# BIOCHEMISTRY 7766.01 Syllabus

# ADVANCED NUCLEIC ACIDS, SPRING 2023

Tuesdays and Thursdays, 11:10 AM - 12:30 PM, 209 Enarson Hall

## Instructors

**Karin Musier-Forsyth**, musier-forsyth.1@osu.edu, 387 CBEC

**TA: Chathuri Pathirage**, pathirage.1@buckeyemail.osu.edu, 370C CBEC

*Instructors are available to assist students outside of class hours by appointment.*

## Course Format (in person only)

The class will generally consist of in-person interactive lectures on select topics/methods presented by the regular and guest instructors on Tues. The Thurs class period will consist of in-person presentations/discussions, focused on recent papers using the methods presented on Tues. Some of the paper presentations will be led by students in teams of two.

## Grading

The course will be graded using letter grades. The final grade will be decided based on three criteria: **(i) classroom participation (30 pts)**, **(ii) classroom presentation (40 pts)**, and **(iii) a final written report (30 pts)**. There is no final exam. Further details are provided below.

***Classroom Participation (30 pts):*** Students are expected to actively participate during lectures and classroom discussions. It is expected that weekly readings (posted at least 1 week in advance) will be completed outside of class in preparation for each class period. The instructors will keep a record of participation during the entire course.

***Student Presentations (40 pts):*** Students will self-organize into two-member teams. Each team must select from a list of topics/methods provided by the instructors and indicate their choice to the instructors by **March 21, 2023**. A list of primary research articles will also be provided and the team may select from this list or find an appropriate paper on their own. The instructors will work with each team to ensure that the paper chosen to highlight the topic/method of choice is appropriate for the class presentation. Papers to be presented must be approved 2 weeks prior to the presentation date. Although the student presenters will be responsible for introducing the overarching objective of the paper and how the highlighted method was used to fulfill this goal, all students in the class are responsible for reading the papers before class and may be called on randomly to participate in the paper discussion. The presentations will be evaluated on the basis of (i) clarity, (ii) quality of slides, and (iii) ability to lead the discussion following questions/comments from peers/instructors. Each presentation should be 25-30 minutes long and will be followed by a 10-15 minute discussion (i.e., 40 minutes per two-member team).

***Written report:*** The overarching goal of this course is to provide students with the practical knowledge necessary to successfully apply cutting-edge techniques to advance their own research goals. The final written report will consist of a description of how **one of** the experimental approaches described during the semester (by the instructors or the student teams) could be

applied to each student's research projects. The method cannot be one already used routinely by the student. The report should include a short introductory paragraph with the background information relevant to the project, a clear statement of the important outstanding question that the student is trying to address, and a description of how the approach selected by the student will be applied to this specific research problem. A final paragraph should address expected outcomes and potential pitfalls of the planned approach. Include illustrations as appropriate. The report should be a **maximum** of two double-spaced pages with one-inch margins and 11-point font size. Illustrations and References, which must be formatted in accordance with standard conventions, are not included in the two-page limit. Upload a PDF copy to the assigned folder in the course portal in Canvas by **April 21, 2023 (5:00 PM)**. Please include a brief, signed statement that you have read and understood OSU's policy on academic misconduct, and that the written report is your **own** work.

## Student responsibilities

Attendance is strictly required, unless an acceptable excuse (i.e. medical emergency) is provided by the student with appropriate documentation (i.e. doctor's note). Failure to attend a class, without prior notice/consent, may result in the student's final grade being dropped to the next grade tier (e.g. from A to A-, A- to B+, etc.). All students are required to read the assigned Review papers prior to the Tues class Lecture/Discussion. In addition, all students are expected to read assigned Research papers for Discussions on Thursdays and be prepared to present/discuss figures.

## Tentative Schedule (subject to changes/updates):

### Week 1

**3/2 (Th):** **Course Introduction and overview of single-molecule methods** (Karin)

Review Reading:
https://www.nature.com/articles/nmeth.3107 (required; TJ Ha 2014)
https://pubmed.ncbi.nlm.nih.gov/35063098/ (skim; TJ Ha 2022)

### Week 2

**3/7 (Tu):** **11:10-11:50** **Optical Tweezers** (Dr. Ehsan Akbari, akbari.5@osu.edu)

**Noon-1 PM** **RNA Center presentation** by Prof. Peter Dedon, MIT — "Revisiting the central dogma in the age of the epigenome and epitranscriptome" (115 BRT; pizza lunch at 1-1:30)

Review Reading:
https://pubs.acs.org/doi/10.1021/cr4003006 (required section 1-3; skim 4-7)

**3/9 (Th):** Readings for Discussion (led by Ehsan and Karin):

https://www.nature.com/articles/s41594-019-0188-z (required; Cas9 specificity)

https://pubmed.ncbi.nlm.nih.gov/36207294/ (skim; holiday junctions)

**Week 3**

**3/14-3/16:** **SPRING BREAK**

**Week 4**

**3/21 (Tu):** **Sequencing Methods:** Next-generation (DNA and RNA-seq), third generation (Prof. Sanggu Kim, kim.6477@osu.edu)

Review Readings:
https://www.nature.com/articles/s41587-021-01108-x (required; Wang, 2021; Nanopore)
https://www.nature.com/articles/nrg.2016.49 (skim; overview of seq technologies)

**3/23 (Th):** Readings for Discussion (led by Dr. Sanggu Kim and Karin):

https://pubs.acs.org/doi/10.1021/acsnano.1c06488 (required; tRNA nanopore seq)
https://www.sciencedirect.com/science/article/pii/S2666979X22000143(skim; nanoSHAPE)

**Week 5**

**3/28 (Tu):** **RNA epigenetics/modifications:** identification and function (Chathuri)

Review Readings:
https://www.nature.com/articles/nrg.2016.169 (required; Helm 2017)
https://pubmed.ncbi.nlm.nih.gov/28622506/ (required; Roundtree, Cell 2017)

**3/30 (Th):** Readings for Discussion (led by Chathuri and Karin):

https://pubs.acs.org/doi/10.1021/jacs.8b02618 (required; miCLIP-MaP-seq)

https://www.nature.com/articles/s41586-022-05668-z (skim; cap2-methylome)

**Week 6**

**4/4 (Tu):** **Mapping RNA structure** in vitro and in cells (Karin)

Review Readings: TBA

**4/6 (Th):** Readings for Discussion (led by **Teams 1 and 2, papers approved by 3/23**):

TBA

**Week 7**

**4/11 (Tu):** **Mapping RNA-protein interactions** in vitro and in cells (Karin)

Review Readings: TBA

**4/13 (Th):** Readings for Discussion (led by **Teams 3 and 4, papers approved by 3/30**):

TBA

**Week 8**

**4/18 (Tu): RNA therapeutics and RNA as a drug target** (Dr. Aru Kavoor, kavoor.1@osu.edu)

Review Readings: TBA

**4/20 (Th)**: Readings for Discussion (led by **Team 5 and 6, paper approved by 4/6**):

TBA

**Statements on Academic Misconduct, Disability Services, Mental Health, and Diversity**

**Academic Misconduct:**
It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

## Disability Services

The University strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

**Mental Health:**
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may

lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

**Diversity:**
The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.