

Advanced Topics in Biology: RNA Biology

BIOL377_01 / CRN# 59064 / Class Time: Mondays and Fridays, 5:30 – 6:45 pm

Course Syllabus: Spring, 2021

Course Description:

This course covers advanced topics in a specified subdiscipline of biology. The course allows for exploration of an area of biology not covered in-depth in other course offerings and is meant for upper level students. The course will include reading and discussion of the primary literature and the consideration of recent advances and perspectives within the area of study being covered. Subjects may differ each semester. (May be taken twice under different subtitles.) Prerequisite: BIOL 300 or BIOL 335. Credits: 3(3-0) Not offered on a regular basis.

Course Instructor:

Dr. Salvador Z. Tarun, Jr.

Office: ISC 139D, Phone: 585-243-6483, e-mail: tarun@geneseo.edu

Office hours: 10:30 am – 11:50 am Monday, Wednesday and Friday or by appointment

Join CLASS Zoom Meeting

<https://geneseo.zoom.us/j/92583251186?pwd=Rm5WY01WTHZCQm9QRzhoK0VMeldPUT09>

Meeting ID: 925 8325 1186

Passcode: 629557

OFFICE HOUR in Zoom

<https://geneseo.zoom.us/j/99602909594?pwd=Yjd4eHlscUJPaU9FcjBLeEE5K1dWUT09>

Meeting ID: 996 0290 9594

Passcode: 619868

Required Textbook and Materials:

Textbook: *Molecular Biology of RNA* (Second Edition, copyright 2016) by David Elliot & Michael Ladomery, Oxford University Press. Available through the SUNY Geneseo bookstore as a print text: ISBN 978-0-19-967139-7.

Course materials: Other course materials (published papers, supplementary review articles, guides and notes, slides and videos) will be available within the Canvas System (<https://canvas.geneseo.edu/courses/20659>).

Check the system regularly for updates to new or modified materials provided to you. Self-help guides are available through the Canvas system website as well

(<https://wiki.geneseo.edu/display/cit/Canvas+Self+Help+Documents>).

Instructor's Philosophical Framework for Teaching Biol377_Advanced Topics in RNA Biology:

I like to use the simple metaphor of 'eating and drinking' to describe and illustrate the rational framework for this course in keeping with its description. At least half of the learning that you receive in your undergraduate education is derived from textbooks as source material. I call this source as 'processed food and drink'. It is a body of knowledge that has undergone a complex and critically rigorous process of intellectual extraction, filtration, distillation and synthesis to simplify and allow facts and principles to be easily digested mentally for the student. In other words, someone (the pedagogical expert) has done the hard work of higher mental cognition to 'tease out the meat from the bone and squeeze the milk from the udder' in the original sources, processing them further, in order to feed the essential facts and principles to the student for comprehension. The goal and content for this advanced course was designed with this contextual view in mind.

Course Goal and Content:

Goal: This more advanced course for juniors and seniors has a long-term tripartite goal that shapes its organization, implementation, and learning expectations: First, it aims to ‘wean students from eating processed food in order to take in more solid and fresh food directly from the source’. It means directly entering, exploring, and extracting the recent discoveries and studies in the field of RNA Biology to learn its advances, applications and implications. *The textbook in this course will simply be a means to an end -- serving only as a road map for your further inquiry.* Second, it aims to train students to acquire the intellectual skills necessary to critically explore, examine and learn advanced knowledge derived from original research. This includes understanding how the original authors made their discoveries. An old adage tells it this way: “Give a man a fish, and you will feed him for a day. Teach a man to fish, and you have fed him for a life time.” Third, it aims to train students to further process this advanced understanding to be able to communicate it effectively as new knowledge to general or less specialized learners. Your learning does not truly reach its consummation unless and until you can skillfully transmit it to others. This is how knowledge advances robustly. And this is how you get prepared for advanced studies or a professional career in science after your undergraduate education. Eventually, I hope, you will come to realize you never really stop learning. Fourth, it aims to bring students into the realm of collective and collaborative learning. A free, creative exchange of ideas based on unique perspectives and experiences through team communication and cooperation can generate unexpected synergies and novelties of thinking and abstractions (of facts, problems, solutions, ramifications, applications, limitations) not manifested by the effort of a single mind.

Content: The sequencing of the entire human genome has revealed an unexpected outcome: only about 1.5 % of our DNA encode for proteins, yet up to 80% of our genome appear to be transcribed and at least 5-15% are transcribed into noncoding RNAs. This is a stunning and totally unexpected recent discovery that undermines our traditional view of biological information storage, transmission, expression and control, approaching a paradigm shift. We may not be living in a protein- or DNA-centric world after all. Consequently, it is opening up profound insight into life’s inner workings and its deeper roots, with RNA at the core. In this course, we will examine the validity of this rapidly-evolving narrative by looking critically at the latest progress and trends in our understanding of the growing number and types of non-canonical and noncoding RNAs and the central role they play in the control of gene expression and disease states. We will also explore the implication of the RNA’s combined genetic, structural and catalytic functions in the emergence of first life on earth in a hypothesized ‘RNA world’.

Learning Outcomes:

Upon completion of this course, the student should

1. have a comprehensive view and working knowledge of RNA biology in general, as well as the particular complex roles of noncanonical RNAs in Biology, Biogenesis and Disease.
2. be able to have an intuitive feel of how scientists, working as teams and collaborators in their specialized field, frame their questions and design their experiments in addressing fundamental and cutting-edge biological problems that an RNA-centric world presents.
3. have acquired the mental skill to critically examine, understand and evaluate the importance and limitations of an original published work to advancing knowledge in RNA Biology.
4. have gained experience in effectively communicating the important advances in RNA research to both specialist and non-specialist learners.

Evaluation:

Graded Work	Contribution:
Individual Participation (Discussion + Recitation)	30% + 10%, respectively
Individual Take Home Activity/Exercise (Bioinformatics)	5%
Group Presentation (Primary Paper)	20%
Group Mini-Review (Implications or Applications of Topic of Choice)	10%
Group Take Home Test (Mid-term and Final)	25%
BONUS: Attendance and Attitude (Instructor, Self + Group Assessment)	3%

Individual Participation: Much of the engagements that you will encounter either in graduate school, or in medical school or in your chosen professional field will involve team collaboration and learning. This implies that for the group to succeed in an enterprise, the participation and the contribution of the individual is critical. Hence, to train you for such graduate / professional environments, you will be motivated and are expected to be fully engaged in recitation during lectures and participation in discussions during readings and presentations of original articles. You will be graded mainly on your degree of effort to contribute, not strictly on correctness. Between 40 - 60% of the course will be delivered as lecture by the Instructor to provide key background knowledge as a common foundation for advanced exploration, and the rest will be a group-lead critical study of selected primary literature covering the advances. A list of selected original research articles for class reading will be posted on Canvas for the course. At the beginning of the course, each group (of 2-3 members) will select an article to moderate and lead in reading, and will formulate 5 questions for discussion at least 1 week before their assigned date of reading. A round-table Journal-Club format will be adapted. Pointers for moderating and leading the group reading and discussion will be provided separately. The instructor will moderate and lead the first article to demonstrate and guide subsequent readings.

Individual Activity/Exercise: To develop an intuitive feel of the current tools in Bioinformatics used by RNA biologists to examine and discover structure – function relationships, you will be provided short take-home activities to complete. Details of each activity will be provided later.

Group Presentation: You will be organized into 2- or 3-member groups. Each group will have the opportunity to provide a 45-50 minute analytical and critical presentation of an **original published research article** of their choice in a Seminar format, followed by a 10-minute answer and question session from colleagues and Instructor. This should provide an opportunity for the students to hone their skills in effective oral scientific communication. The rubrics for group presentation will be provided later.

Group Mini-Review: Your group will write and submit a 3-5 page Review article that integrates at least 2 recent original published articles related to a novel function, technical application, medical impact or biogenesis implication of studies related to **mRNA, non-coding, or catalytic RNAs**. We will adapt the format of a *Scientific American* article. This will train you to develop your skill in effective science communication writing of advanced knowledge for a non-science but sophisticated readers. Rubrics for this enterprise will be provided later.

Group Take-Home Test: Your group will complete **two 50-point take-home test**, one for the Mid-term and another for the Final, covering topics covered in each period. Most of the questions will be problem-based to test your analytical, synthetic and evaluative skills of cognition and comprehension of topics. Problems may be sourced from the textbook, lectures, and review articles or original research papers that we may or may have not read. This will provide you an opportunity to integrate your understanding of the topics and further sharpen your higher cognitive skills according to Bloom’s Taxonomy of Learning.

Attendance and Attitude: A bonus category that could be a critical determinant of your final grade. You will provide an assessment of yourself and each member of your group worth 2% and the Instructor will provide an additional 1% assessment. On balance, it is important to note that missing a class will negatively affect your grades substantially, given the high percentage apportioned to individual participation (i.e. discussion and recitation).

Grades: You will be able to track your performance through the semester using the gradebooks in Canvas. Grades will follow the following point distribution, usually without adjustment or “curving” and with no quota for particular letter grades:

>93%, A	87-89%, B+
90-92%, A-	83-86%, B

80-82%, B-
77-79%, C+
73-77%, C

70-72%, C-
60-69%, D
<60%, E

Other Important Policies:

Attendance: The SUNY Geneseo Student Handbook stipulates that students are expected to attend all classes. It is essential that students attend the first two meetings of each class each semester to establish their intent to pursue the course. Academic departments reserve the right to drop students from courses if the students have not attended the first two class meetings. Exceptions to this policy would be case-specific instances related to the current COVID-19 Pandemic challenges, and other extenuating circumstances beyond the control of the student. The student would need to communicate the circumstances as soon as reasonably possible to the Instructor to avoid being dropped.

Accommodations: SUNY Geneseo and the Instructor of this course will make reasonable accommodations for persons with documented physical, emotional or learning disabilities. Students should consult with the Director in the Office of Disability Services (Tabitha Buggie-Hunt, 105D Erwin, tbuggieh@geneseo.edu) or the Instructor regarding any needed accommodations as early as possible in the semester.

Professionalism: Please arrive on time for the Zoom meeting, stay through class, turn off your cell phone (including vibration mode). Use of laptops and other technology are only permitted for class-related activities. It is understood that the continuing development of new technology can be beneficial to the process of education. For this reason, laptops and smartphones are permitted for Zooming, note-taking and viewing classroom materials. Unacceptable classroom use of technology includes, but is not limited to social media websites, e-mail, playing games, and class – unrelated cell phone photography. These diversions not only reduce your class participation, they can also distract those around you. If you disrupt the lecture or are distracting others around you, you may be asked to leave and forfeit your participation grade. If the behavior of other students around you is affecting your learning, let them know, and please tell your Instructor.

If you have an emergency for which you need your cell phone to be turned on, talk to the Instructor before the beginning of the lecture and to be excused from this rule. Only then will you not be asked to leave if your cell phone rings/vibrates during the lecture period.

If you miss class or other class activities for reasons including but not limited to required school-related events (e.g. Conference, Class Travel), representing the College, College interviews, personal illness, death or serious illness in the family, religious observances, and required training for work or military service, please provide a valid excuse letter early if feasible. Where possible, discussion of alternative arrangements should take place with your group and me ahead of a missed class or class activity.

Communication: Check your e-mail daily in order to ensure that you receive reminders of what to bring to or prepare for class, as changes in schedule are sometimes necessary. E-mail is also usually the fastest way to get in touch with your Instructor. Because your Instructor's job require that he deals with many students from other courses, please include your name and Biol377 in all e-mails sent to him.

Appealing grades: A simple error in scoring will not require a formal appeal. But any graded work deemed unfair may be submitted for re-evaluation along with a written appeal. The basis for your appeal will usually be either ambiguity in (1) class notes or reading materials, or (2) a test question, or (3) a rubric in grading. The appeal should contain a brief written explanation of your concerns, including your reading of the ambiguity of the written material, or why you answered the question the way that you did, or why a grading does not reflect the rubric. Appeals should be turned within one week of receiving the graded work. When you submit your written appeal, we will schedule an individual conference to discuss its merit.

Academic dishonesty: In this advanced course, the most egregious and serious offense is **PLAGIARISM**, intentional or unintentional. As juniors and graduating seniors I expect you to be familiar with the serious nature of this offense and the academic consequence of committing it in this course. I will not hesitate to give an E for the course to a student who commits Plagiarism, after a first warning. If committed for the first time, the student will be given an E for the work. This will serve as the first and only warning.

Policy exceptions: Policies are designed to address common issues and concerns. The Instructor cannot anticipate every possible problem that may arise, and therefore policies can have limits and exceptions! If you are experiencing problems in completing class work or activity for any reason, especially in the remote method of instructions, please e-mail me immediately or make an appointment to talk with me.

Resources related to Covid-19

Health and Wellbeing in a Stressful Time

The changes brought on by COVID-19 have impacted us all in a number of ways, and will continue to do so at various times and to varying degrees during the upcoming semester. Your health and wellbeing are foundational to your ability to learn, and if you find that you are feeling unwell (physically or mentally) and it is impacting your ability to complete your coursework, please reach out. Because the learning environment will be different than it has been in the past, the indicators that usually let you know something is wrong may not be as clear to you or those around you as they would be during a typical semester. Additionally, the ways in which you normally engage in self-care may have been disrupted. Please remember that it's never too late to ask for help. The [Dean of Students](#) (585-245-5706) can assist and provide direction to appropriate campus resources. The college also has collected resources in a [Coping with COVID webpage](#).

In a similar way, I will occasionally ask for some patience and flexibility on your part. The pandemic is affecting faculty as well as students and creating demands that would not be present in an ordinary semester. If I am slow responding to an email, if I take some time to grade an assignment, if I am a bit late posting a video lecture, please be patient (and feel free to send me a 'nudge'; I will not be offended). You will never suffer any disadvantage in the course because of delays on my part. Remember that we are all in this together.

CLASSES WITH ONLINE COMPONENTS:

Accessibility of Course Materials

All course materials are available on Canvas and I've made every attempt to ensure that they are accessible to everyone. If you have difficulties accessing any materials (including needs for alternative formats), please let me know as soon as possible and I will rectify the situation.

Attendance at "Live" or "Synchronous" Online Sessions

Accessing course materials online may be challenging - we've all experienced things like unforeseen emergencies and internet disruptions. Although this course includes some "live" or synchronous course activities, we can all be understanding about the challenges posed by the COVID-19 pandemic and the limits of technology. If you miss a synchronous session, please let me know as soon as possible so that we can discuss ways to keep you on track. If you are experiencing longer-term disruptions, please be proactive in communicating with me and contact the Dean of Students if you expect to be out for an extended period of time.

Getting Help with Online Classes

CIT has developed a number of [resources that can help you formulate good strategies for success in online courses](#). These include general strategies for keeping on track with your courses as well as more specific resources about learning experiences that you may encounter in an online course. The Office of the Dean for Academic Planning and Advising has also introduced the new [KOALA \(Knights' Online Academic Learning Assistance\)](#) course support resource. Throughout the semester, if you need help with online learning strategies, you can contact the KOALA support desk, which will assist you with identifying resources and strategies for success.

[CIT also provides a range of technology support resources](#). When you are in Canvas, the Help menu on the left side of the screen will also direct you to a number of CIT supports, including self help resources and options to request technology assistance.

Important Dates (Spring 2021):

February 1	First day of class
February 14	Add/drop period ends; Registrar can accommodate requests for late adds between February 8 and February 13, only with instructor permission
March 23 (Tuesday)	MIDTERM Take Home Exam Deadline (closes at 11:59 pm)
March 24	Rejuvenation day; Semester is half over!
April 22	Rejuvenation day
May 10 (Monday)	Last Class Meeting
May 12	Last day of classes. Last day to withdraw from full semester courses. Last day to elect Pass/Fail for full semester courses
May 17 (Monday)	FINAL Take Home Exam Deadline (closes at 11:59 pm)

Advanced Topics in Biology: RNA Biology - BIOL 377 (01), CRN# 59064
 MF 5:30 pm -6:45 pm, Instructor: Dr. Salvador Z. Tarun, Jr.
 Course Outline, Spring 2021

***Note 1: Schedules and Topics may change. So please watch announcements in Canvas for changes.**

****Note 2: R&D = Reading and Discussion**

Class Schedule	Date	*Topic / Activity (Subject to adjustment)	Instructor/Presenter
Week 1: February 1 - 5			
1.	February 1	Introduction / Syllabus / Schedule / Policies /Grouping/ Overview: The Rise of the RNA	Dr. Tarun

2.	February 5	Lecture: Ch. 1 – Introduction to Molecular Biology of RNA / Assign **R&D1_Ch2 sections into Groups	Dr. Tarun
Week 2: February 8 - 12			
3.	February 8	Lecture: Ch. 2 – RNA Can Form Versatile Structures (Part 1)	Dr. Tarun
4.	February 12	Lecture: Ch. 2 – RNA Can form Versatile Structures (Part 2)	Dr. Tarun
Week 3: February 15 - 19			
5.	February 15	R&D1_Ch2: RNAs: Regulators of Bacterial Virulence / Assign R&D2_Ch3 sections into Groups	Class Presentation & Discussion
6.	February 19	Lecture: Ch. 3 – Catalytic RNAs (Part 1)	Dr. Tarun
Week 4: February 22 - 26			
7.	February 22	Lecture: Ch. 3 – Catalytic RNAs (Part 2)	Dr. Tarun
8.	February 26	R&D2_Ch3: RNA, the First Macromolecular Catalyst: The Ribosome is a Ribozyme_TiBS_2003 / Assign mFOLD Exercise: tRNA Secondary Structure Prediction	Class Presentation & Discussion
Week 5: March 1 - 5			
9.	March 1	Lecture Video: The Origin of Cellular Life on Earth (Part 1) – ‘RNA World’ Hypothesis / Assign R&D3 sections into Groups	Dr. Jack Szostak (Harvard U) / Dr. Tarun
10.	March 5	Lecture Video: The Origin of Cellular Life on Earth (Part 2) – ‘RNA World’ Hypothesis	Dr. Jack Szostak / Dr. Tarun
Week 6: March 8 - 12			
11.	March 8	R&D3: The Ribosome Challenge to the RNA World_JMolEvol_2015 / Finalizing Group Oral Presentation and Mini-Review Paper Topics	Class Presentation & Discussion
12.	March 12	Lecture: Ch. 4a – The RNA-binding Proteins	Dr. Tarun
Week 7: March 15 -19			
13.	March 15	Lecture: Ch. 4b – RNA-Protein Interaction Methods / Submission of mFOLD Exercise (Closes at 11:59 pm) / Release of Mid-term Take Home Exam	Dr. Tarun
14.	March 19	Lecture: Overview of the Central Dogma – 21 st Century Version	Dr. Tarun
Week 8: March 22 -26			
15.	March 22	Lecture: Chapter 11 – Translation and Stability of mRNA / Submission of Mid-term Take Home Exam (Closes at 11:59 pm)	Dr. Tarun
16.	March 26	R&D_Tarun: PABP-eIF4G and Translation in Yeast_PNAS_1997	Dr. Tarun
Week 9: March 29 – April 2			
17.	March 29	Lecture: RNA as Viruses (Part 1): What makes them tick?	Dr. Tarun
18.	April 19	Lecture: RNA as Viruses (Part 2) and RNA as Vaccines: How are we fighting back?	Dr. Tarun
Week 10: April 5 - 9			
19.	April 5	R&D_Group 1	Class Presentation & Discussion
20.	April 9	R&D_Group 2	Class Presentation & Discussion
Week 11: April 12 -16			
21.	April 12	Lecture: Ch. 13 – RNA editing	Dr. Tarun
22.	April 16	Lecture: Ch. 16 – short noncoding RNAs (snRNAs) – Part 1	Dr. Tarun
Week 12: April 19 - 23			
23.	April 19	Lecture: Ch. 16 – short noncoding RNAs (snRNAs) – Part 2	Dr. Tarun

24.	April 23	R&D_Group 3	Class Presentation & Discussion
Week 13: April 26 - 30			
25.	April 26	R&D_Group 4	Class Presentation & Discussion
26.	April 30	Lecture: Ch15 – The ‘Macro’ ncRNAs: Long Non-coding RNAs and Epigenetics (Part 1)	Dr. Tarun
Week 14: May 3 -7			
27.	May 3	Lecture: Ch15 – The ‘Macro’ ncRNAs: Long Non-coding RNAs and Epigenetics (Part 2)	Dr. Tarun
28.	May 7	R&D_Group 4	Class Presentation & Discussion
Week 15: May 10 - 12			
29.	May 10	Catching Up Day – Q&A / Submission of Group Mini-Review Article / Release of FINALS Take Home Exam	
Week 16: FINALS WEEK			
30.	May 17	Submission of FINALS Take Home Exam (Closes at 11:59 pm)	