Meeting times for the first week: Mon 1/8 12-1, Wed 12-1:30, Friday 1:30-3:00 (WID 330)
Rest of the class: MWF 8:30-9:30am in the library (WID 330)

OFFICE HOURS:
By appointment.

GOALS:
This course is part of the core graduate level biochemistry courses offered at USU. This section will focus on regulatory processes occurring in both prokaryotic and eukaryotic systems. This will include coverage of protein, nucleic acid, and small molecule mechanisms that occur in Nature as well as synthetic methods based on these processes.

MEETINGS
The lecture days and times will be established during the first week of classes. In scheduling the class meeting times, first priority will be to accommodate biochemistry graduate students.

TEXT:
A current biochemistry text book such as Lehninger Principles of Biochemistry, by Nelson and Cox is recommended as background reading. Content beyond the textbook level will be drawn from a variety of specialty books, current review articles, and the primary literature. Materials for the course, including literature, will be available on the course Canvas page.

PREREQUISITES:
A full year of undergraduate organic chemistry; a full year of undergraduate biochemistry (comparable to CHEM 5700-5710 at USU), with physical chemistry recommended.

ONLINE INFO:
Classroom handouts, class standings, exam keys, etc. will be available on the course Canvas page at canvas.usu.edu. Username = banner ID; password = banner pin.

EXAMS:
There will be two examinations worth 150 points each during the course. Missed exams will be scored as a zero. Make-up exams are possible only for excused absences by appointment. Exams are a combination of open book/notes and closed book in class. Exams will take place outside of the normal class period—scheduling will be done on a person-by-person basis.

Class projects:
There are three class projects that feed into one another. Complete the first, and I’ll give you the second. Complete the 2nd and I’ll give you the third.

GRADING:
Grading is based on the points earned on the exams, participation and class projects.

Two exams @ 110 points each ......................... 220 points
In class participation ..................................... 50 points

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Total .......................... 270 points

ASSESSMENT:
Assessment of the course will include the University online IDEA evaluation conducted at the end of the course. Information from the evaluation will be used to improve the course.

PROVISIONS: This course will adhere to the USU Academic Policies and Procedures Manual found at the web site http://www.usu.edu/policies/ and in the student code http://www.usu.edu/studentservices/studentcode/. Any student with a disability who requires accommodation must contact the instructor. The disability must be documented by the Disability Resource Center. Course materials may be requested in alternative formats.
<table>
<thead>
<tr>
<th>Date</th>
<th>Topics</th>
<th>Read (name of article)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 8</td>
<td><strong>Introduction and review of central dogma, regulation</strong></td>
<td>Protein domains Science</td>
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</tbody>
</table>
| Jan 10     | **Protein domains**  
Protein interactions/methods       |                                                                                         |
| Jan 12     | Protein switches  
Moonlighting                     | **STUDENT DISCUSSION: Dueber, JE signaling switch...Science**  
A protein therapeutic modality ... PNAS  
Briesewitz borrowing surfaces |
| Jan 15, 17, 19 | **Non-coding RNAs**  
RNAi, RNAa, LncRNAs  
Pseudogenes  
Riboswitches  
CRISPR  
aptamers      | miRNA siRNA  
MicroRNAs in cancer review (do not worry about the specific role of each miRNA)  
A ceRNA hypothesis  
Genetic control by riboswitches  
SAM riboswitch Nature  
Aptamer review  
**STUDENT DISCUSSION: A modular and extensible RNA-based platform** |
| End of 2nd week | **EXAM 1** | **Schedule a 2 hour block for Exam 1** |
| Jan 22, 24, 26 | **Posttranslational modifications**  
Phosphorylation in eukaryotes and prokaryotes,  
Identification using SILAC,  
Glycosylation and metabolic labeling | PTM walsh1  
PTMWalsh2  
Rational design of inhibitors  
Abl Harrison review  
Dissecting the insulin pathway using stable isotope labeling and MS  
**STUDENT DISCUSSION: McsB**  
SILAC  
Detection of insulin signaling  
Glycosylation review  
Bertozzi metabolic labeling |
| **Oxidative stress redox chemistry** | Mir1 alpha  
**Pathogen manipulation** |
| **EXAM 2** | | **Schedule a 2 hour block for Exam 2** |
Reading Articles (be prepared to DISCUSS in class the articles in orange)

Protein domains/switches

Protein domains Pawson Science review
Duebner et.al, use of proteins domains as molecular switches
Briesewitz borrowing surfaces

RNAs

miRNA siRNA
MicroRNAs in cancer review (do not worry about the specific role of each miRNA)
A ceRNA hypothesis
Genetic control by riboswitches
SAM riboswitch Nature
Aptamer review
A modular and extensible RNA-based platform

Posttranslational modifications-Phosphorylation and Glycosylation examples in depth
PTM walsh1
PTMWalsh2
Rational design of inhibitors
Abl Harrison review
Dissecting the insulin pathway using stable isotope labeling and MS
McsB
SILAC
Detection of insulin signaling
Glycosylation review
Bertozzi metabolic labeling

Oxidative Stress
HIF1alpha
Oxygen sensing at the mitochondria

Concepts you will learn:

1. Regulatory mechanisms used by eukaryotes and prokaryotes to control replication, transcription, translation, half-life of proteins, and activity of proteins. These processes affect virulence, cell division, and the general health of a cell.

2. Methodologies: Click chemistry, metabolic labeling, mass spectrometry of proteins (SILAC, ICAT strategies), molecular biology reporters and sensors, molecular biology/biochemical standard bench experimental tools (IP, pull-down, RNAi), and protein/nucleic acid interaction tools