



## CHEM 4560 – Biophysical Chemistry Laboratory

The University of Toledo  
College of Natural Sciences and Mathematics  
CHEM 4560-071, CRN: 53150

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**Instructor:** Tim Mueser  
**Email:** timothy.mueser@utoledo.edu  
**Office Hours:** T, Th 10:00 am – 11:30 am  
**Office Location:** WO 4211  
**Office Phone:** 419-530-1510  
**Offered:** Fall 2021

**Teaching Assistant:** Aravinda Ulluwis Hewage  
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**Lab Location:** BO 1099  
**Lab Day/Time:** T, Th 1:00 pm – 3:50 pm  
**Credit Hours:** 2

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### SPECIAL COURSE EXPECTATIONS DURING COVID-19

#### ATTENDANCE

The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Students must perform a daily health assessment, based on [CDC guidelines](#), before coming to campus each day, which included taking their temperature. Students who are symptomatic/sick should not come to class and should contact the Main Campus Health Center at 419-530-3451. *Medical and Physician Assistant Students should contact Jyothi Sri Pappula, MD via email at: [Jyothi.pappula@utoledo.edu](mailto:Jyothi.pappula@utoledo.edu); All other clinical students should contact Dean Linda Lewandowski, College of Nursing, via email at [Linda.Lewandowski@UToledo.Edu](mailto:Linda.Lewandowski@UToledo.Edu) or by phone at 419-383-5835..* Absences due to COVID-19 quarantine or isolation requirements are considered excused absences. Students should notify their instructors and these absences may not require written notice.

#### FACE COVERINGS

All students must wear face coverings while on campus, except while eating, alone in an enclosed space, or outdoors practicing social distancing. NO students will be permitted in class without a face covering. If you have a medical reason that prevents you from wearing a face covering due to a health condition deemed high-risk for COVID-19 by the Centers for Disease Control and Prevention (CDC), you should submit a request for an accommodation through the Student Disability Services Office (SDS) by completing the [online application](#). Students will need to provide documentation that verifies their health condition or disability and supports the need for accommodations. If a student is already affiliated with SDS and would like to request additional accommodations due to the impact of COVID-19, should contact their accessibility specialist to discuss their specific needs.

#### SOCIAL DISTANCING

Students should practice social distancing inside and outside the classroom please follow signage and pay attention to the seating arrangements. Do not remove stickers or tape from seats and/or tables, this is there to provide guidance on the appropriate classroom capacity based on the recommended 6 feet of social distancing between individuals. Please be conscious of your personal space and respectful of others. Also be cognizant of how you enter and exit the room; always try to maintain at least 6 feet of distance between yourself and others.



## **DESKS AND WORK SPACES**

Students will need to sanitize their desks and/or work space before class with the University provided sanitizing spray and paper towels their desks.

## **SPECIAL NOTES**

It's important to note that based on the unpredictability of the COVID-19 virus things can change at any time so please be patience and understanding as we move through the semester. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID.

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## **CATALOG/COURSE DESCRIPTION**

Data Analysis of modern biophysical measurements related to the topics discussed in CHEM 4570 (Biophysical Chemistry), an introduction to scientific writing, and the preparation of scientific manuscripts.

## **COURSE OVERVIEW/ TEACHING METHODOLOGY**

Biophysical chemistry applies the concepts of physical chemistry to the study of biological molecules. Modern instruments used in biophysics are expensive and sophisticated. To obtain a reasonable understanding of these techniques, students will observe the use of instruments and learn to process and interpret the data that is acquired, and to report the findings in a scientific manuscript form.

## **STUDENT LEARNING OUTCOMES**

Upon successful completion of the computational chemistry component of this course, students will be able to process and interpret data from:

- Isothermal and Differential Scanning Calorimetry
- Analytical Ultracentrifugation
- Ligand Binding and Kinetics including Surface Plasmon Resonance
- X-ray and Visible Light Scattering
- X-ray Diffraction and Structural Analysis
- Computation Molecular Mechanics

Upon successful completion of the WAC component of this course, students will be able to prepare a scientific manuscript:

- Prepare experimental procedures and results from each stage of analysis
- Identify supporting literature and prepare a cogent introduction and discussion of the experiments and results
- Prepare a bibliography of the references most relevant to the report.
- Carry out peer review and present the findings

## **PREREQUISITES AND COREQUISITES**

Prerequisite: A grade of C or better in CHEM 3520 (Biochemistry II).

Corequisite: Chem 4570 (Biophysical Chemistry)

## **TEXTS AND ANCILLARY MATERIALS**

Software and training information utilized is mostly open source. The tech fee will cover the cost of temporary licensing of commercial software.

## **TECHNOLOGY REQUIREMENTS**

Access to a computer capable of running the programs associated with the projects will be provided if necessary.



## **ACADEMIC POLICIES**

### **Safety Requirements**

No food or drink is allowed in the computer labs. Observe all posted notices.

### **Student Responsibilities**

- All students will learn to run the data analysis programs.
- The links to training videos and tutorials will be provided and students should be familiar with the programs prior to lab. Training and analysis will be completed in the designated lab hours.
- Many programs are open source and can be used on personal computers.
- All students will submit experimental methods and results of each analysis by the designated due dates.
- All students will complete peer review and participate in the preparation of the composite manuscript components.

Undergraduate Policies: <http://www.utoledo.edu/policies/academic/undergraduate/>

## **COURSE EXPECTATIONS**

This lab course has two components:

### **I.) Learn to analyze and interpret data using computational analysis**

- Thermodynamic data will include isothermal and differential scanning calorimetry
- Hydrodynamic data will include analytical ultracentrifugation and dynamic light scattering
- Ligand binding will include surface plasmon resonance, rapid reaction kinetics, and enzyme kinetics
- Protein Identification will include peptide fingerprinting for database mining.
- Structural Analysis will include Xray scattering and Xray diffraction
- Molecular mechanics will include 3D profile of the energetics of binding

### **II.) Assemble a scientific manuscript to report the results.**

- The projects will utilize data from a known protein:ligand complex but presented as an unknown.
- Groups of three will work to develop manuscripts describing the results of their “unknown”.
- Introduction to scientific writing and the preparation of scientific manuscripts: Abstract, Introduction, Experimental Methods, Results, Discussion, Conclusion
- Each person will be responsible for writing an experimental and results section and preparing figures for each type of analysis. This will be handed in for evaluation and feedback from the instructor.
- Each member of the team will conduct peer review of the other team member’s work. Each student will submit the peer review comments and the revised report for evaluation. The team will then generate a composite experimental and results sections for each of the experiments. This will be handed in for evaluation and feedback from the instructor.
- Each of the modules will then be incorporated into a final manuscript.
- In the final weeks of the semester, the unknowns will have been identified and the experimental and results sections completed. The individuals will then prepare an introduction and discussion. A bibliography will be assembled using EndNote.



- Individual manuscripts will be peer reviewed and revised version submitted. Individuals will prepare a final “manuscript” and a PowerPoint readied for an oral presentation during the final week.

## OVERVIEW OF COURSE GRADE ASSIGNMENT

### Semester Evaluation

Final grades will be based on:

- The quality and effort of manuscript preparation based on the materials submitted
- The quality and completeness of the final manuscript
- The final presentation

Your total number of points for the semester will be used to calculate a percentage based on 150 total points.

|                                                                                                    |           |              |
|----------------------------------------------------------------------------------------------------|-----------|--------------|
| Each individual revised experimental and results section<br>(Including the efforts in peer review) | 15 points | 90 pts total |
| Final composite manuscript                                                                         | 45 points |              |
| Final presentation                                                                                 | 15 points |              |

Grades will be as follows:

|               |   |
|---------------|---|
| 90% or better | A |
| 80-89%        | B |
| 70-79%        | C |
| 60-69%        | D |
| 59% and below | F |

These numbers are an approximation. The cut-off for letter grades may be less than that stated above, but will never be higher. There will NOT be any extra credit in this course.

## UNIVERSITY POLICIES

### Policy Statement on Non-Discrimination on the Basis of Disability (ADA)

The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance](#). Students can find this policy along with other university policies listed by audience on the [University Policy webpage](#) (<http://www.utoledo.edu/policies/audience.html/#students>).

### Academic Accommodations

The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the [Student Disability Services Office](#) (<http://www.utoledo.edu/offices/student-disability-services/>) by phone: 419.530.4981 or email at [StudentDisability@utoledo.edu](mailto:StudentDisability@utoledo.edu).

## ACADEMIC AND SUPPORT SERVICES

Please follow this link to view a comprehensive list of [Student Academic and Support Services](#) (<http://www.utoledo.edu/studentaffairs/departments.html>) available to you as a student.



## SAFETY AND HEALTH SERVICES FOR UT STUDENTS

Please use the following link to view a comprehensive list: [Campus Health and Safety Services](#) available to you as a student.

## INCLUSIVE CLASSROOM STATEMENT

In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, gender identity/expression, socioeconomic background, and a myriad of other social identities and life experiences. We will encourage and appreciate expressions of different ideas, opinions, and beliefs so that conversations and interactions that could potentially be divisive turn, instead, into opportunities for intellectual and personal development.

## COURSE SCHEDULE

| Week | Day     | Project                                                                                           | Program                         | Assignments Due                                                                     |
|------|---------|---------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------|
| 1    | T<br>Th | Introduction to Scientific Writing<br>Introduction to GraphPad Prism                              | Scitable<br>GraphPad Prism      |                                                                                     |
| 2    | T<br>Th | Introduction to ITC<br>Analysis of ITC data                                                       | CHASM                           | Individual Exp, Res, Fig: ITC                                                       |
| 3    | T<br>Th | Introduction to AUC<br>Analysis of AUC Eq and SV data                                             | SedAnal                         | Peer Review: ITC<br>Individual Exp, Res, Fig: AUC                                   |
| 4    | T<br>Th | Introduction to SPR<br>Local analysis of SPR binding data                                         | GraphPad Prism                  | Peer Review: AUC<br>Individual Exp, Res, Fig: SPR                                   |
| 5    | T<br>Th | Global analysis of SPR binding data<br>Introduction to Pymol<br>Protein Identification - Database | GraphPad Prism<br>Pymol<br>NCBI | Peer Review: SPR                                                                    |
| 6    | T<br>Th | Introduction to X-Ray scattering<br>Analysis of X-Ray scattering data                             | ATSAS                           | Individual Exp, Res, Fig: SAXS                                                      |
| 7    | T<br>Th | Analysis of X-Ray scattering data<br><b>No Class – Fall Break</b>                                 | ATSAS                           | Peer Review: SAXS                                                                   |
| 8    | T<br>Th | Introduction to X-ray diffraction<br>Analysis of X-Ray diffraction data                           | Coot                            | Individual Exp, Res, Fig: XRD                                                       |
| 9    | T<br>Th | Analysis of X-Ray diffraction data<br>Molecular Modelling                                         | Coot                            |                                                                                     |
| 10   | T<br>Th | Introduction to CCP4 & Phenix<br>Model Refinement                                                 | CCP4/Phenix                     | Peer Review: XRD<br>Individual Exp, Res, Fig: Ligand<br>Identification & Refinement |
| 11   | T<br>Th | Model Refinement<br><b>No Class – Veteran's Day</b>                                               | CCP4/Phenix                     | Peer Review: Refinement                                                             |
| 12   | T<br>Th | Manuscript Intro & Discussion<br>Manuscript Preparation                                           | SciFinder<br>Scitable           | Individual Manuscript                                                               |
| 13   | T<br>Th | Manuscript Preparation<br><b>No Class - Thanksgiving</b>                                          | EndNote                         | Peer Review: Manuscript                                                             |
| 14   | T<br>Th | Student Presentations<br>Student Presentations                                                    | PowerPoint                      | Final Manuscript Due                                                                |