



## INSTRUCTOR INFORMATION

Instructor: Dr. **Narasimha Sreerama** (Sree)

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Communication Policy: Responses to emails will be provided within 24 hours

Office hours: **30 min before class** (7:20 AM) and by appointment

## PREREQUISITES FOR COURSE

BZ 110 or BZ 120 or LIFE 102) and (CHEM 241 or CHEM 245 or CHEM 341 or CHEM 345)

## COURSE DESCRIPTION & OBJECTIVES

Structure and function of biological molecules; biocatalysis; metabolism and energy transduction.

Upon the completion of this course, students will be able to:

1. Describe the structure and function of biological molecules and the chemical basis of life.
2. List and explain the intermolecular forces that govern the biochemical processes.
3. Describe the composition of proteins and nucleic acids.
4. Characterize and explain different levels of structures of proteins and nucleic acids.
5. Describe the molecular processes of Central Dogma.
6. Characterize biochemical reactions and proteins as biocatalysts.
7. Outline and explain the composition of biological membranes and the nature of transmembrane transport
8. Describe the different stages of cellular metabolism. Sketch the pathways and steps in: glycolysis, pentose phosphate pathway, citric acid cycle, oxidative phosphorylation.
9. Identify and link key metabolites in carbohydrate, fatty acid and amino acid metabolism.
10. Identify and characterize important aspects of metabolic regulation.

## TEXTBOOK / COURSE READINGS

**Lehninger Principles of Biochemistry**, 7th Edition, by Nelson and Cox, W.H. Freeman and Company, New York (ISBN-13: 978-1464187964)

**But any biochemistry text should work** - you will have to search for topics. A free searchable book provided by NIH is available here: <https://www.ncbi.nlm.nih.gov/books/NBK21154>

## COURSE MATERIALS & EQUIPMENT

Course content will be placed on Canvas. A Laptop or a PC and internet to access Course Material is needed. **Quizzes** will be on Canvas (**Online, open-note, computer/internet needed**). **Exams are currently planned to be taken online** (**Online, open-note, computer/internet needed**). *Let me know if that is not acceptable and you will need to take it in class*

Lectures (Slides and Supplemental Information) are posted one module at a time. Please keep up with the pace of the course, about 4 lectures per week and regular Quizzes and Exams.

## PARTICIPATION/BEHAVIORAL EXPECTATIONS

Students are expected to access Canvas regularly for course related activities. Students are expected to pay attention to announcements on Canvas and spend approximately 12 hours per week on course activities. **Students are expected to take Quizzes Online during weekends. Students are expected to take exams in a specified time-window (currently planned Online).** There will be a total of 10 quizzes and 4 exams. *Please review the [core rules of netiquette](#) for some guidelines and expectations on how to behave in an online learning environment.*

## COURSE POLICIES (LATE ASSIGNMENTS, MAKE-UP EXAMS, ETC.)

There will be a total of 10 quizzes and 4 exams. All assignments must be completed on time. **Late assignments: Generally not accepted.** Contact instructor in case of emergencies (I forgot, I submitted a wrong Quiz, I had to walk the dog, etc. are not emergencies).

## GRADING POLICY (Grades may be curved and +/- Grades may be awarded at instructor's discretion)

Grade	Range
A	100% to 90%
B	89.9% to 80%
C	79.9% to 70%
D	69.9 %to 60.0%
F	Below 60%

As a student enrolled in this course, one of your responsibilities is to submit course work by the due dates listed in Canvas. With that said, I take my role as your instructor very seriously, and, in fact, I care about how well you do in this course and that you have a satisfying, rewarding experience. To that end, it is my commitment to you to respond individually to the work you submit in this class and to return your work in a timely manner. Quizzes will be online and will be returned within 24 hrs after the due date. Exams will be returned within 24 hours.

ASSIGNMENT	GRADE POINTS	GRADE PERCENTAGE
Weekly Quizzes (10 quizzes, 10 pts each)	100	20%
3 Mid-Term Exams (100 pts each)	300	60%
Final Exam (100 pts)	100	20%
<b>Total:</b>		<b>100 %</b>

\*Keep a copy of all work created for the course, including work submitted through Canvas course learning management system.

## WEEKLY SCHEDULE

Below is the tentative schedule of topics and reading assignments. Use them in conjunction with the Lectures (posted on Canvas) and Problems (Homework problems and Problem sets, for self-assessment, posted on Canvas).

**Reading:** Page Numbers given below are approximate. You may use any Biochemistry text and find these topics therein.

**Lecture Slides/Notes:** *The slides for each lecture or a block of lectures will be provided. Meant to be a guide – Use text, homework problems, and problem sets to learn and apply yourself.*

Week	Topic
<b>Module 1: Introductory (Review) Topics and Central Dogma</b>	
Week 1	Introduction; Biomolecules; Building Blocks; Chemical Basis of Life; Thermodynamics; $\Delta H$ , $\Delta G$ ; $\Delta G^\circ$ and $K_{eq}$
Week 2	Oxidation Number; Functional Groups; Water and Polar/Nonpolar groups; Noncovalent Interactions; pH, pK and acid/base forms; Buffers
Week 3	Central Dogma; Nucleic Acids – DNA/RNA; Nucleotides and Ribose; Chargaff's Rules; DNA/RNA Structure and Function
Week 4	Gene and Gene Expression; Genetic Code and Translation; Silent and Missense Mutations; DNA Stability; DNA sequencing
<b>Exam 1 (Introduction – DNA Sequencing)</b>	

<b>Module 2: Genetic Engineering and Protein Structure/Function</b>	
Week 5	PCR; Recombinant DNA – Plasmids and Cloning; Blue/White Screening; DNA Libraries; Gene Alteration;
Week 6	Proteins – Classes, Composition, Hierarchical Structures; Amino Acids – R-Groups, Classes, Charges; Secondary Structures and Salt-links;
Week 7	Ramachandran Plot; Sequence to Secondary Structure Rules; Tertiary and Quaternary Structures; Protein Folding – Principles and Energetics; Protein Purification; Protein Sequencing
Week 8	Protein Function – Myoglobin and Hemoglobin; Oxygen Binding and Delivery; T and R states; Hb Mutations and Oxygen binding
<b>Exam 2 (PCR – Hb/Mb Function)</b>	

<b>Module 3: Muscle Contraction, Membranes and Enzymes</b>	
Week 9	Cytoskeletal Proteins and Muscle Contraction; Lipids – Storage and Membrane Lipids; Membrane Structure; Membrane Proteins;
Week 10	Membrane Transport; Enzymes – Names, Models, and Free energy Profile; Enzyme Kinetics – $K_m$ and $k_{cat}$ ; Serine Proteases – Specificity Mutations
Week 11	Serine Proteases – Reaction Mechanism; Enzyme Regulation; Reaction Classes
Week 12	Metabolism – Intermediates, Pathways, Flux, Energy; Redox and Cofactors; Carbohydrates – mono and polysaccharides; Glucose Metabolism
<b>Exam 3 (Muscle Contraction – Intro to Metabolism)</b>	

Week	Topic
<b>Module 4: Metabolism</b>	
Week 13	Glycolysis – Phases, Reactions, Intermediates, Yield; Gluconeogenesis and PPP – Summary; Fates of Pyruvate
Week 14	PDH and TCA – Summary; Oxidative Phosphorylation – ETC and ATP synthesis; P:O Ratio; Uncoupling; Photophosphorylation
Week 15	Fatty Acids – HDL, LDL, Ketone Bodies; $\beta$ -Oxidation – ATP yield; N-metabolism – Ketogenic and Glucogenic amino acids; Interconversion of Nutrients;
<b>Final Exam (Glycolysis – Metabolic Integration)</b>	

TEXTBOOK / COURSE READINGS Page Numbers from **Lehninger Principles of Biochemistry** are Approximate. You can search for specific topics in the free book provided by NIH:

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

<p><b>Introductory Topics:</b> Please read Chapters 1 and 2 in full. There are a few topics that we will not discuss, but they help you understand the foundations.</p>
<p><b>Nucleic Acids:</b> List of specific topics and page numbers from Book are listed below. The page numbers from previous editions are in the Lecture Slides Central Dogma – <b>p955</b>; Covalent Structure of nucleotides – <b>pp279-284</b>; Chargaff's Rules – problem <b>pp8-22 (p316)</b>; 3-D structure of DNA – <b>pp285-289</b> 3-D structure of RNA – <b>pp292-294</b>; Gene Structure – <b>pp958-962</b> RNA Splicing, Rev transcription – <b>p1054, p1064</b> Genetic Code, in vitro/in vivo translation – <b>pp1078-1086</b> DNA stability – pp295-296; Sanger's sequencing – <b>pp301-307</b>; PCR – <b>pp301-302</b> Genomics (genetic eng.) – <b>pp319-328; pp330-332; p335</b>; Cystic fibrosis – <b>pp419-420</b>;</p>
<p><b>Proteins:</b> Basics and covalent structure – <b>pp75-88; pp96-97</b>; 3-D structure of proteins – <b>pp115-124, pp130-131</b>; Fibrous proteins – <b>pp125-131</b> Protein denaturation/folding – <b>pp142-144</b>; Protein purification – <b>pp92-95</b> Protein sequencing – <b>pp97-100</b>; Protein function (Mb/Hb) – <b>pp157-166; pp169-173</b> Muscle Contraction <b>pp179-183</b></p>
<p><b>Lipids and Membranes:</b> Lipids – <b>pp361-371</b>; Membranes – <b>pp387-399</b>; Membrane Transport – <b>pp405-413; p427</b></p>
<p><b>Enzymes:</b> Enzymes Basics – <b>pp187-196</b>; Enzyme Kinetics – <b>pp190-204; pp207-210</b> Chymotrypsin Mechanism – <b>pp213-218</b>; Enzyme Regulation – <b>pp225-227</b></p>
<p><b>Biochemical Reactions and Intro to Metabolism:</b> Biochemical Reactions – <b>pp197-198; pp501-513</b>; Carbohydrates – <b>pp241-257</b> Glucose Metabolism – <b>pp533-534</b> Glycolysis, PPP, and other topics: <b>Use supplemental Notes Provided</b></p>

## QUIZ AND EXAM SCHEDULE

**Quizzes** (weeks 2, 3, 4, 6, 7, 8, 10, 11, 12, and 14; Dates are given below) will start at **Noon (12 PM) on Friday and end at Noon (12 PM) Sunday**. Quizzes will be on Canvas (**10 Q, 1 attempt, 30 min**). A practice Quiz for each of the Quizzes will be provided.

**Exams** will be on Mondays of Weeks 5, 9, 13 and 16 (Dates are given below). **Exams** will be on a block of lectures (**45 Q, 100 pt, 75 min**, see Sample Exams for details; Dates are given below). At this point they are offered online (on Canvas, open note, open during a **6 hr window – 6 AM – Noon**). *If you want to take it in class let me know.* **Exam Q&A sessions planned for Sunday 5 PM.**

Quiz and Exam Schedule				
	QUIZ	EXAM	Quiz Dates	Exam Date
Module 1 (Weeks 1 – 4)	Quiz 1		Fri, Sept 3 – Sun, Sept 5	
	Quiz 2		Fri, Sept 10 – Sun, Sept 12	
	Quiz 3		Fri, Sept 17 – Sun, Sept 19	
		Exam 1		Sept 20 (Monday)
Module 2 (Weeks 5 – 8)	Quiz 4		Fri, Oct 1 – Sun, Oct 3	
	Quiz 5		Fri, Oct 8 – Sun, Oct 10	
	Quiz 6		Fri, Oct 15 – Sun, Oct 17	
		Exam 2		Oct 18 (Monday)
Module 3 (Weeks 9 – 12)	Quiz 7		Fri, Oct 29 – Sun, Oct 31	
	Quiz 8		Fri, Nov 5 – Sun, Nov 7	
	Quiz 9		Fri, Nov 12 – Sun, Nov 14	
		Exam 2		Nov 15 (Monday)
Module 4 (Weeks 13 – 15)	Quiz 10		Fri, Dec 3 – Sun, Dec 5	
		Finals		Dec 13 (Monday)

### Important information for students on COVID-19

All students are required to follow public health guidelines in any university space, and are encouraged to continue these practices when off-campus(es). For the latest information about the University's COVID resources and information, please visit the **CSU COVID-19 site** (<https://covid.colostate.edu/>)

### THIRD PARTY HomeWork HELPER SITES

The use of online “homework helper” sites including, but not limited to, Chegg, NoteHall, Quizlet, and Koofers is not permitted in this course. Please reach out to us (me or GTAs) to discuss if a specific service you are thinking about using for this course is acceptable.

Use of these types of resources will be considered receiving unauthorized assistance and, therefore, a violation of the student conduct code. Using them may result, at the discretion of the instructor, in a zero for the course, assignment, quiz, or exam. All incidents of this type will be referred to the CSU Student Resolution Center and may be subject to additional University disciplinary action.

## CANVAS INFORMATION & TECHNICAL SUPPORT

Canvas is the where course content, grades, and communication will reside for this course.

- [Login for Canvas](#)
- [Canvas Support](#)
- For passwords or any other computer-related technical support, contact the [Central IT Technical Support Help Desk](#).
  - (970) 491-7276
  - [help@colostate.edu](mailto:help@colostate.edu)

The [Technical Requirements](#) page identifies the browsers, operating systems, and plugins that work best with Canvas. If you are new to Canvas quickly review [the Canvas Student Orientation](#) materials.

## ACADEMIC INTEGRITY & CSU HONOR PLEDGE

This course will adhere to the CSU [Academic Integrity/Misconduct](#) policy as found in the General Catalog and the [Student Conduct Code](#).

Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, I will ask that you affirm the CSU Honor Pledge as part of completing your work in this course.

Further information about Academic Integrity is available at CSU's [Academic Integrity - Student Resources](#).

## UNIVERSAL DESIGN FOR LEARNING/ACCOMMODATION OF NEEDS

I am committed to the principle of universal learning. This means that our classroom, our virtual spaces, our practices, and our interactions be as inclusive as possible. Mutual respect, civility, and the ability to listen and observe others carefully are crucial to universal learning.

If you are a student who will need accommodations in this class, please contact me to discuss your individual needs. Any accommodation must be discussed in a timely manner. A verifying memo from [The Student Disability Center](#) may be required before any accommodation is provided.

The Student Disability Center (SDC) has the authority to verify and confirm the eligibility of students with disabilities for the majority of accommodations. While some accommodations may be provided by other departments, a student is not automatically eligible for those accommodations unless their disability can be verified and the need for the accommodation confirmed, either through SDC or through acceptable means defined by the particular department. Faculty and staff may consult with the SDC staff whenever there is doubt as to the appropriateness of an accommodative request by a student with a disability.

The goal of SDC is to normalize disability as part of the culture of diversity at Colorado State University. The characteristic of having a disability simply provides the basis of the support that is available to

students. The goal is to ensure students with disabilities have the opportunity to be as successful as they have the capability to be.

Support and services are offered to student with functional limitations due to visual, hearing, learning, or mobility disabilities as well as to students who have specific physical or mental health conditions due to epilepsy, diabetes, asthma, AIDS, psychiatric diagnoses, etc. Students who are temporarily disabled are also eligible for support and assistance.

Any student who is enrolled at CSU, and who self-identifies with SDC as having a disability, is eligible for support from SDC. Specific accommodations are determined individually for each student and must be supported by appropriate documentation and/or evaluation of needs consistent with a particular type of disability. SDC reserves the right to ask for any appropriate documentation of disability in order to determine a student's eligibility for accommodations as well as in support for specific accommodative requests. The accommodative process begins once a student meets with an accommodations specialist in the SDC.

### THIRD-PARTY TOOLS/PRIVACY

Please note that this course may require you to use third-party tools (tools outside of the Canvas learning management system), such as Skype and others. Some of these tools may collect and share information about their users. Because your privacy is important, you are encouraged to consult the privacy policies for any third-party tools in this course so that you are aware of how your personal information is collected, used and shared.

### COPYRIGHTED COURSE MATERIALS

Please do not share material from this course in online, print, or other media. Course material is the property of the instructor who developed the course. Materials authored by third parties and used in the course are also subject to copyright protections. Posting course materials on external sites (commercial or not) violates both copyright law and the CSU Student Conduct Code. Students who share course content without the instructor's express permission, including with online sites that post materials to sell to other students, could face appropriate disciplinary or legal action.

### UNDOCUMENTED STUDENT SUPPORT

Any CSU student who faces challenges or hardships due to their legal status in the United States and believes that it may impact their academic performance in this course is encouraged to visit [Student Support Services for Undocumented, DACA & ASSET](#) for resources and support. Additionally, only if you feel comfortable, please notify your professor so they may pass along any additional resources they may possess.

### TITLE IX/INTERPERSONAL VIOLENCE

For the full statement regarding role and responsibilities about reporting harassment, sexual harassment, sexual misconduct, domestic violence, dating violence, stalking, and the retaliation policy please go to: [Title IX – Sexual Assault, Sexual Violence, Sexual Harassment](#).

If you feel that your rights have been compromised at CSU, several resources are available to assist:

- Student Resolution Center, 200 Lory Student Center, 491-7165
- Office of Equal Opportunity, 101 Student Services, 491-5836

A note about interpersonal violence: If you or someone you know has experienced sexual assault, relationship violence and/or stalking, know that you are not alone. As instructors, we are required by law to notify university officials about disclosures related to interpersonal violence. Confidential victim advocates are available 24 hours a day, 365 days a year to provide support related to the emotional, physical, physiological and legal aftermath of interpersonal violence.

Contact the Victim Assistance Team at: 970-492-4242.

## RELIGIOUS OBSERVANCES

CSU does not discriminate on the basis of religion. Reasonable accommodation should be made to allow individuals to observe their established religious holidays. Students seeking an exemption from attending class or completing assigned course work for a religious holiday will need to fill out the [Religious Accommodation Request Form](#) and turn it in to the Division of Student Affairs, located on the second level of the Administration building.

Once turned in, the Division of Student Affairs will review the request and contact the student accordingly. If approved, the student will receive a memo from the Dean of Students to give to their professor or course instructor.

Students are asked to turn in the request forms as soon as the conflict is noticed. Similarly, unanticipated conflicts requiring a religious observance, such as a death in the family, can also be reviewed.

## CSU PRINCIPLES OF COMMUNITY

**Inclusion:** We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents and contributions.

**Integrity:** We are accountable for our actions and will act ethically and honestly in all our interactions.

**Respect:** We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge.

**Service:** We are responsible, individually and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities.

**Social Justice:** We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

## DIVERSITY AND INCLUSION

The [Mission, Vision, and Focus](#) webpage of the Vice President for Diversity includes a comprehensive statement of CSU's commitment to diversity and inclusion.

This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog – 1.6, pages 7-9

(<http://www.catalog.colostate.edu/Content/files/2012/FrontPDF/1.6POLICIES.pdf>) and the Student Conduct Code (<http://www.conflictresolution.colostate.edu/conduct-code>). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.