

2016 SJTU-UM SUMMER PROGRAM

Organized Jointly by
Zhiyuan College, Shanghai Jiao Tong University (SJTU)
and
Department of Chemistry, University of Michigan (UM)

2-credit course in Chemical Biology and Bio-Organic Chemistry

Dear Shanghai Jiao Tung University – Zhiyuan Honors College – Chemistry Students:

It is our pleasure to meet you, and to teach to you a two-cycle course about organic chemistry in a biological context. We have a two-part design for this course, which is meant to follow a standard introduction to organic chemistry.

The first part is called *“Introduction to Chemical Biology.”* Chemical Biology is an interdisciplinary discipline that involves chemistry, physics and biology. Through its application of tools and techniques, new and complex biological questions can be examined. Often this involves the synthesis and development of small molecules and/or biological molecules, and examining the effect that they have within biological systems.

The second part is called *“Bio-Organic Chemistry.”* Mechanistic organic chemistry is a powerful tool. There is no biological reaction of organic compounds that does not follow the basic rules of organic chemistry. In each of the class sessions, there will be problems that begin with a review of a fundamental area of mechanism in organic chemistry followed by an application of that area to biological molecules. The focus is on organic chemistry, not biochemistry.

The format for both sections will be seven 2-hour sessions that are driven, each day, by a problem set. The problem sets will be distributed in advance, and we will work through as many as possible the next day. Detailed discussion will follow from thinking about the questions and their solutions. Our goal for this course is to make this an interactive course, in which includes all of us communicating, discussing, presenting, and asking questions. Through this discussion, it is our goal that you will learn the fundamentals of how chemistry interfaces with biology, and be prepared for further study or work in these areas. Our approach in both sections involves a mechanistic approach to understand how the synthesis and reactions of biologically relevant molecules proceeds.

You will receive a coursepack that includes a variety of problems that we will cover throughout the course. Though the use of the coursepack, we will discuss the problems together and every class we will do the following:

- 1) Students will go to the board, and answer the questions. During this time, we will lead the discussion and encourage the student at the board to answer the question. In addition, we encourage students to ask questions of interest to the student. We expect that each student go to the board at least once. Defending and presenting a scientific answer to an audience is an important skill for any scientist.

- 2) Based on the discussion, we will spend some time presenting additional information regarding the topic of interest

- 3) Time permitting, if we finish the problems for the day, we may continue with the next topic, or we may have an additional set of "in-class" problems. We will ask students to form groups, and to propose an answer to the problem. We will ask someone from your group to go to the board and present the answer for the class.

Best Regards,



Brian P. Coppola, PhD
Arthur F. Thurnau Professor of Chemistry
Associate Chair for Educational Development & Practice



Jean-Paul Desaulniers, PhD
Associate Professor in Chemistry
Undergraduate Program Director in Chemistry

About the guest professors:

Dr. Brian P. Coppola received his B.S. degree from the University of New Hampshire and his Ph.D. in Organic Chemistry from the University of Wisconsin-Madison. Moving to Ann Arbor in 1986, he joined an active group of faculty in the design and implementation of a revised undergraduate chemistry curriculum. He was promoted to Full Professor of Chemistry in 2002. His publications include mechanistic organic chemistry research in 1,3-dipolar cycloaddition reactions, educational practice, and international cross-cultural analysis of higher education between the US and China. As Associate Chair for Educational Development and Practice, he is responsible for directing of the department's future faculty program, in which undergraduate students, graduate students, and post-doctoral associates work with faculty members on teaching and learning projects within the department's curriculum (sites.lsa.umich.edu/csie-um/). Dr. Coppola has received numerous awards for his contributions to undergraduate education.

Dr. Jean-Paul Desaulniers received his Honors B.Sc. in 2000 from Western University, and his PhD in Chemical Biology from Wayne State University in 2005. Between the years 2005-2008, he moved to the University of Michigan, where he worked under the guidance of Profs. Mapp and Coppola. During his time, he was awarded a prestigious American Cancer Society Postdoctoral Fellowship, and was also involved in the future faculty program, in which he taught Organic Chemistry to undergraduates. Since the fall of 2008, Jean-Paul started as an Assistant Professor in Chemistry at the University of Ontario Institute of Technology (UOIT) and was promoted in 2013 to an Associate Professor. He has received numerous research grants to support his research program in Chemical Biology at UOIT, which focuses on developing unnatural biological scaffolds that are capable of controlling gene expression. He is currently the Undergraduate Program Director in Chemistry at the UOIT.

Course Text: Any undergraduate textbook in organic chemistry is helpful to refresh mechanisms and reactions in general organic chemistry.

Evaluation: The course grade will be calculated from both exams and will include an assessment for participation, attendance, and discussion during class lectures.

Contact Information:

Professor Brian P. Coppola, e-mail: bcoppola@umich.edu

Professor Jean-Paul Desaulniers, e-mail: Jean-Paul.Desaulniers@uoit.ca

Class Schedule:

	<i>Lecture Date</i>	<i>Topic</i>	
Week 1	<i>June 28</i>	Origins of Chemical Biology, Prebiotic Synthesis	
	<i>June 29</i>	Amino Acid Structure, and Protecting Group Chemistry	
	<i>June 30</i>	Amide-Bond Coupling Reactions	
	<i>July 1</i>	Solid-Phase Peptide Synthesis (SPPS), and Native Chemical Ligation	
Week 2	<i>July 4</i>	Carbohydrate Chemistry and Nucleic Acids.	
	<i>July 5</i>	Base-Pairing, and Synthetic Monomers. Biological Synthesis of Oligonucleotides.	
	<i>July 6</i>	Chemical Synthesis of Oligonucleotides and Applications	
	<i>July 7</i>	Examination	
Week 3	<i>July 12</i>	Bronsted acid/base; structure & isomerism	enzyme catalysis
	<i>July 13</i>	Substitution/Elimination reactions	biological oxidation/reduction
	<i>July 14</i>	Electrophilic Addition reactions/EAS	epoxides & cationic cyclization
	<i>July 15</i>	Nucleophilic Addition reactions	carbohydrates & vitamin B6
Week 4	<i>July 18</i>	Substitution at sp ² centers	proteases
	<i>July 19</i>	Condensation reactions	fatty acid synthesis
	<i>July 20</i>	Pericyclic reactions	biological examples of pericyclics
	<i>July 21</i>	Examination	

- No PowerPoint will be used.
- Students need to present solutions, at the board, as a part of the class.
- No textbook will be used. However, any standard organic chemistry text will be useful.
- Problem sets will be distributed before class.
- Students are encouraged to work together on the problem sets, in preparation for presenting their solutions in class.