

# BIO 330 SYLLABUS - Fall 2017

## COURSE DESCRIPTION

This course considers the molecular basis and treatments of eight genetically inherited human diseases associated with defects in a single protein. Examples and their physiological systems include hemophilia B and chronic myeloid leukemia (blood), cystic fibrosis (lungs), Pompe disease (glycogen storage in muscles), PKU and MCADD (phenylalanine and fatty acid metabolism in liver), Duchenne muscular dystrophy (muscles), and Huntington's disease (central nervous system). Data come from biochemistry and medical journals, including new approaches for treatment and current results from human clinical trials.

3 credit lecture course : NSC 201 : Tues-Thurs 8:00-9:20 AM

Prerequisite : one semester of biochemistry (BCH 403, BIO 205, CHE 312, or MT 401)

Detailed list of topics : See Appendix I

Schedule of topics :

We will cover an average of 21-22 figures per lecture

Calendar : See Appendix III

## EXAM SCHEDULE (each exam is on two diseases) :

Exam I Sept 21 Pompe disease ; Hemophilia B

Exam II Oct 17 MCADD (acyl-CoA dehydrogenase deficiency) ; Chronic myeloid leukemia

Exam III Nov 16 Cystic fibrosis ; Muscular dystrophy

Exam IV Dec 12 Phenylketonuria (PKU) ; Huntington's disease

Final exam week : Tues Dec 12, 8:00-9:10 AM, new room is Cooke 121

## STUDENT LEARNING OUTCOMES

Course objectives :

- A. Develop an appreciation for the medical research method
- B. Integrate knowledge from biochemistry, cell biology, genetics, and physiology
- C. Understand the underlying chemical basis for human diseases and their treatment
- D. Evaluate quantitative data in graphs, tables, and spectra
- E. Search the Internet and electronic journals for medically related information
- F. Learn how to use Medline-via-Ovid and Endnote library tools
- G. Learn current state-of-the-art approaches to managing human diseases
- H. Consider ethical values issues
- I. Build on an intro biochemistry course (such as BIO 205) to advance your knowledge

For details regarding course objectives, assessment instruments, and links to departmental program objectives, see Appendix IV (Excel spreadsheet).

## COURSE REQUIREMENTS : summary of points

- Exams : 4@125 = 500 pts : dates given in the calendar : 70 min long (8:00-9:10 AM)  
4 Homework projects = 4 @ 25 pts each = 100 pts : due by 8 AM at the exam on that disease  
Each project (1 project for each part of the course : parts I, II, III, and IV : where each part of the course has 2 diseases to choose from)
- Highlight and summarize one journal article on one disease : 9 pts
  - Identify and describe 4 URL's for that same disease : 8 pts
  - Write 10 original practice problems for that same disease : 8 pts
- Optional extra credit : 30 pts : due no later than 8 AM at the final exam
- Medical ethics report : 10 pts
  - Endnote library : 10 pts
  - Special documents : 10 pts
- For detailed descriptions, see Appendix II

## ACADEMIC CONTENT

- Students are required to read and understand the classnotes.
- Students must complete the exams and homework on schedule.
- Attendance in class is expected, but absences will not be recorded.

## GRADING POLICY

Make-up policy :

Make-up exams will be provided when the student has a valid medical excuse or family emergency, or makes arrangements with Dr. Snyder ahead of time (such as for varsity athletic events, medical school interviews, religious obligations). Unexcused absences will result in a grade of 0. Students who miss an exam must phone Dr. Snyder (645-4939) and talk with him personally before noon on the day of the exam. E-mails are NOT acceptable substitutes for talking to Dr. S, nor are written notes, nor is a phone voice mail message, nor are messages left with any other person. Requests for regrading of exams must be made no later than 1 week after grades are posted at UBLearns in your personal gradebook. Exams are photo-copied before being returned to students, to discourage their being altered before any regrading.

- Religious excuses : letter 1 week in advance from rabbi/priest/pastor/other with need and dates
- Medical excuses : letter from a doctor telling what dates the student should be excused.
  - UB health clinic : Doctor must be willing to state in a phone call that he/she is certain that you were too sick to take the exam. In many cases, complaints of stomach aches or headaches do not generate such a statement, because there are no physical data (such as elevated temperature, signs of infection) to indicate disease.
  - Mental health : letter from a licensed M.D. psychiatrist indicating what dates you should be excused. Without this, a student's personal claim of "exam stress" will not be honored.
- Family emergency : letter from parent, with documentation of funeral/wedding/location/dates
- Excused absences : student may make up the exam as soon as the medical/family emergency is over, provided that the student spoke with Dr. S on the morning of the original exam.
- Unexcused absences OR undocumented excuses OR failure to speak with Dr. S on the morning of the exam will result in a grade of 0.
- Three exams on the same day : see Dr. S before that date to pre-arrange a make-up date for the Bio 330 exam if you want that option. Two exams on the same day : must take Bio 330 exam as scheduled.

### Cutoffs for letter grades (%) :

Range	grade	Range	grade
100.00-92.00	A	75.99-72.00	C+
91.99-88.00	A-	71.99-68.00	C
87.99-84.00	B+	67.99-64.00	C-
83.99-80.00	B	63.99-60.00	D+
79.99-76.00	B-	59.99-52.00	D

### Incompletes :

A student who is physically unable to take one of the exams in the course (for example because of an extended illness documented by a doctor's letter) may request to complete that work at a later date, receiving an "I" in the course. That student may not restart the whole course all over in a later semester. The completed exams have been completed, and those grades will be saved and used to calculate the final average when the missed exams have been finished. "A grade of incomplete (I) may be given to students who have not completed all of the assigned work in a course if they have a passing average." This quoted rule is the official university policy. If you have an F average, you do not have a passing average and may not receive an "I". If you are failing the first half of the course, you should resign with an R grade before the deadline for that option.

#### Reference to UB Incomplete Policy :

<http://undergrad-catalog.buffalo.edu/policies/grading/explanation.shtml>

### OFFICE HOURS

Cooke 373A : Tues & Thurs : 10-11 AM : 645-4939  
or by appointment

### ACADEMIC INTEGRITY

Reference to the UB Academic Integrity Policy

<http://undergrad-catalog.buffalo.edu/policies/course/integrity.shtml>

Use of cell phones during exams is strictly forbidden : use will be penalized

Exams must be turned in on time : continued writing after 9:10 AM will be penalized

### OFFICE OF ACCESSIBILITY RESOURCES

UB's Accessibility Resources Office : for students needing special accommodations on exams

Office at 60 Capen Hall 645-2608

<http://www.buffalo.edu/accessibility>

email : [stu-accessibility@buffalo.edu](mailto:stu-accessibility@buffalo.edu)

### COURSE RESOURCES : provided online at UBLearns

Classnotes

Expanded outline giving purpose and main points for each figure

Practice problems for each figure, arranged and numbered in the same order as the figures

## APPENDIX I : Detailed list of topics

### POMPE DISEASE

- Lysosome : the cell's garbage disposal
- Trafficking : mannose-6-phosphate labeling
- Gaucher's disease - lysosomal sphingolipid storage disease
- Pompe disease - lysosomal glycogen storage disease
- Pompe disease : enzyme replacement in infants and children - Myozyme (Genzyme product)
- Enzymes with increased efficiency - phosphorylation by organic chemistry (oximes)
- Stem cell approach
- Use of red blood cells to retrain the immune system

### Hem B : HEMOPHILIA TYPE B

- Introduction to hemophilia : X-linked genetics, 2 clotting factor injections/week
- Introduction to gene therapy : finding a safe and efficient viral vector
- Codon optimization
- AAV (adeno-associated virus) serotypes : targeting organ types, minimizing immune response
- Capsid uncoating rates
- Self-complementary sequence design
- Successful human clinical trial : 1 gene injection/yr

### MCADD : MEDIUM-CHAIN ACYL-CoA DEHYDROGENASE DEFICIENCY

- Fatty acid (FA) catabolism : dietary adjustments
- Comparison of 3d structures : dehydrogenases for very-long vs. medium vs. short chain FA's
- MCADD disease : clinical symptoms, metabolites in blood and urine
- Screening of newborn infants in N.Y. State
- Dominant mutation in MCADD : Lys<sup>+</sup> 304 Glu<sup>-</sup>

### CML : CHRONIC MYELOID LEUKEMIA

- Chromosomal translocations : mechanisms and karyotype
- Role of the oligomerization domain : enhancing autophosphorylation in the oligomer
- Protein kinase inhibitors : specificity : binding to inactive forms, alkyne minimum steric effect
- Other issues : cost of drug, patent variations, accelerated approval process

### CF : CYSTIC FIBROSIS

- Introduction : defective ion channels, lung damage
- Structural consequences of the common F508del mutation
- Pharmaceutics : corrector (VX-809) and potentiator (VX-770) for F508del mutation
- Other methods : hypertonic salt, human DNase, dietary lipase
- Gender gap : females affected by CF more than males

### MD : DUCHENNE MUSCULAR DYSTROPHY

- Introduction : blood clotting cascade, damage to joints
- Dystrophin structure : 24 tandem spectrin-like repeats, some of which are unneeded
- Exon skipping : anti-sense oligonucleotides PRO051 and Eteplirsen
- U7 small nuclear RNA gene therapy approach
- Mini and micro dystrophin constructs
- Application of Crispr/Cas9 gene-editing technology in mice

### PKU : PHENYLKETONURIA

- Introduction : buildup of phenylalanine, brain damage
- Glycomacropptide : low phenylalanine fragment of a milk protein
- Tetrahydrobiopterin : enzyme cofactor
- Phenylalanine ammonia lyase : alternative dietary enzyme from microorganisms

### HD : HUNTINGTON'S DISEASE

- Introduction : protein aggregation, atrophy of brain tissue
- Genetics : autosomal dominant
- Huntingtin protein structure
- Trinucleotide repeat hairpins : mechanisms of trinucleotide repeat expansion
- RNA therapies : small interfering (si) and micro (mi) RNA

Appendix II : COURSE POINTS : 600 pts total

EXAMS : 4@125 = 500 pts

These will be a mixture of multiple-choice (68%) and short answer questions (32%). Practice problems will be posted online at UBLearns. Answers may be discussed in office hours or at a help session. The 4th exam, given during final exam week, covers just two diseases PKU and HD, and therefore is not accumulative.

REQUIRED HOMEWORK : 4@25 = 100 pts total : must be submitted as a hard copy, not by email

The course is divided into four parts, each covering two diseases. For each part you will choose one of the two diseases. Then for that choice, you will complete three tasks all related to that same disease.

Task 1 : Journal article

Choose 4 of the 8 diseases in the course. For each of those diseases, read one literature article related to some aspect of the classnotes, highlight key portions, and attach a cover page identifying the reference (journal, volume, page, and year). Write at least 3 sentences describing the best features of the paper. The journal article must be at least 4 pages long and include regular sized figures. Training will be provided for accessing the Health Sciences Library electronic journals. You may use either one of the papers posted at UBLearns, or any paper published no earlier than 2012 which you have found yourself.

Task 2 : 4 URLs

Search the Internet for four websites related to some aspect of the classnotes for the disease. Record the four URLs for each chosen disease, and write at least 3 sentences for each URL describing its best features.

Task 3 : 10 practice problems

Write 10 practice problems (multiple choice and/or short answer questions). Identify which figure from the classnotes is associated with each question by using the figure # as your question #. Provide the correct answer. The questions must be different from those represented in the practice problems posted at UBLearns.

Homework format : Each of the three tasks must be printed and stapled together as a separate document for each task, with your name and the disease appearing at the top of the first page. Then the three documents (one per task) should be paper clipped together in the following order : journal article, URLs, practice problems.

OPTIONAL EXTRA CREDIT (@ 10 pts each) = 30 pts :  
must be submitted as printed hard copies, not sent as emails

Medical ethics report  
Endnote library  
Special documents

Medical ethics report : optional extra credit

Research an ethics issue related to a subject in BIO 330. Reference any papers or Internet sites, and write a brief report (800-1000) words on that topic. If you use a medical ethics paper or URLs to meet the homework requirements, you may not use those same sources for this extra credit project.

Endnote library : optional extra credit

Training will be provided for how to use the Health Sciences Library's Medline/Ovid search engine and how to use the Endnote bibliography software available for free download for PCs or Macs. Prepare an Endnote library listing 30 references on a disease not covered in BIO 330, and print out an Endnote bibliography.

Special documents : optional extra credit

Read one of the following special documents posted at UBLearns and write a brief report (800-1000 words) on what you learned and found to be interesting. You may do this for only one of the three choices.

1. Hemophilia B : Environmental risk assessment dossier
2. CML : decision by the Supreme Court of India
3. PKU : U.S. patent application 6555659 for purification of GMP

# Fall

APPENDIX III

BIO 330

# 2017

September

October

November

December

Sun	Mon	Tues	Wed	Thur	Fri	Sat
	Classes Begins 28	POMPE 1 29	30	POMPE 2 31	1	2
3	Labor Day Observed 4	POMPE 3 5	6	HEM B 1 7	8	9
10	11	HEM B 2 12	13	HEM B 3 14	15	16
17	18	MCADD 1 19	20	EXAM 1 21	22	23
24	25	MCADD 2 26	27	CML 1 28	29	30
1	2	CML 2 3	4	CML 3 5	6	7
8	9	CML 4 10	11	CF 1 12	13	14
15	16	EXAM 2 17	18	CF 2 19	20	21
22	23	CF 3 24	25	CF 4 26	27	28
29	30	MD 1 31	1	MD 2 2	3	4
5	6	MD 3 7	8	MD 4 9	10	11
12	13	PKU 1 14	15	EXAM 3 16	17	18
19	20	PKU 2 21	Fall Recess Begins 22		24	25
26	Classes Resume 27	HD 1 28	29	HD 2 30	1	2
3	4	HD 3 5	6	HD 4 7	Last Day of Classes 8	Reading Day 9
Reading Day 10	Final Exams Begin 11	EXAM IV 12	13	14	15	16
17	Final Exams End 18	Winter Recess Begins 19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	Winter Session Begins 4	5	6

For more detailed information: <http://registrar.buffalo.edu/calendars/academic/2017-18.php>  
 Spring 2018 Semester Begins Monday, January 29th

Number	Appendix IV - Program Learning Outcome	Depth	Specific outcome objectives for BIO 330	Assessment instrument
1	Students will develop a broad background in the biological sciences and achieve an understanding and appreciation of <b>basic biological concepts and principles</b> . They will become proficient in five broad areas of biology: evolutionary biology, cell biology, physiology, biochemistry, and genetics.		NA	
2	Students will acquire laboratory and field skills necessary to answer biological questions and an ability to understand and employ scientific methodologies. They will be able to understand how to obtain, critically evaluate, and communicate experimental results	1	#A. Develop an appreciation for the medical research method: 1st is experiments in tissue culture, 2nd is experiments in animals, 3rd is human clinical trials phases I, II, and III (safety, efficacy, improvement over existing methods)	Separately scored subsections of exams
3	Students will gain understanding of how to integrate knowledge across biological sub disciplines and to synthesize examples, facts, or hypotheses from more than one level of organization into a coherent whole. They will also obtain the ability to integrate the physical sciences (chemistry, physics, and mathematics) with biology.	3	#B. Integrate knowledge of the biochemistry, cell biology, physiology, and genetics underlying human diseases (BIO 201, 203, 205, 319)	Separately scored subsections of exams
			#C. Understand that the human biology of disease mechanisms and treatment has an underlying chemical basis	Separately scored subsections of exams
4	Students will develop effective quantitative reasoning skills and be able to operate as a scientist to formulate and test appropriate biological hypotheses. They will be engaged both independently and collaboratively in the scientific process and learn to critically evaluate the veracity and value of published information.	3	#D. Evaluate graphs, tables, and spectra containing quantitative experimental data of many types : cardiac, pulmonary, metabolic, digestive, ion channel currents, NMR, others	Separately scored subsections of exams
5	Students will be able to retrieve information from multiple sources, to analyze this information and communicate it precisely in both written and oral forms.	2	#E. Search the Internet and online electronic journals to identify new material related to diseases discussed in class	Homework assignment : submitted with comments and highlighting
			#F. Learn how to use the following tools at UB's Health Science Library website : Medline-via-Ovid, Endnote, electronic journals	Extra credit project : Submit an Endnote library on a disease not considered in class
6	Students will develop an interest in lifelong learning and be able to evaluate and advance knowledge in biology. Students will be exposed to current problems in biology, as well as develop an appreciation for the nature of living organisms, the mechanisms of life function, the different levels of biological organization and the interactions among organisms and their environments.	3	#G. Learn current state-of-the-art approaches to managing human diseases : enzyme replacement therapy, gene therapy, chaperone drugs, drugs bypassing null mutations, oligonucleotides for exon skipping, silencing RNA's, and others	Separately scored subsections of exams
7	Students will learn to appropriately place biological knowledge into an ethical context, appreciate the importance of ethical conduct in science and demonstrate knowledge of contemporary social and ethical issues related to biology and the professional responsibilities of a biologist.	1	#H. Consider ethical values issues : giving placebos to sick patients, testing experimental drugs in third-world countries, budgeting insurance dollars towards expensive treatments for a small number of patients with a rare disease, notifying patient's relatives regarding discovery of a genetically transmitted disease, abortion of a pregnancy when the fetus has inherited a disease	Extra credit project : write a brief paper on a medical ethics issue related to a disease discussed in class
8	Students will complete a more advanced level of study in areas of their choice to obtain a deeper coverage of at least one of the five broad areas.	3	#I. Build on the prerequisite of an introductory level of biochemistry (such as BIO 205) to develop an advanced level of biochemistry and its practical applications	Separately scored subsections of exams