suggestions:

We will cover large amounts of material in BCHM 462 including learning metabolic pathways, enzymes, reaction types their relationship and their regulation. Therefore, it is important to keep up on the reading and reviewing of material. Last minute cramming is usually not successful in BCHM 462.

Do come to class and actively listen.

Do read the text and actively learn to remember (**memorize**).

Do focus on identifying key concepts.

Do ask questions if you do not understand the concepts.

Do actively draw and redraw pathways and connections.

Do learn to identify relevant information.

Please do not rely on passive reading and highlighting/underlining of the textbook.

Please do not sit and stare at the handouts (they are an outline, not a text).

Please do not try to read 50 review books. (Make your own review book instead!)

CLASS ATTENDANCE

Attendance Policy during COVID-19: Students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus. In the current context of COVID-19, in-person attendance will not be a factor in the final grades, but the student still needs to inform the instructor of any conflict that can be anticipated and will affect the submission of an assignment or the ability to take an exam. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, through Brightspace, or by phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.

ACADEMIC GUIDANCE IN THE EVENT A STUDENT IS QUARANTINED/ISOLATED

If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.

PROTECT PURDUE PLAN

The Protect Purdue Plan, which includes the Protect Purdue Pledge, is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, wearing a mask in classrooms and campus buildings, at all times (e.g., no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining proper social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights.

ACADEMIC MISCONDUCT

Academic misconduct of any kind will not be tolerated in any course offered by the Department of Biochemistry. Information on Purdue's policies with regard to academic misconduct can be found at http://www.purdue.edu/studentregulations/student_conduct/regulations.html

Any incidence of academic misconduct will be reported to the Office of the Dean of Students. Academic misconduct may result in disciplinary sanctions including expulsion, suspension, probated suspension, disciplinary probation, and/or educational sanctions. In addition, such misconduct will result in punitive grading such as:

- receiving a lower or failing grade on the assignment, or
- assessing a lower or failing grade for the course

Punitive grading decisions will be made after consultation with the Office of the Dean of Students. Please note reported incidences of academic misconduct go on record for reference by other instructors. Further, a record of academic misconduct is likely to influence how current/future situations are handled.

To provide you with an unambiguous definition of academic misconduct, the following text has been excerpted from "Academic Integrity: A Guide for Students", written by Stephen Akers, Ph.D., Executive Associate Dean of Students (1995, Revised 1999, 2003), and published by the Office of the Dean of Students in cooperation with Purdue Student Government, Schleman Hall of Student Services, Room 207, 475 Stadium Mall Drive West Lafayette, IN 47907-2050.

"Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, [Student Regulations](#)] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

More specifically, the following are a few examples of academic dishonesty, which have been discovered at Purdue University.

- substituting on an exam for another student
- substituting in a course for another student
- paying someone else to write a paper and submitting it as one's own work
- giving or receiving answers by use of signals during an exam
- copying with or without the other person's knowledge during an exam
- doing class assignments for someone else
- plagiarizing published material, class assignments, or lab reports
- turning in a paper that has been purchased from a commercial research firm or obtained from the internet
- padding items of a bibliography
- obtaining an unauthorized copy of a test in advance of its scheduled administration
- using unauthorized notes during an exam
- collaborating with other students on assignments when it is not allowed
- obtaining a test from the exam site, completing and submitting it later
- altering answers on a scored test and submitting it for a regrade
- accessing and altering grade records
- stealing class assignments from other students and submitting them as one's own
- fabricating data
- destroying or stealing the work of other students

Plagiarism is a special kind of academic dishonesty in which one person steals another person's ideas or words and falsely presents them as the plagiarist's own product. This is most likely to occur in the following ways:

- using the exact language of someone else without the use of quotation marks and without giving proper credit to the author
- presenting the sequence of ideas or arranging the material of someone else even though such is expressed in one's own words, without giving appropriate acknowledgment
- submitting a document written by someone else but representing it as one's own"

NOTICE OF COPYRIGHT PROTECTION OF COURSE MATERIALS

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

EMERGENCY PREPAREDNESS

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other

circumstances. To get information about changes in this course consult the class Blackboard site or e-mail or phone the instructor.

ON-LINE COURSE EVALUATIONS

During the last two weeks of the semester, you will be provided an opportunity to evaluate this course and your instructor(s). To this end, Purdue has transitioned to online course evaluations. On Monday of the fifteenth week of classes, you will receive an official email from evaluation administrators with a link to the online evaluation site. You will have two weeks to complete this evaluation. Your participation in this evaluation is an integral part of this course. Your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

NON-DISCRIMINATION POLICY

Purdue University's non-discrimination policy will be upheld in this classroom. Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University views, evaluates, and treats all persons in any University related activity or circumstance in which they may be involved, solely as individuals on the basis of their own personal abilities, qualifications, and other relevant characteristics.

In this course, each voice in the classroom has something of value to contribute. Please take care to respect the different experiences, beliefs and values expressed by students and staff involved in this course. We support Purdue's commitment to diversity, and welcome individuals of all ages, backgrounds, citizenships, disability, sex, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences

For more information, see http://www.purdue.edu/purdue/ea_eou_statement.html.

MENTAL HEALTH

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765) 494-6995 or <http://www.purdue.edu/caps/> after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

ACCESSIBILITY AND ACCOMODATIONS

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

DISCLAIMER

This syllabus is subject to change.

PROJECT FOR HONORS COLLEGE STUDENTS

Create a presentation for Biochemistry Club Outreach Program: Use BCHM 462 course to create an illustrative presentation on how life style could be an underlying cause of metabolic syndrome. You can use poster, PowerPoint presentation or multimedia approaches.

PROJECT DUE DATE

December 5th

CREDIT

20 points are awarded for this honors project.

LECTURE SCHEDULE (May slightly change)

Date	Day	Chapter in 8 th Edition	Exams/ Quizzes	Topic
Aug 25	T	15		Course policy: Review Metabolism: Basic Concepts and Design
27	TH	16		Metabolism: Basic Concepts and Design, Glycolysis
Sep 1	T	16		Glycolysis
3	TH	16		Gluconeogenesis
8	T	16	Quiz 1	Gluconeogenesis
10	TH	21		Glycogen metabolism
15	T	17		The Citric Acid Cycle
17	TH	17		The Citric Acid Cycle
22	T		Exam 1 during class	
24	TH	18		Oxidative Phosphorylation,
29	T	18		Oxidative Phosphorylation,
Oct 1	TH	19		Oxidative Phosphorylation, ATP synthesis
6	T	19	Quiz 2	Photosynthesis – Light reactions
8	TH	20		Photosynthesis – Light reactions
13	T	20		Photosynthesis – Light reactions
15	TH	22	Exam 2, 6:30-7:30 PM LILY 3118	The Calvin Cycle
20	T	22		The Calvin Cycle
22	TH	22		Fatty Acid Degradation
27	T	22	Quiz 3	Fatty Acid Degradation/ Ketone bodies
29	TH	22		Fatty Acid Synthesis
Nov 3	T	22	Exam 3, 6:30-7:30 PM LILY G126	No class
5	TH			Amino Acid Degradation
10	T	23		Amino Acid Degradation
12	TH	23		Amino Acid Synthesis
17	T	24		Amino Acid Synthesis
19	TH	24	Exam 4, 6:30-7:30 PM LILY 3118	No class
24	T	20		Nucleotide Biosynthesis (Virtual Lecture)
Dec 1	T	25		Nucleotide Biosynthesis (Virtual Lecture)

3	TH	25		Pentose Phosphate Pathway (Virtual Lecture)
Due on 11	Fri		Final Assignment	Should be submitted via an email to hgowher@purdue.edu

EXAMPLE QUIZ

Matching

Choose the correct answer from the list. Not all the answers will be used.

- A) Glucokinase
- B) ----
- C) ----
- D)
- E)
- F)
- G)
- H)
- I)
- J)
- K)
- L)

1. The products of glycolysis include: ATP, NADH, and _____
2. -----

Multiple Choice

3. During reactions utilizing the enzymes shown below, in which case(s) is ATP produced?

- I. phosphofructokinase (PFK)
- II. phosphoglycerate kinase (PGK)
- III. pyruvate kinase (PK)

- A) I
- B) II
- C) III
- D) I, II
- E) II, III

EXAMPLE EXAM

Exam Directions:

You have a choice of attempting questions to get a maximum of 80 pts and indicated points from each section.

- ❖ There is no negative marking, so attempt as many as you can
- ❖ Read each question carefully and select the best answer
- ❖ Answer each question in the space provided
- ❖ Answer all questions in a brief but specific scientific manner
- ❖ Write your name on this page and initial all additional pages
- ❖ This exam is worth 80 points

A. Below are questions on Glycolysis. Max earned score 20pts

1. (2 pt) If you start with two molecules of fructose 6-phosphate and end glycolysis at phosphoenolpyruvate, what is the net output of ATP and NADH?
 - a) 2 ATP and 2 NADH
 - b) 2 ATP and 4 NADH
 - c) 4 ATP and 2 NADH
 - d) 4 ATP and 4 NADH
 - e) None of the above

(3 pt) Please justify how you derived this number.

2. (3 pt) Name the reactions in glycolysis that demonstrate substrate level phosphorylation?
3. (2 pt) Why is this called substrate level phosphorylation?