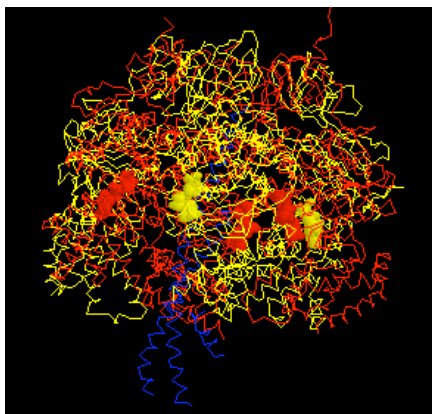


**CHEMISTRY 335
METABOLIC BIOCHEMISTRY
SPRING 2009**

**DR. JANIS E. LOCHNER, OLIN CENTER 223, EXT. 7538, (lochner@lclark.edu)
OFFICE HOURS: TUESDAY 3:00 – 4:00 P.M., WEDNESDAY 2:00 P.M. – 3:00 P.M. AND FRIDAY
11:30 P.M. – 12:30 P.M.**

**LECTURE: 10:20 A.M. - 11:20 A.M. MONDAY, WEDNESDAY AND FRIDAY, HOWARD HALL 124
TEXT: LEHNINGER PRINCIPLES OF BIOCHEMISTRY 5TH ED. (2008), NELSON AND COX
CLASS WEB SITE: <http://www.lclark.edu/~lochner/chem335.html>**



***“Energy is eternal delight.”
William Blake***

METABOLIC BIOCHEMISTRY PROBES THE CHEMICAL PROCESSES WHEREBY CELLS DERIVE METABOLIC ENERGY AND EXPLORES HOW CELLULAR ENERGY IS JUDICIOUSLY ALLOCATED TO DRIVE BIOSYNTHETIC REACTIONS. THROUGHOUT THE SEMESTER, WE WILL ASSESS HOW THESE FUNDAMENTAL CHEMICAL PROCESSES RELATE TO THE METABOLIC BASIS OF HUMAN DISEASE AND TO COMPLEX PHYSIOLOGICAL PROCESSES SUCH AS APPETITE REGULATION AND AGING.

SCHEDULE OF LECTURES AND EXAMS

JAN 21	BIOENERGETICS AND THE STRATEGY OF METABOLISM
JAN 23	GLYCOLYSIS, REGULATORY CONTROL EXERTED BY PHOSPHOFRUCTOKINASE
JAN 26	GLUCONEOGENESIS, RECIPROCAL REGULATION OF GLYCOLYSIS AND GLUCONEOGENESIS
JAN 28	PYRUVATE DEHYDROGENASE, SHUTTLING METABOLITES VIA A VECTORIALLY ASSEMBLED MULTI-ENZYME COMPLEX COENZYME ACTION – THIAMIN AND BERIBERI

JAN 30	CITRIC ACID CYCLE, AMPHIBOLIC NATURE OF THE PATHWAY
FEB 2	ELECTRON-TRANSFERREING REACTIONS, FREE ENERGY CHANGES ACCOMPANYING ELECTRON TRANSFER
FEB 4	LITERATURE REVIEW AND PRESENTATION GLUCOKINASE AND DIABETES SUSCEPTIBILITY
FEB 6	ATP SYNTHASE, STRUCTURE FUNCTION RELATIONSHIP OF A ROTARY ENGINE
FEB 9	THERMOGENESIS AND UNCOUPLING PROTEINS
FEB 11	LITERATURE REVIEW AND PRESENTATION GLUCOSE METABOLISM, CYTOCHROME C OXIDATION AND APOPTOSIS
FEB 13	METABOLIC GAMES
FEB 16	<i>QUIZ I</i>
FEB 18	LITERATURE REVIEW AND PRESENTATION GENETIC VARIATION OF ALCOHOL METABOLIZING ENZYMES
FEB 20	PENTOSE PHOSPHATE PATHWAY
FEB 23	GLYCOGEN DEGRADATION, REVERSIBLE CONTROL BY PHOSPHORYLATION GLYCOGEN SYNTHESIS AND ESSENTIALS OF BIOSYNTHETIC STRATEGIES
FEB 25	LITERATURE REVIEW AND PRESENTATION REPATTERNING ENERGY METABOLISM TO YIELD SUPERMICE
FEB 27	LIGHT REACTIONS OF PHOTOSYNTHESIS STRUCTURE OF THE OXYGEN EVOLVING COMPLEX
FEB 29	DARK REACTIONS, SYNTHESIS OF CARBOHYDRATE BY THE CALVIN CYCLE REDOX REGULATION OF RUBISCO
MARCH 2	PHOTORESPIRATION, COMPETITION BETWEEN C3 AND C4 PLANTS
MARCH 4	LITERATURE REVIEW AND PRESENTATION TRANSGENIC PLANTS AND RESISTANCE TO HIGH TEMPERATURE
MARCH 6	CARNITINE SHUTTLE AND FATTY ACID OXIDATION RECIPROCAL REGULATION OF FATTY ACID SYNTHESIS AND BREAKDOWN
MARCH 9	LITERATURE REVIEW AND PRESENTATION MECHANISM OF ACTION OF BROAD-SPECTRUM ANTIBACTERIALS
MARCH 11	<i>MIDTERM EXAM</i>
MARCH 13	CYCLOOXYGENASE STRUCTURE AND ARACHIDONIC ACID METABOLISM PHOSPHOLIPID METABOLISM
MARCH 16	SYNTHESIS OF MEMBRANE LIPIDS
MARCH 18	LITERATURE REVIEW AND PRESENTATION LEPTIN, ACETYL COA CARBOXYLASE AND REGULATION OF FOOD INTAKE
MARCH 20	CHOLESTEROL BIOSYNTHESIS, LDL RECEPTORS AND HYPERCHOLESTEROLEMIA
MARCH 30	AMINO ACID DEGRADATION, TRANSAMINASE ACTION AND VITAMIN B6
APRIL 1	LITERATURE REVIEW AND PRESENTATION REGULATION OF CHOLESTEROL BIOSYNTHESIS

APRIL 3	ENERGY COST OF UREA SYNTHESIS
APRIL 6	SYNTHESIS OF AMINO ACIDS FROM MAJOR METABOLIC INTERMEDIATE AMINO ACIDS AS PRECURSORS TO NEUROTRANSMITTERS NITRIC OXIDE SYNTHASE AND NO
APRIL 8	LITERATURE REVIEW AND PRESENTATION NITRIC OXIDE SIGNALING RESPONSE TO MILD EXERCISE
APRIL 10	<i>QUIZ II</i>
APRIL 13	THE SYNTHETIC CHALLENGE OF THE PORPHYRIN RING PORPHYRIA AND KING GEORGE III
APRIL 15	LITERATURE REVIEW AND PRESENTATION SIRTUINS, NAD AND AGING
APRIL 17	PURINE NUCLEOTIDE SYNTHESIS, SALVAGE PATHWAY FOR RECYCLING BASES PYRIMIDINE NUCLEOTIDE SYNTHESIS AND DEGRADATION
APRIL 20	NUCLEOTIDE METABOLISM DISORDERS, GOUT, LESCH-NYHAN SYNDROME, ADENOSINE DEAMINASE DEFICIENCY
APRIL 22	LITERATURE REVIEW AND PRESENTATION METABOLOMICS – INTRACELLULAR ENERGY STATUS AND CONTROL OF RDNA
APRIL 27	HORMONAL REGULATION OF METABOLISM INTEGRATION OF METABOLISM
APRIL 29	METABOLIC MAPS / METABOLOMICS

STRUCTURE OF THE COURSE

READINGS FOR STRUCTURAL BIOCHEMISTRY

READINGS FROM THE TEXT LEHNINGER PRINCIPLES OF BIOCHEMISTRY 5TH ED WILL COMPLEMENT THE MATERIAL DISCUSSED IN LECTURE. PROBLEMS PERTINENT TO LECTURE WILL BE PERIODICALLY ASSIGNED AND YOU ARE ENCOURAGED TO WORK COOPERATIVELY WITH YOUR CLASSMATES ON ADDRESSING THESE QUESTIONS. YOU MAY ALSO INITIATE A DIALOG WITH ME REGARDING THE HOMEWORK BY BRINGING YOUR QUESTIONS TO OFFICE HOURS. YOU WILL ALSO BE ASSIGNED THREE GRADED HOMEWORKS THAT FOCUS PRIMARILY ON TOPICS EXPLORED IN OUR LITERATURE REVIEW SESSIONS.

IN ADDITION TO THE AFOREMENTIONED RESOURCES, RESEARCH PAPERS FROM THE BIOCHEMICAL LITERATURE WILL BE CONSIDERED IN CLASS DURING THE LITERATURE REVIEW SESSIONS. DURING THE COURSE OF THE TERM, YOU WILL WORK WITH A PARTNER ON PRESENTING A LITERATURE REVIEW. YOU AND YOUR PARTNER WILL SHARE YOUR INSIGHTS WITH THE CLASS BY HIGHLIGHTING YOUR ANALYSES OF THE PAPER IN AN ORAL PRESENTATION AND BY PREPARING A TWO-PAGE WRITTEN SYNOPSIS OF THE WORK. LITERATURE REVIEWS ARE INTENDED TO FURTHER YOUR UNDERSTANDING OF SELECT AREA NOW ATTRACTING RESEARCH INTEREST. THESE SESSIONS SHOULD ALSO PROVIDE YOU WITH THE OPPORTUNITY TO SHARPEN YOUR ANALYTICAL SKILLS.

SCHEDULE OF READINGS / *BIOCHEMISTRY 6TH EDITION*

CHAPTERS	13	JANUARY	21
CHAPTER	14	JANUARY	23-26
CHAPTER	15	JANUARY	28
CHAPTER	16	JANUARY	30
CHAPTER	17	MARCH	6
CHAPTER	18	MARCH	30-APRIL 3
CHAPTERS	19	FEBRUARY	6-9
CHAPTER	20	FEBRUARY	27-MARCH 4
CHAPTER	21	MARCH	6-20

CHAPTER 22
CHAPTER 23

APRIL 6-20
APRIL 27-29

FOR THOSE OF YOU WHO WANT TO DELVE FURTHER INTO TOPICS IN METABOLIC BIOCHEMISTRY, I HAVE PLACED A NUMBER OF BOOKS ON RESERVE AT WATZEK LIBRARY. THE FIRST BOOK PROBES SELECT ASPECTS OF ENZYME MECHANISMS AND PROTEIN FOLDING. THE SECOND RESOURCE REPRESENTS AN ENCYCLOPEDIA REFERENCE ON THE MOLECULAR BASIS OF INHERITED DISEASE. IN THIS COURSE, WE OFTEN EXPLORE HOW SPECIFIC MUTATIONS CAN COMPROMISE PROTEIN STRUCTURE AND THEREBY LEAD TO DISEASE. IF YOU ARE KEEN ON LEARNING ADDITIONAL INFORMATION RELEVANT TO THESE DISORDERS, THIS FOUR-VOLUME TREATISE IS AN EXCELLENT PLACE TO START YOUR QUEST FOR FURTHER INFORMATION. REFERENCES THREE AND FOUR PROVIDE COMPREHENSIVE OVERVIEWS OF METABOLIC BIOCHEMISTRY. GOOD LUCK IN YOUR STUDY OF BIOCHEMISTRY! I LOOK FORWARD TO WORKING WITH YOU.

1. STRUCTURE AND MECHANISM IN PROTEIN SCIENCE: A GUIDE TO ENZYME CATALYSIS AND PROTEIN FOLDING (ALAN FERSCHT), 1999.
2. THE METABOLIC AND MOLECULAR BASIS OF INHERITED DISEASE (ED CHARLES R. SCRIBER ET AL.), 2001.
3. FUNCTIONAL METABOLISM: REGULATION AND ADAPTATION (ED KENNETH B. STOREY), 2004.
4. FUNDAMENTALS OF BIOCHEMISTRY: LIFE AT THE MOLECULAR LEVEL (DONALD VOET, JUDITH G. VOET, CHARLOTTE W. PRATT), 2006.

WORLD WIDE WEB RESOURCES

GENERAL RESOURCES RELEVANT TO YOUR WORK IN METABOLIC BIOCHEMISTRY

[HTTP://WWW.NCBI.NLM.NIH.GOV/ENTREZ/QUERY.FCgi](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi) THE KEY SITE FOR SEARCHING THE BIOMEDICAL LITERATURE

[HTTP://WWW.EXPASY.CH/CGI-BIN/SEARCH-BIOCHEM-INDEX](http://www.expasy.ch/cgi-bin/search-biochem-index) - THE BOEHRINGER MANNHEIM CHART OF BIOCHEMICAL PATHWAYS. ENTER THE NAME OF A METABOLIC INTERMEDIATE OF INTEREST AND YOU WILL RECEIVE A LIST OF ALL KNOWN REACTIONS AND AVAILABLE METABOLIC MAPS. NOTE THAT YOU CAN NAVIGATE FROM ONE ADJOINING SEGMENT OF THE MAP TO THE NEXT USING THE ARROW KEYS.

[HTTP://WWW.GENOME.AD.JP/KEGG/KEGG.HTML](http://www.genome.ad.jp/kegg/kegg.html) - REACTIONS WITHIN 85 DIFFERENT PATHWAYS ARE PROFILED. THE STANDARD METABOLIC PATHWAYS ARE NOT SPECIFIC TO PARTICULAR ORGANISMS BUT RATHER CONSENSUS VIEWS OF BIOCHEMICAL PATHWAYS. REACTIONS SPECIFIC TO A GIVEN ORGANISM MAY BE REQUESTED VIA THE MENU. ADDITIONAL INFORMATION ON METABOLIC DISEASES RELATED TO PATHWAY REACTIONS MAY BE REQUESTED VIA THE MENU.

[HTTP://WWW.RCSB.ORG/PDB/](http://www.rcsb.org/pdb/) REPOSITORY FOR ALL PUBLISHED PROTEIN STRUCTURES, ATOMIC COORDINATES OF PROTEINS CAN BE DOWNLOADED FROM THIS SITE AND THEN VISUALIZED USING A VARIETY OF FREE PROGRAMS SUCH AS PROTEIN EXPLORER

[HTTP://WWW.UMASS.EDU/MICROBIO/CHIME/EXPLORER/](http://www.umass.edu/microbio/chime/explorer/)

[HTTP://WWW.NCBI.NLM.NIH.GOV/](http://www.ncbi.nlm.nih.gov/) NATIONAL CENTER FOR BIOTECHNOLOGY INFORMATION REPOSITORY FOR PROTEIN AND GENE SEQUENCE DATA

[HTTP://WWW.PUBLIC.IASTATE.EDU/~PEDRO/RESEARCH_TOOLS.HTML](http://www.public.iastate.edu/~pedro/research_tools.html) PEDRO'S BIOMOLECULAR RESEARCH TOOLS, COMPREHENSIVE LIST OF WWW LINKS RELATED TO WORK IN THE BIOMOLECULAR SCIENCES

DETERMINATION OF FINAL COURSE EVALUATION

LITERATURE REVIEW AND PRESENTATIONS	100 POINTS
LITERATURE REVIEW QUESTIONS	50 POINTS
QUIZZES (FEB 16, APRIL 10)	100 POINTS
MIDTERM EXAM / MARCH 11 (7:00P.M. - 9:00 P.M.)	100 POINTS
FINAL EXAM / MAY 5 (1:00 P.M. - 4:00 P. M.)	100 POINTS

HONOR CODE GUIDELINES

PLEASE READ THE GUIDELINES PROVIDED IN THE STUDENT HANDBOOK CONCERNING ACADEMIC HONESTY AND THE HONOR CODE. THE ACADEMIC HONESTY AND HONOR CODE APPLIES TO ALL MATERIAL IN THIS CLASS.