



LAND ACKNOWLEDGEMENT

UBC’s Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəyəm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.

COURSE INFORMATION

Course Title	Course Code Number	Credit Value
Protein Structure and Function	BIOC 402	3

PREREQUISITES

One of **BIOC 302**, **BIOC 303**, **BIOT 380**. (A minimum standing of 65% is recommended in these courses.)

COREQUISITES

None

COURSE LOCATION AND TIME

Time (Day(s), Hour)	Room
Mon Wed Fri, 9:00-10:00 AM	WOOD/IRC 6

COURSE CHAIR

Course Chair	Contact Details
Prof. Jörg Gsponer	gsponer@msl.ubc.ca

COURSE INSTRUCTOR(S)

Course Instructor(s)	Contact Details	Office Location	Office Hours
Prof. Jörg Gsponer	gsponer@msl.ubc.ca	Office 179, Michael Smith	Mon Wed Fri: 10-11 am



Prof. Calvin Yip (Pronouns: he/him/his)	calvin.yip@ubc.ca	Laboratories Rm. 5301, Life Sciences Centre	TBA
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LEARNING OUTCOMES

This course should provide a solid foundation in advance concepts in protein biochemistry and structural biology. Key learning objectives are:

- Get a detailed understanding of the continuum of structure types that can be adopted by polypeptide chains.
- Understand the physico-chemical principles that underlie protein structure formation, dynamics and interactions
- Develop a good understanding of (i) the major biophysics methods used to determine and characterize protein structures (including UV, CD, fluorescence and solution state NMR spectroscopy as well as X-ray crystallography, molecular electron microscopy (EM), cryo-EM and mass spectrometry) and (ii) state-of-the-art computational methods used in structure prediction and modeling.
- Being able to recognize and understand the impact of post-translational modifications of proteins.
- Describe the mechanisms of protein-based signaling.

Specific topics covered are listed below:

J. Gsponer

1. Structural components of proteins

- (a) Amino Acids and the Polypeptide Chain Backbone 2
- (b) Protein Structural Elements 1
- (c) Protein Taxonomy 1

2. Non-globular protein structures

- (a) Amyloid fibrils and protein phase separation 2
- (b) Intrinsically disordered proteins 1

3. Protein chemistry and spectroscopic techniques

- (a) Hydrogen bonds, pH, titration curves 3
- (b) Spectroscopic techniques (including nuclear magnetic resonance)..... 5

4. Signal transduction

- (a) Protein signaling 2

C. Yip



(b) Posttranslational modification1

4. Protein sequencing, mass spectrometry, protein-protein interaction

(a) Protein sequencing..... 1

(b) Mass spectrometry and proteomics 2

(c) Chemical modification, cross-linking 1

(d) Protein-protein interaction & macromolecular assemblies..... 1

5. De novo structural determination techniques

(a) Overview of X-ray crystallographic approach 2

(b) Assessing X-ray crystallographic data2

(c) Molecular electron microscopy & cryo-EM3

6. Structural proteomics and in silico structural determination

(a) Structural proteomics2

(b) Machine learning-based structural determination2

COURSE OUTLINE

BIOC402 is a lecture-based course. Three 1-hour lectures will be given each week. Lecture slide deck will be uploaded the BIOC402 course Canvas site before each lecture and it is expected that students preview them ahead of class. Although all lectures will be recorded with link available on the course Canvas site, in-person attendance of the lectures are highly recommended.

A Piazza online forum has been set up for discussing questions that usually come up. If used appropriately, asking and answering questions on this forum can significantly enhance class experience. Please be respectful to others when posting questions. Please only discuss questions about lecture material, class logistics, and problem sets and keep complains off this platform. Any concerns or suggestions about the course should be directed to the course instructor through e-mail or personal meetings. While one is encouraged to answer questions on Piazza, try to guide others to the answer as opposed to giving out the answer straight up.

COURSE SCHEDULE

J. Gsponer	Wednesday, September	7
	Friday, September	9
	Monday, September	12
	Wednesday, September	14
	Friday, September	16
	Monday, September	19
	Wednesday, September	21
	Friday, September	23



	Monday, September	26	
	Wednesday, September	28	
	Friday, September	30	<i>National Day for Truth and Reconciliation (University closed)</i>
	Monday, October	3	
	Wednesday, October	5	
	Friday, October	7	
	Monday, October	10	<i>Thanksgiving Day (University closed)</i>
	Wednesday, October	12	
	Friday, October	14	
	Monday, October	17	
	Wednesday, October	19	
	Friday, October	21	Midterm examination #1
C. Yip	Monday, October	24	
	Wednesday, October	26	
	Friday, October	28	
	Monday, October	31	
	Wednesday, November	2	
	Friday, November	4	
	Monday, November	7	
	Wednesday, November	9	<i>Midterm Break (no lecture)</i>
	Friday, November	11	<i>Remembrance Day (University closed)</i>
	Monday, November	14	Midterm examination #2
	Wednesday, November	16	
	Friday, November	18	
	Monday, November	21	
	Wednesday, November	23	
	Friday, November	25	
	Monday, November	28	
	Wednesday, November	30	
	Friday, December	2	
	Monday, December	5	
	Wednesday, December	7	

COURSE MATERIALS

There is no textbook for this course. All course material will be posted throughout the term via Canvas.

Problem sets will also be posted via Canvas (answers ~1 week later). These are invaluable for your learning and also serve as practice exam questions.



GRADING SCHEME

Quizzes and Assignments	10% (Drs Gsponer and Yip)
Midterm #1	30% (Dr. Gsponer)
Midterm #2	15% (Dr. Yip)
Final	45% (Drs Gsponer and Yip)

GRADING AND COURSE POLICY

1. Quizzes and Assignments (online)

- There will be online **quizzes and assignments** during the entire course, overall worth 10% of the course grade.
- Instructors will communicate when quizzes and assignments become available online.
- Results of quizzes and assignments will be made available on Canvas.
- A penalty will be applied to late submissions of quizzes and assignments.

2. Midterm Examinations (in-person, paper-based)

- There will be **two** midterm exams, worth **30%** and **15%** of the course grade, respectively.
- Past midterm examinations will **not** be made available.
- All students should be able to provide and show their student IDs.
- Marks will be posted on Canvas.
- There are no make-up/deferred exams.** For students who could provide an appropriate medical/academic excuse for missing a midterm exam, **the Final exam will be reweighted** accordingly. Otherwise, a mark of 0% will be recorded for the missed midterm exam.

3. Final Examination (in-person, paper-based)

- The final exam will be worth **45%** of the total BIOC 402 course mark. The final will cover **all** course material.
- Past final examinations will **not** be made available to students.



- c) All students need to provide and show their student IDs at the exam.
- d) After the December examination period, you can access your grades online at the Student Service Centre.

Students with disabilities and ongoing medical conditions have the option to request an accommodation for the course assessments after registering with the Centre for Accessibility. If you are eligible for exam accommodations, you will need to write your exams with the Centre for Accessibility. To book an exam, notify the course chair or instructor by email and register with the Centre for Accessibility **at least one week in advance of the midterm date, or at least 7 days before the start of the examination period for a final exam.**

If you are ill, please do not attend class.

If you do miss a final exam because of illness: Students who miss a final exam due to illness or extreme personal distress and would like to apply for a deferred exam must submit a request for an academic concession within 48 hours of the missed exam with Science Advising (<https://science.ubc.ca/students/advising/concession>). All appropriate documentation must be submitted within 14 calendar days of the missed exam. In addition, the course chair and instructor should also be notified by email within 48 hours to coordinate the deferred exam.

If the instructor is sick: We will all do our best to stay well, but if one of the instructors falls ill then they will not come to class. If that happens, all efforts will be made to communicate that to students in a timely manner prior to class time, usually via an announcement in Canvas. Depending on the situation a substitute lecturer will take over, the lecture may take place over zoom, or the class may be cancelled.

ACADEMIC MISCONDUCT

UBC and the Department of Biochemistry and Molecular Biology take the issue of academic misconduct very seriously; the honest assessment of student learning is key to both the success of the university and success for individual students. Cheating, in any form, undermines the value of a degree and can have serious consequences for your continued academic success. As such it is important to know what your responsibilities are, what constitutes misconduct and how you can avoid it. With some effort and forethought no student should ever have to find themselves facing discipline for academic misconduct; inform yourself as to the expectations placed on you and what your responsibilities are. UBC definition of academic misconduct can be found in the UBC Calendar and additional information is available in this UBC resource link.

What consequences can arise from academic misconduct?

The severity of the discipline can range from a letter of reprimand or a zero on the assignment in question all the way to expulsion from the University. Perhaps the most common outcome in these cases are grades of zero in the course in which the misconduct occurred.

EQUITY DIVERSITY AND INCLUSION (EDI) POLICIES



It is our goal that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and diversity that the students bring to this class be viewed as a resource, strength and benefit. We make a commitment to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture. We will foster a climate within the classroom where students of diverse backgrounds and identities feel comfortable sharing their opinions and experience with varied topics throughout the class. We (like many people) are learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable or if you observe a situation where someone else is made to feel uncomfortable, please talk to us about it. This includes concerns about any class-related interactions that lead to feelings of exclusion or marginalization. We welcome and encourage your feedback on how we can better cultivate a sense of inclusion in our course. This can be done through meetings, email or anonymous feedback through canvas. We aim to do our best to address each situation as it arises and effect meaningful changes moving forward. For more information visit our [departmental EDI webpage](#).

STUDENT RESOURCES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the [UBC Senate website](#).

Mental Health Resources

In case you are struggling with mental health, or are feeling stressed or anxious, [UBC Counselling services](#) provides information about a number of resources for students to use. Additionally, UBC students receive [mental health coverage of up to \\$1500](#) under the AMS Health & Dental Plan (more information about coverage [here](#)).

[Here2Talk](#) is available for BC post-secondary students to talk with trained counsellors 24/7 (via voice call or text messages). If you are a student living in UBC residence, [Counsellors in Residence](#) can also be a valuable resource to provide mental health support. If you have a UBC email address, [Therapy Assistance Online \(TAO\)](#) is a free online resource that provides tools to manage stress, relationship problems, substance use, etc.

COVID RELATED POLICIES

For UBC's latest response to COVID-19, please visit [covid19.ubc.ca](#). For our in-person meetings in this class, it is important that all of us feel as comfortable as possible engaging in class activities while sharing an indoor space. Non-medical masks that cover our noses and mouths are a primary tool to make it harder for COVID-19 to find a new host. The higher the rate of vaccination is in our community overall, the lower the chance of spreading this virus. You are an important part of the UBC community. Please arrange to



get vaccinated if you have not already done so. **If you're sick, it's important that you stay home – no matter what you think you may be sick with (e.g., cold, flu, other).**

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