TENTATIVE SYLLABUS **Chemistry 6740, Spring 2018**

Cell Processes & Regulation: Cellular communication by small molecules and proteins

1 credit Prof. Joanie Hevel, W235, 797-1622, joanie.hevel@usu.edu

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
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.

TENTATIVE **Outline of Topics/Schedule/Reading material**

Date	Topics	Read (name of article)
Jan 8 Jan 10	**Introduction and review of central dogma, regulation** **Protein domains** Protein interactions/methods	Protein domains Science
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	HIF1alpha
	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

A protein therapeutic modality founded on molecular regulation (2011) *PNAS* doi: 10.1073/pnas.1102803108

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