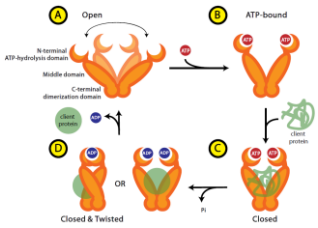
BIOD12H: Protein Homeostasis
Winter 2021

Professor Rongmin ZHAO; TA: Bona MU



This is a lecture/seminar course focusing on mechanisms of the cellular protein quality control systems. Animal and plant models will be used to highlight selected protein folding and degradation machineries critical to cell functions. Primary literature in protein homeostasis and possible consequence of malfunction in eukaryotic cells will be discussed.

Prerequisite: BIOC12 or BIOC10

Professor office hours: Monday 5-6pm or by appointment; Email: rongmin.zhao@utoronto.ca. Please use E-mail ONLY when it is critical for you to get in touch with the professor and use BIOD12H-Protein Homeostasis in the subject line. Your student name and number must be included in your email.

Teaching Assistant
Bona Mu is the teaching assistant to help the course delivery, particularly to evaluate the student presentation and examination grading. Depending on the enrolment, the TA will probably give a lecture and help to run some tutorials when needed.

Lecture Materials
The University of Toronto QUERCUS system will be used to support the course. You can log in from the website q.utoronto.ca with your UTORid. Lecture notes and related materials will be posted on the course website. All information related to this course will be announced in Quercus and you are required to check the announcement regularly.

Textbooks: No assigned textbook. Lecture notes and primary research articles will be provided. **However,** most Biochemistry textbooks have certain chapters related to protein folding and degradation, *e.g.* Chapter 32 in Biochemistry (First Canadian Edition by Garrett et al., 2013 Nelson Publisher, available at the UTSC library), Fundamentals of Biochemistry (5th by Voet et al., chapter 6 and chapter 27), and can be used as resources for general background information.

Lectures: Tuesday 3-5pm. Professor gives lectures on relevant foundation topics and methodology in the first half of the course (approximately and depending on the enrolment). Other weeks will be student group presentations on selected articles and student discussions. Lectures will be held through the Quercus Bb Collaborate and part of the lectures will be

recorded. For the student discussion part, it is anticipated that all students will actively participate in and some will be accounted as participation marks. unless certain extreme and approved conditions.

Tentative schedule (may be revised)

Weeks 1-6: Professor lectures on foundation topics in protein homeostasis, methodology, primary research articles reading etc.

Weeks 7-12: Student presentations.

Student presentation and assignments will be based on small groups. Groups are formed and finalized during the second week, and the number of students for each group will be determined and announced in the first class, depending on the total enrolment. Students are encouraged to find partners and form groups themselves. Otherwise, professor will assign the groups.

Tutorials

Wednesday (4-5pm), led by the professor or teaching assistant. Tutorials start from week 1, but the first week tutorial will be used as a general Q/A section on research articles and proposal. From the second week, the focus will be on technical issues, including but not limited to materials and methods of the articles. Students are encouraged to bring their own questions related to their chosen paper for discussion, otherwise the instructor will discuss relevant methods from the article that will be discussed in the next week. Tutorials will be held through the Quercus Bb Collaborate too and participation marks will be accounted for tutorial discussions, unless certain extreme and approved conditions.

Course Evaluation

Participation: 15%
Assignment (part 1 as group): 5%
Assignment (part 2 as group): 10%
Assignment (part 3 individual): 5%
Presentation: 25%
Final examination: 40%

Participation (15%)

Participation mark is given based on your attendance to lectures (10%) and tutorials (5%). Participation will be checked at the beginning of the lecture and tutorial section. It is also graded based on your active participation in class discussion. However, it is understandable that some students may be in different time zone, and those who have difficulty to attend the regular lectures or tutorials must inform the professor in the first week of class.

In the week of student presentation, all non-presenting groups need to read the same article and submit at least three (3) questions one day before (before midnight of Monday) to the professor by email. These questions will be discussed by the group after the student presentation on Tuesday. Depending on the complication of the question and available time, not all questions may be discussed.

Presentation (25%)
The presentation is expected to be 35-40 min long. Everyone in the team needs to present and all parts are combined as a complete oral presentation. The presentation format is expected in the following order: general introduction, research goals/rationale, results, discussion and possible future direction. Materials and methods are not necessarily presented in a separate section and could be integrated into the results section.

Order of student presentation
Each group need to read and prepare for the presentation from the beginning of the course. The presenting group will be determined one week before the presentation. For example, at the end of lecture on Tuesday in week 6, the presenting group in week 7 lecture time will be determined.

During student presentation weeks, the presenting group must email the presentation slides to professor before 12pm on Monday. The group then come to meet with the professor during the office hour (5-6pm) on Monday. If you are scheduled to present on Tuesday March 2nd, you must submit your presentation on March 1st and meet with the professor during the office hour on March 1st. As an alternative way, you can send the presentation slides to the professor and meet with the professor during the tutorial session the week before the presenting week. For example, if you are scheduled to present on March 2nd, you can email the slides before 12pm on Feb 24th and meet with the professor during the tutorial on Wednesday Feb 24th. Please note, as a group, you can send a representative to meet with the professor, not everyone needs to be present in the meeting. However, everyone needs to participate in the presentation and will be graded, unless it is impossible due to extreme conditions and agreed by the professor.

A brief meeting with the professor is intended to ensure the proper presentation on the next day and some comments can be provided if the professor think it is critical regarding the format. The presentation will be graded by both professor and peer students (including TA). and the rubrics will be provided before the presentation week.

Rubrics of grading on oral presentation and class participation will be posted on the course website in the third week.

Assignments
The assignment is to write a short proposal to address some critical questions related to the research article the group choose. The final product will be a five-page proposal (the format will be announced later in class). The assignment will be finished with three steps, submitted as two partial and one complete assignment. Every student in the group will receive the same mark for the part 1 and part 2. Before handing in part 2 and part 3, some feedback or comments may be given back to the groups and the group or individual may revise accordingly together with the submission of the next part. Example proposal will be given as a reference. The following highlights the specific requirement for the assignment.

Part 1 (5%): Due on Feb 14th. It will be in 1 to 1.5 pages. It should include the title, the general background information about the topics you choose and may also include the update after the

research article you have chosen was published. At the end of the background information, list up to three unsolved questions you may want to address further. References should be treated as extra, not part of the 1 to 1.5 pages.

Part 2 (10%): Due on March 21st. It is a 4-page proposal. It should include the part 1 you submitted earlier, but it is not necessarily exact the same. You could revise the general background information. This part will be mainly updated with possible experiments you want to do to address the questions you laid out earlier. Again, you can even revise the questions. You only need to strategically explain the experiments, expected results etc. No need to include any experimental details such as the reagent names, volumes, times etc. References should be treated as extra, not part of the 4 pages.

Part 3 (5%): Due on April 12th. Based on parts 1 and 2, students will submit their final five-page proposals individually. This part is intended to fine-tune the previously submitted work and make the proposal more readable and more eye-catching. It is expected each student revises the previous 4-page proposal, without changing the overall structure and main theme of the work. A short paragraph of possible significance of the work can be included. A contribution statement indicating how each member of the group contributes to the proposal can be added too (for format only, the exact weight of contribution will not be graded).

Policy on late assignment
Assignments must be submitted on time electronically. Late assignment will be penalized by 20% each day.

Miss the course work due to illness
If you miss the course work (assignments, presentation) due to illness or any other legitimate reasons, you need to contact with the undergraduate coordinator Jennifer Campbell (*jac.campbell@utoronto.ca*) with the self-declaration form to determine if an alternative arrangement can be made. You can find more information on the website: *https://www.utsc.utoronto.ca/biosci/missed-term-work*

Final examination (40%)
The schedule of the final exam will be arranged by the Registrar's office. It covers general concepts discussed in the professor's lecture and the student presentation. Focus will be given to those questions submitted and discussed in lectures.

Please note, part of the final examination will be group specific questions. A set of questions (worth of 20% of the final marks, tentatively) will be given and you only need to answer the ones related to your group on the chosen primary research article.

Research articles
Research articles used for class discussion will be posted on the course website in the first week. It is expected students download all articles at the beginning and have a quick scan of the article, at least on the abstract. This should help to choose the article to present in class at the later time. The assignment of paper presentation will be determined/finalized in the second week during tutorial section. If students cannot form groups or pick research articles, the

groups and articles will be assigned by the professor on a random basis. One or two more articles will be given to ease your choice. Unless with extreme circumstance, the student is not allowed to work alone.

Research articles may include but not limited to the following topics:

- ❑ Structure and function of the 26S proteasome
- ❑ Polyubiquitination pathways
- ❑ Regulated protein degradation in plants
- ❑ Protein aggregation in animal cells.
- ❑ Protein folding: J-domain proteins structure and function.
- ❑ Protein folding: HSP60 structure and functions
- ❑ Protein folding: HSP70 structure and functions
- ❑ Protein folding: HSP90 structure and function in higher organisms

Information Regarding AccessAbility Services at UTSC
Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to contact with me and/or the Access*Abilit*y Services Office as soon as possible. You can contact AccessAbility Services at 416-287-7560 or ability.utsc@utoronto.ca.

Academic Integrity
Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (*https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019*) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

- IN PAPERS AND ASSIGNMENTS: Using someone else's ideas or words without appropriate acknowledgement; submitting your own work in more than one course without the permission of the instructor; making up sources or facts. Obtaining or providing unauthorized assistance on any assignment.
- ON TESTS AND EXAMS: Using or possessing unauthorized aids; looking at someone else's answers during an exam or test; misrepresenting your identity.
- IN ACADEMIC WORK: Falsifying institutional documents or grades; Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see https://www.utsc.utoronto.ca/vpdean/academic-integrity-matters).

Tentative Lecture Schedule

Topics covered are listed in the table on the next page. This is a tentative schedule, and the order and contents may be changed later. Lecture notes, if any, will be posted weekly.

Weeks	Date	Section	Topics	Note/Homework
1	Jan 12	Lecture	Introduction on protein homeostasis; getting to know each other	First class on Jan 12, Tuesday; tutorial on Wednesday
	Jan 13	*Tutorial*	*Introduction on primary literature and student groups*	
2	Jan 19	Lecture	Ubiquitin proteasome system (UPS); 26S proteasome structure and function	Jan 24, last day to adjust course load; read primary literatures
	Jan 20	*Tutorial*	*Protein structure visualization software; group finalization*	
3	Jan 26	Lecture	Prokaryotic and organellar protein degradation; heat shock proteins: sHSP	Read primary literature
	Jan 27	*Tutorial*	*Research techniques*	
4	Feb 2	Lecture	Heat shock proteins: J-domain proteins and HSP70	
	Feb 3	*Tutorial*	*Research techniques*	
5	Feb 9	Lecture	Heat shock proteins: HSP60 and HSP90	**Assignment part 1 due on Feb 14**
	Feb 10	*Tutorial*	*Research techniques*	
6	Feb 23	Lecture	how to present primary research work	
	Feb 24	*Tutorial*	*Research techniques*	
7	Mar 2	Lecture	Primary research project/Student presentation	
	Mar 3	*Tutorial*	*Research techniques*	
8	Mar 9	Lecture	Student presentation and discussion	
	Mar 10	*Tutorial*	*Research techniques*	
9	Mar 16	Lecture	Student presentation and discussion	**Assignment part 2 due on March 21**
	Mar 17	*Tutorial*	*Research techniques*	
10	Mar 23	Lecture	Student presentation and discussion	March 29, last day to drop S courses without academic penalty
	Mar 24	*Tutorial*	*Research techniques*	
11	Mar 30	Lecture	Student presentation and discussion	
	Mar 31	*Tutorial*	*Research techniques*	
12	Apr 6	Lecture	Student presentation and discussion	
	Apr 7	*Tutorial*	*TBA*	
13	Apr 12	Last day of class; **Final Assignment part 3 due**		
	April 13-23	Final examination period		