

## Chemistry 413/569: Advanced Bioorganic Chemistry

**Instructor:** Katherine Ryan ([ksryan@chem.ubc.ca](mailto:ksryan@chem.ubc.ca))

**General Description:** This course is designed to introduce senior chemistry students with little or no background in biochemistry to the techniques and theories of modern bioorganic chemistry. Much of the course will focus on understanding the chemical strategies and mechanisms behind enzyme catalysis. Key concepts in the biosynthesis of natural products will also be presented. Students will also be exposed to "special topics" that have recently appeared in the literature. Students need to have mastered major concepts from organic chemistry (for example, stereochemistry, carbonyl chemistry, radicals, pK<sub>a</sub> values) to succeed in this course.

<b>Chemistry 413 – Undergraduate students</b>	
Problem sets	10 %
Midterm	30 %
Presentation	10 %
Final exam	50 %

<b>Chemistry 569 – Graduate students</b>	
Problem sets	10 %
Midterm	20 %
Review article	15 %
Presentation	10 %
Final exam	45 %

**Problem Sets:** Submit a single PDF file on UBC Canvas by the deadline listed below. Solutions will be posted on UBC Canvas after the deadline.

**Presentation:** All students give a short presentation (~5 minutes) on a topic in modern methods or current topic in the field. The topic should present the topic with a focus on ~3 recent papers that highlight advances in this area.

**Review Article (Chem 569 only):** Graduate students enrolled in 569 will additionally write a short review article in the format of *Current Opinion in Chemical Biology*.

**Midterm:** One midterm exam is written in-class and is based on Problem Sets 1-3.

**Final exam:** The final exam is cumulative with some emphasis on the later material.

### Preliminary Lecture Schedule:

#### Week 1:

Sept 2 (Imagine Day – no class)  
Sept 4 Introduction to enzymes as protein-based catalysts

#### Week 2:

Sept 9 Mechanisms of catalysis  
Sept 11 Michaelis-Menten kinetics

#### Week 3:

Sept 16 Inhibition kinetics; Proteases  
Sept 18 Proteases, continued  
Problem Set #1 is due

<b><u>Week 4:</u></b>	
<b>Sept 23</b>	Glycosidases and Glycosynthases
<b>Sept 25</b>	Phosphatases
<b><u>Week 5:</u></b>	
<b>Sept 30</b>	<b>(National Day for Truth and Reconciliation – no class)</b>
<b>Oct 2</b>	ATP, ligases, glycosyltransferases, and kinases
	<b>Problem Set #2 is due</b>
<b><u>Week 6:</u></b>	
<b>Oct 7</b>	NAD(P)H
<b>Oct 9</b>	FAD/FADH <sub>2</sub>
<b><u>Week 7:</u></b>	
<b>Oct 14</b>	Non-ribosomal peptide synthesis
<b>Oct 16</b>	Cytochrome P450
	<b>Problem Set #3 is due</b>
<b><u>Week 8:</u></b>	
<b>Oct 21</b>	<b>Midterm Exam</b>
<b>Oct 23</b>	Carbon-carbon bond formation
<b><u>Week 9:</u></b>	
<b>Oct 28</b>	Fatty Acid Biosynthesis and Polyketide Biosynthesis
<b>Oct 30</b>	Reactions with CO <sub>2</sub>
<b><u>Week 10:</u></b>	
<b>Nov 4</b>	Thiamine diphosphate + SAM
	<b>Problem Set #4 is due</b>
<b>Nov 6</b>	Terpenes
<b><u>Week 11:</u></b>	
<b>Nov 11</b>	<b>(Midterm Break and Remembrance Day – no class)</b>
<b>Nov 13</b>	Pyridoxal phosphate
<b><u>Week 12:</u></b>	
<b>Nov 18</b>	Alkaloids, cofactor-free isomerases
<b>Nov 20</b>	Hydratases / dehydratases
	<b>Problem Set #5 is due</b>
<b><u>Week 13:</u></b>	
<b>Nov 25</b>	Vitamin B12 and radical SAM
<b>Nov 27</b>	Special Topic 1 / Student presentations
<b><u>Week 14:</u></b>	
<b>Dec 2</b>	Special Topic 2 / Student presentations
	<b>Problem Set #6 is due</b>
<b>Dec 4</b>	Special Topic 3 / Student presentations