

**Syllabus (26:160:551)****Class:** Biophysical Chemistry**Semester:** Spring 2022**Time:** Tuesday 6:00 PM - 9:00 PM**Location:** Smith Hall, Room 241; Rutgers University-Newark**Website (Canvas):** <https://rutgers.instructure.com/courses/176672>**Remote instruction:** *via* Zoom link posted on Canvas**Instructor:** Prof. Colin Kinz-Thompson**Office:** Olson Hall 206**Email:** [colin.kinzthompson@rutgers.edu](mailto:colin.kinzthompson@rutgers.edu)**Office hours:** by appointment

**Description:** From cryoEM to computational chemistry, learn how to measure and investigate the structure, function, and dynamics of the molecules of life. This course covers the application of physics and chemistry-based theories and techniques to the study of biological systems. The target audience is chemistry graduate students with little to no previous biological knowledge or course work. We will begin by covering the chemistry and physics governing the structure, function, and dynamics of different biomolecules. After this, we will cover different techniques capable of measuring these properties. Finally, we will discuss several molecular phenomena where biophysical chemistry has played a key role in achieving our current understanding.

**Learning outcomes:** Students will be able to:

- 1) Explain the physics of proteins and nucleic acids that define their structure and dynamics.
- 2) Compare the benefits and differentiate between physical chemistry techniques and methods for studying different biomolecular systems.
- 3) Recall classic studies and theories of the behavior of biological macromolecules.
- 4) Interpret and assess claims presented in the biophysics literature from sources such as Biophysical Journal.
- 5) Perform an analytical analysis of experimental data reporting on the structure and/or dynamics of a biomolecular system.

**Secondary goal:** Students will be capable of adapting their research into NIH-fundable projects.**Suggested textbooks:**

- 1) Biophysical Chemistry (CRC Press) by Klostermeier and Rudolph
- 2) The Molecules of Life: Physical and Chemical Principles (Garland Science) by Kuriyan, Konforti and Wemmer
- 3) Biophysical Chemistry I-III (WH Freeman and Co) by Cantor and Schimmel

**Daily class structure:** Approximately 2/3<sup>rd</sup> lecture, 1/3<sup>rd</sup> discussion and/or activity

<b>Grade breakdown:</b>	<b>Fraction</b>
Five problem sets	5/15
Four significance statements	4/15
Class participation	1/15
Final project	5/15

**Lecture schedule:***Chemical and physical properties of biological macromolecules*

1. Jan. 18 Introduction to biophysics [Remote - Zoom]
2. Jan. 25 Protein structure [Remote - Zoom]
3. Feb. 1 Nucleic acid structure
4. Feb. 8 Molecular forces and conformational dynamics

*Selected techniques and methods to study biological macromolecules*

5. Feb. 15 Optical spectroscopy
6. Feb. 22 Nuclear magnetic resonance (NMR) spectroscopy
7. Mar. 1 X-ray crystallography
8. Mar. 8 Cryogenic electron microscopy (cryoEM)
- Mar. 15 *Spring Break*
9. Mar. 22 Computational methods
10. Mar. 29 Single-molecule methods

*Behavior of biological macromolecules*

11. Apr. 5 Kinetics and thermodynamics of ligand interactions
12. Apr. 12 Protein and nucleic acid folding
13. Apr. 19 Biological regulation, conformational changes and allostery
14. Apr. 26 Case Study

*Final project*

Course exam date scheduled for May 10  
 No exam. Instead, due date for final project

**Assignment due dates (subject to change):**

<i>Problem set</i>	<i>Start date (class)</i>	<i>Due date (class)</i>
1	Jan. 18 (1)	Feb. 8 (4)
2	Feb. 8 (4)	Mar. 1 (7)
3	Mar. 1 (7)	Mar. 22 (9)
4	Mar. 22 (9)	Apr. 5 (11)
5	Apr. 5 (11)	Apr. 26 (14)

<i>Significance statement</i>	<i>Start date (class)</i>	<i>Due date (class)</i>
1	Jan. 25 (2)	Feb. 1 (3)
2	Feb. 15 (5)	Feb. 22 (6)
3	Mar. 22 (9)	Mar. 29 (10)
4	Apr. 12 (12)	Apr. 19 (13)

*Final project* – due May 10.

**Description of ‘significance statement’ assignments:**

Students will be assigned a paper to read, and then write a significance statement (120 word maximum) for that article in the style of those published with Proc. Natl. Acad. Sci. articles.

**COVID-Safety Statement:** In order to protect the health and well-being of all members of the Rutgers-Newark community, masks must be worn by all persons inside campus buildings (e.g., classrooms) when in the presence of others, and in buildings in non-private enclosed settings (e.g., common workspaces, workstations, meeting rooms, classrooms, etc.). Masks should securely cover the nose and mouth. Masks must be worn during class meetings. Each day before you arrive on campus or leave your residence hall, you must complete the brief survey on the My Campus Pass symptom checker self-screening app found at: myRutgers Portal. Violations will be reported immediately with the COVID Observation Reporting Form.

**Absences:** Per the University's Course Attendance policy (10.2.7), students are responsible for communicating with their instructors regarding absences. The Division of Student Affairs is available to verify extended absences: (973) 353-5063 or [DeanofStudents@newark.rutgers.edu](mailto:DeanofStudents@newark.rutgers.edu).

**Academic Integrity:** As an academic community dedicated to the creation, dissemination, and application of knowledge, Rutgers University is committed to fostering an intellectual and ethical environment based on the principles of academic integrity. Academic integrity is essential to the success of the University's educational and research missions, and violations of academic integrity constitute serious offenses against the entire academic community. The entire Academic Integrity Policy can be found here: <http://academicintegrity.rutgers.edu/academic-integrity-policy/>

**Accommodation Statement:** Rutgers University Newark (RU-N) is committed to the creation of an inclusive and safe learning environment for all students. RU-N has identified the following resources to further the mission of access and support:

- **Students with Disabilities:** Rutgers University welcomes students with disabilities into all of the University's educational programs. The Office of Disability Services (ODS) is responsible for the determination of appropriate accommodations for students who encounter barriers due to disability. In order to receive consideration for reasonable accommodations, a student with a disability must contact ODS, register, have an initial appointment, and provide documentation. Once a student has completed the ODS process (registration, initial appointment, and documentation submitted) and reasonable accommodations are determined to be necessary and appropriate, a Letter of Accommodation (LOA) will be provided to the student. The student must give the LOA to each course instructor, followed by a discussion with the instructor. This should be completed as early in the semester as possible as accommodations are not retroactive. More information can be found at [ods.rutgers.edu](http://ods.rutgers.edu). Contact ODS: (973) 353-5375 or [ods@newark.rutgers.edu](mailto:ods@newark.rutgers.edu).
- **Religious Holiday Policy and Accommodations:** Students are advised to provide timely notification to instructors about necessary absences for religious observances and are responsible for making up the work or exams according to an agreed-upon schedule. The Division of Student Affairs is available to verify absences for religious observance, as needed: (973) 353-5063 or [DeanofStudents@newark.rutgers.edu](mailto:DeanofStudents@newark.rutgers.edu).
- **Counseling Services:** Counseling Center Room 101, Blumenthal Hall, (973) 353-5805 or <http://counseling.newark.rutgers.edu/>.
- **Students with Temporary Conditions/Injuries:** Students experiencing a temporary condition or injury that is adversely affecting their ability to fully participate in their courses should submit a request for assistance at: <https://temporaryconditions.rutgers.edu>.

- **Students Who are Pregnant:** The Office of Title IX and ADA Compliance is available to assist students with any concerns or potential accommodations related to pregnancy: (973) 353-1906 or [TitleIX@newark.rutgers.edu](mailto:TitleIX@newark.rutgers.edu).

**Gender or Sex-Based Discrimination or Harassment:** Students experiencing any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking, should know that help and support are available. To report an incident, contact the Office of Title IX and ADA Compliance: (973) 353-1906 or [TitleIX@newark.rutgers.edu](mailto:TitleIX@newark.rutgers.edu). To submit an incident report: [tinyurl.com/RUNReportingForm](http://tinyurl.com/RUNReportingForm). To speak with a staff member who is confidential and does **NOT** have a reporting responsibility, contact the Office for Violence Prevention and Victim Assistance: (973) 353-1918 or [run.vpva@rutgers.edu](mailto:run.vpva@rutgers.edu)