Course Change Request

New Course Proposal

Date Submitted: 11/18/22 12:17 pm

Viewing: BIOL 586 : Medical Biochemistry

Last edit: 03/22/24 3:21 pm

Changes proposed by: dstgerma

Programs referencing this course

SC-MS-BIOL: Biology, MS

Are you completing this form on someone else's behalf?

Yes

Requestor:

In Workflow

1. **BIOL Graduate Representative**
2. **SC Curriculum Committee**
3. SC Associate Dean
4. Assoc Provost-Graduate
5. Registrar-Courses
6. Banner

Approval Path

1. 04/07/23 1:07 pm Iosif Vaisman (ivaisman): Approved for BIOL Graduate Representative
2. 05/05/23 11:42 am Jennifer Bazaz Gettys (jbazaz): Rollback to BIOL Graduate Representative for SC Curriculum Committee
3. 03/22/24 11:37 am Iosif Vaisman (ivaisman): Approved for BIOL Graduate Representative

Name	Extension	Email
Dr. Yuliya Dobrydneva	3-4263	ydobrydn@gmu.edu

Effective Term: Spring 2023

Subject Code: BIOL - Biology

Course Number: 586

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Medical Biochemistry

Banner Title: Medical Biochemistry

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May only be taken once for credit, limited to 2 attempts (N2)

Max Allowable Credits: 6

Default Grade Mode: Graduate Regular

Recommended Prerequisite(s):

Successful completion of Organic Chemistry I and Organic Chemistry II (minimum grade of C) or equivalent courses.

Recommended Corequisite(s):

None

Required Prerequisite(s) / Corequisite(s) (Updates only):

None

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

Biochemistry involves the study of the molecular composition of living cells, the organization of biological molecules within the cell, the structure and function of these biological molecules and the relationship between structure and function.

Methods and approaches used in this course will be correlated with the biochemical basis of human disease.

Justification:

o What: Creating a new course.

o Why: The course has been offered as selected topics for several semesters and has been very successful. The new course would be open to graduate students, and to undergraduate students with permission.

Does this course cover material which crosses into another department? No

Learning Outcomes:

Upon successful completion of the didactic portion this course, the learner will be able to:

1. Create correct representations of 3D structure of biomolecules and spatial arrangement of functional groups
2. Describe the relationship between structure and function for main classes of biomolecules such as proteins, carbohydrates, nucleic acids and lipids.
3. Describe the roles of different classes of biomolecules in metabolism and the regulation and coordination of major metabolic pathways
4. Apply principles of inter and intramolecular interactions, enzyme catalysis, and structural analysis to biochemical reactions.
5. Analyze mechanism of enzymatic reactions and predict the products.
6. Identify molecular and biochemical basis of human disease states and explain biochemical mechanisms of disease.

Will this course be scheduled as a cross-level cross listed section?

Attach Syllabus

BIOL 586 Medical Biochemistry Syllabus.pdf

Additional Attachments

Staffing:

Dr. Yuliya Dobrydneva

Relationship to Existing Programs:

This course is currently used as an elective and will be included in the list of course options for General track, Microbiology & Infectious Disease, Cell & Molecular, Neuroscience, and Translational & Clinical Research concentrations for MS Biology, and MID and CMB concentrations for PhD Biosciences programs.

Relationship to Existing Courses:

None

Additional Comments:

Reviewer Comments

Jennifer Bazaz Gettys (jbazaz) (05/05/23 11:42 am): Rollback: I'm helping Dr. Hakami set up a SSB Curriculum Committee step in CIM. It'll be a little while before it's created, though- please have this course run through that committee before coming to the COSCC. Thanks!

Key: 17955

Medical Biochemistry (3 credits)

Instructor: Yuliya Dobrydneva, Ph.D.
Time: 7.20 – 10.00 pm every Wednesday
Class meets online via zoom. Link to the class is on Bb in the Zoom tab on the left.

Bulletin Description: Biochemistry involves the study of the molecular composition of living cells, the organization of biological molecules within the cell, the structure and function of these biological molecules and the relationship between structure and function. Methods and approaches used in the present course will be correlated will the biochemical basis of human disease.

Number of Credit(s): 3

Prerequisites: Successful completion of one of the following courses (minimum grade of C)
Organic Chemistry I and Organic Chemistry II or equivalent courses
Or Biology 213 and General chemistry I
or Physiology or equivalent course
or Cell Biology course or equivalent
Or undergraduate biochemistry

Overall Course Learning Objectives:
The course is focused on medial biochemistry aspects in human disease, including symptoms, diagnosis, treatment modalities, pharmaceutical drugs, and prevention strategies.
The course is divided into two units.
The first unit examines the structure of clinically important cellular proteins and enzymatic catalysis with examples relevant to human diseases. The second unit focuses on the metabolism of human cells, the use of complex biomolecules as energy sources, the synthesis of key cellular components and intercellular signaling molecules, with an emphasis on hormones, and the pathophysiological changes resulting from the genetic error and the metabolic changes.

Upon successful completion of the didactic portion this course, the learner will be able to:

- Create correct representations of 3D structure of medically relevant biomolecules and spatial arrangement of their functional groups
- Describe the relationship between structure and function for main classes of biomolecules such as proteins, carbohydrates, nucleic acids and lipids, with pathophysiologicaly relevant examples.
- Describe the roles of different classes of biomolecules in human metabolism, compare and contrast health vs disease, and the regulation and coordination of major metabolic pathways
- Apply principles of inter and intramolecular interactions, enzyme catalysis, and structural analysis to medically relevant biochemical reactions and pharmaceutical drugs .
- Analyze mechanism of medically relevant enzymatic reactions and predict their products and functional consequences.

- Identify molecular and biochemical basis of human disease states and explain biochemical mechanisms of disease

Required Text: Biochemistry: Jeremy M. Berg, John L. Tymoczko and Lubert Stryer 9th edition (2019).≥

Components of the Final Grade:

Weekly quizzes, weighted evenly 20%
Exam I 20%
Exam II 20%
Exam III 20%
Final Exam (cumulative) 20%

- All exams, assessments and quizzes are administered via Bb only! Please be sure that you are proficient in basic functionality of Bb
- Course announcements are the main way to communicate with the class. Please be sure that your email is set up to receive announcements from GMU Bb.
- **All exams and quizzes are open book, open notes, open everything and untimed**
- The final exam will be given according to the university schedule.
- Important: **Exams are not repeatable. When you sign up for this class, you are committing to come to the class for exams.**
- Final exam will be administered during the finals week (TBA)

Grading: Students will receive a letter grade based on a 100-pointscale. An A+ is not awarded as a final grade. **No extra credit is allowed in this course!**

Letter grades for the course will be assigned as follows:

Letter grades for the course will be based on an overall % for the course and assigned as follows:
≥92 A
≥90 A-
≥87 B+
≥84 B
≥77 B-
≥ 60 C
F below 60

Grades will not be rounded up. Therefore, if you receive a grade of 76.99, your grade will be C, not a B-.
This graduate course is non-repeatable (NR)

Expectations:

- Let Dr. Dobrydneva know of your needs and constraints as early as possible **prior** to the assignment due dates.
- Notify Dr. Dobrydneva during the first week of the semester regarding course schedule conflicts due to military obligations and/or religious observances.

- **Any notifications beyond the first week of classes or after the exam/quiz due date has passed may not be approved and grade of zero will be entered.**

LATE POLICY: PLEASE READ CAREFULLY!

- Students should make every effort to submit/complete assignments on time.
- ***Any assignment that is not turned in on time, without prior arrangements with the instructor, will result in a zero grade for this assignment***
- Any arrangements to extend a deadline for an assignment must be made prior to the deadline.
- No extension will be granted after the deadline.
- Each student is allowed maximum of two (2) extensions per semester. Other requests may not be granted and grade of zero will be entered
- Any assignment/assessment that has not been completed by the end of the semester will receive a grade of zero.

Required Equipment –Since this is an online course and all assessments are complete through the computer, you need to have a computer with a **reliable** internet connection**.**

Technology Requirements: ***It is a student's responsibility to ensure access to a reliable internet for quizzes, exams and lectures.***

- **Hardware**: You will need access to a Windows or Macintosh computer with at least 2GB of RAM and access to a fast and reliable broadband internet connection (e.g., cable, DSL). A larger screen is recommended for better visibility of course material. You will need speakers or headphones to hear recorded content and a headset with a microphone is recommended for the best experience. For the amount of Hard Disk Space required, when taking a distance education course, consider and allow for:
  1. the storage amount needed to install any additional software and
  2. space to store work that you will do for the course.

If you consider the purchase of a new computer, please go to Patriot Tech to see recommendations.

- **Software**: Many courses use Blackboard as the learning management system (LMS). You will need a browser and operating system that are listed compatible or certified with the Blackboard version available on the myMason Portal . See supported browsers and operating systems. Login to myMason to access your registered courses. Some courses may use other learning management systems. Check the syllabus or contact the instruct for details. Online courses typically use Acrobat Reader, Flash, Java, and Windows Media Player, QuickTime and/or Real Media Player. Your computer should be capable of running current versions of those applications. Also, make sure your computer is protected from viruses by downloading the latest version of Symantec Endpoint/Anti-Virus software for free here.
  - Students owning Macs or Linux should be aware that some courses may use software that only runs on Windows. You can set up a mac computer with Boot

Camp or virtualization software so Windows will also run on it. Watch this video about using Windows on a Mac. Computers running Linux can also be configured with virtualization software or configured to dual boot with Windows. Note: If you are using an employer-provided computer or corporate office for class attendance, please verify with your systems administrators that you will be able to install the necessary applications and that system or corporate firewalls do not block access to any sites or media types.

NOTICE OF MANDATORY REPORTING OF SEXUAL ASSAULT, SEXUAL HARASSMENT,
INTERPERSONALVIOLENCE, AND STALKING As a faculty member, I am designated as a "Non-Confidential Employee," and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, and stalking to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-993-3686 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu. OFFICE OF DISABILITY SERVICES If you are a student with a disability and you need academic accommodations, please see me and also contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu ACADEMIC INTEGRITY Students must be responsible for their work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be a foundation of our university culture (Office of Academic Integrity). HONOR CODE and VIRTUAL CLASSROOM CONDUCT Students must adhere to the guidelines of the George Mason University Honor Code (Honor Code). We value critical thinking, and therefore, students must read the assigned material (e.g., books, articles) before the class with a critical eye. Active thought, quality of inputs, and a conflict resolution attitude should be your guiding principles. The principle of academic integrity is taken very seriously, and violations are treated gravely. OTHER USEFUL CAMPUS RESOURCES : WRITING CENTER: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu UNIVERSITY LIBRARIES "Ask a Librarian" http://library.gmu.edu/ask COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS): (703) 993-2380; http:// caps.gmu.edu UNIVERSITY POLICIES The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/. All members of the university community are responsible for knowing and following established policies.
Family Educational Rights and Privacy Act (FERPA) The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the 'Buckley Amendment,' is a federal law that gives protection to student educational records and provides students with certain rights. https://registrar.gmu.edu/ferpa/

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Schedule Spring 2022 Medical Biochemistry BIOL 508

Schedule may be subject to change! Please stay tuned for the announcements.

Week	Lecture dates	Assignment
Week 1		Lecture Enzymes Weekly quiz
Week 2		Lecture Enzyme kinetics Weekly quiz
Week 3		Lecture Hemoglobin Weekly quiz
Week 4		Lecture Enzyme regulation Weekly quiz
Week 5		**Exam 1**
Week 6		Lecture Metabolism overview Weekly quiz
Week 7		Lecture Glycolysis Weekly quiz
Spring break		**No classes**
Week 8		Lecture Krebs Weekly quiz
Week 9		Lecture Oxphos Weekly quiz
Week 10		**Exam 2**
Week 11		Lecture Glycolysis/gluconeogenesis Weekly quiz
Week 12		Lecture PPP. Lipids. Weekly quiz
Week 13		Lecture Integration metabolism Weekly quiz
Week 14		**Exam 3**
Week 15 Finals week		**Final Exam (TBA)**

Medical Biochemistry weekly schedule

Note: reading chapters are form Stryer, 8th edition.

Lecture 1 Ch.8	Enzymes: Mechanisms of Catalysis Weekly Quiz	1. Describe properties of enzymes as biological catalysts 2. Describe how Enzymes Accelerate Reactions by Facilitating the Formation of the Transition State 3. Apply classification Types of enzymatic reactions depending on the reaction mechanism 4. Describe structure and function Vitamins as Coenzymes 5. Describe types of catalytic mechanism. 6. Describe mechanism of catalysis by Serine Proteases. *Medical correlations: Serine proteases in health and disease. Pancreatic insufficiency and cystic fibrosis.* *Antibiotics: Mechanism of action of penicillin.* *Antiviral drugs: HIV-1* *Clinical vignette: covid 19*
Lecture 2 Ch.8	Enzymes: Kinetics and Inhibition Weekly Quiz	1. Explain how The Michaelis-Menten Model Accounts for the Kinetic Properties of Many Enzymes. 2. Explain how Enzymes Can Be Inhibited by Specific Molecules 3. Determine V max and K M by Double-Reciprocal Plots 4. Describe how Isozymes Provide a Means of Regulation Specific to Distinct Tissues and Developmental Stages. 5. Explain how enzymes Are Activated by Proteolytic Cleavage 6. Explain the types of Types of enzyme inhibition: reversible vs irreversible. 7. Draw and analyze Double reciprocal plots. 8. Apply Kinetics of reversible inhibition and distinguish between competitive, uncompetitive, non-competitive and Substrate inhibition. *Medical correlations: Drug discovery and development. Pharmaceutical drugs as enzyme inhibitors. Beta-blockers and heart disease.* *Clinical vignette: Estrogen receptor modulators for breast cancer*

Lecture 3 Ch.7	Enzyme regulation. Hemoglobin Weekly Quiz	1. Explain how Hemoglobin functions as an honorary enzyme. 2. Describe the mechanism of Hb Transports of Oxygen 3. Explain mechanism Cooperativity and Allosterism 4. Explain how Regulation of oxygen affinity to Hb promotes oxygen release in hypoxia. 5. Analyze Bohr effect. 6. Explain mechanism of CO poisoning. 7. Explain molecular mechanism of Sickle cell disease *Medical correlations: Anemia. Sickle cell disease. Fetal Hb. Carbon monoxide poisoning. Pusle oximetry. Variant Hb in clinical laboratory* *Clinical vignette: where did HbA1c go?*
Lecture 4 Ch.9 and 10	Enzyme regulation. Weekly Quiz	1. Explain biological basis of enzyme regulation, including feedback inhibition, allosteric control, proteolysis. 2. Explain how Aspartate Transcarbamoylase is allosterically inhibited by the end product of its pathway. 3. Explain mechanism of protein kinases 4. Explain how Serine-threonine kinases regulate signal transduction. Explain Kinase-phosphatase cascades and their reciprocal regulation. Explain second messenger system and role of cAMP and PKA. 5. Describe PKA regulation by cAMP. 6. Describe ADP ribosylation of G-proteins. 7. Explain mechanism of Proteolytic cascades and their role in digestion and blood clotting. *Medical correlations: Blood clotting cascades Bacterial infections: cholera and pertussis. Food digestion.* *Clinical vignette: Hemophilia A*
Exam I		Lectures 1-4
Lecture 5 Ch.15	Overview of Metabolism Weekly Quiz	1. Describe three Stages of catabolism. 2. Explain how ATP availability regulates metabolism. 3. Compare and contrast Anabolic vs catabolic pathways and NADP vs NADPH. *Medical correlations: Diet, Exercise and obesity.* *Clinical vignette: food diary*

Lecture 6	Glycolysis Weekly Quiz	1. Describe three stages of anaerobic glycolysis 2. Explain interconversion of glycolytic intermediates in the context of redox pathways 3. Compare and contrast hexokinase vs glucokinase 4. Describe allosteric regulation of glycolysis and main regulatory metabolites 5. Describe microbial fermentation 6. Explain mechanism of Cori cycle 7. Explain regulation of glycolysis in muscle 8. Metabolic fate of fructose and galactose *Medical correlations: Lactic acidosis in hypoxia. Inborn errors of metabolism. Warburg effect in cancer cells. PET scan.* *Clinical vignette: Pellagra*
Lecture 7 Ch.17	Krebs cycle Weekly Quiz	1. Describe Aerobic catabolism of pyruvate. 2. Describe PDH complex, reaction sequence and cofactors and clinical forms of PDH deficiency. 3. Describe a biochemical basis of TCA. 4. Describe and name main Enzymes of TCA cycle. 5. Predict ATP yield in TCA cycle. 6. Explain the Regulation of TCA cycle. 7. Describe how Anaplerotic reactions regenerate TCA cycle intermediates. 8. Describe application avidin and biotin in biomedicine *Medical correlations: inborn errors of metabolism. Pyruvate dehydrogenase deficiency. Beri-beri. Arsenic poisoning.*
Lecture 8 Ch.18	Ox-phos Weekly Quiz	1. Describe the function of Oxidative phosphorylation and electron transfer chain. 2. Explain the biochemical foundation of Chemiosmotic hypothesis. 3. Describe organization of Respiratory complexes in mitochondria. 4. Explain how Electron transport is coupled to ATP synthesis. 5. Describe molecular mechanism of ATP synthase. 6. Explain molecular mechanism of Regulation of ox-phos. *Medical correlations: Respiration. Toxins and poisons. Non-shivering thermogenesis and diet pills.* *Clinical vignette: Fredreich Ataxia*
	Exam II	Lecture 5-8

Lecture 9 Ch.16,21	Glucose homeostasis Weekly Quiz	1. Compare and contrast Glycolysis and gluconeogenesis. 2. Explain Reciprocal regulation of glycolysis vs gluconeogenesis in liver. 3. Describe stages of Glycogen metabolism. 4. Describe Metabolic fate of glucose-6-phosphate. 5. Describe the Reciprocal regulation of glycogen metabolism and degradation. 6. Compare and contrast Glycogen phosphorylase vs glycogen synthase. 7. Describe action of Bicyclic cascades. 8. Explain molecular mechanism of Insulin action. *Medical correlations: Glucose homeostasis in liver vs muscle. Diabetes. Glycogen storage diseases.* *Clinical vignette: discovery of insulin*
Lecture 10 Ch.20	Pentose phosphate pathway Weekly Quiz	1. Describe biochemical role of PPP, or hexose monophosphate shunt. Explain G-6-P dehydrogenase deficiency in erythrocytes. 2. Describe biochemical role of Glutathione. Medical correlations: *Hereditary diseases. Hemolytic anemia. Glucose-6-Phospahte dehydrogenase deficiency* *Clinical vignette: Favism*
Lecture 11 Ch.22	Lipids. Weekly Quiz	1. Explain the role of Fatty acids and triacyl glycerols as a source of energy. 2. Describe Metabolic fate of fat. 3. Compare and contrast Fatty acid degradation vs synthesis. 4. Define Distinct pathways and cofactors of FA acid degradation and synthesis. 5. Describe molecular mechanism of Beta-oxidation. Describe biological role of Phospholipids, Arachidonic acid and eicosanoids. 6. Explain Regulation of FA metabolism. 7. Explain biological mechanism of Fasting and Diabetes. 8. Describe biological role of Ketone bodies. Medical correlations: *Atherosclerosis. Obesity. Pain and inflammation. Non-steroidal anti-inflammatory drugs (NSAIDs). Marijuana and THC in CNS* *Clinical vignette: Meldonium doping scandal*

Lecture 12 Ch. 27,	Metabolic regulation	1. Explain Metabolic regulation of energy homeostasis. 2. Compare and contrast Fate of dietary glucose, FA and a/a in fed vs fasting vs starved state. 3. Describe biochemistry of Fuel metabolism of the major organs. Compare and contrast how Insulin vs glucagon maintain fuel homeostasis. 4. Describe the Metabolic fate of glycolytic intermediates. Medical correlations: *Fasting, starvation and diabetes. Diabetic ketoacidosis. Obesity. Keto-diet vs low-fat diet.*
Exam III		Final, cumulative