

Biology 590S. Origins of Cellular Life

Fall 2017

Meeting times and locations

Lectures: Wed, 3:05-5:30pm (BioSci 155)

Instructors

Dr. Amy K. Schmid, Office: 4105 FFSC, Phone: 613-4464, Email: amy.schmid@duke.edu

Synopsis

The aim of this course is to investigate, explore, and evaluate the evidence for the origin of life on earth and the possibility of life on other planets. Students will read primary literature, understand and discuss competing hypotheses in the field, and write a final review paper on the state-of-the-art evidence for how life began and evolved.

Prerequisites

Molecular biology (Bio201 or equivalent) and inorganic chemistry. Microbiology and organic chemistry recommended but not required.

Course website

See the Biology 590S website at <https://github.com/Bio590S-origins/Fall2017-Bio590S/wiki>

Please see the bibliography at the end of the syllabus for the required reading list and the course Wiki for additional suggested background readings.

Office hours

Instructor is available by appointment. Please email, call, or meet after class to set up an appointment.

Due dates

1. Discussion topic leader choice: September 6 at end of class.
 - List three choices from the syllabus topic list in order of preference.
 - Email your choices to the instructor.
2. Discussion questions: 3-4 questions on the primary and review required readings, emailed to instructor and discussion leader for the day.
3. Paper draft: October 4 at end of class. Email your draft as PDF to instructor
4. Final paper: December 6 at end of class. Email your draft as PDF to instructor

Grading

Discussion leadership, 33%

Final Paper, 33%

Paper draft, 16.7%

Class participation, 16.7%

Format

The course is composed of reading, discussion, and writing a paper. Each week, we will read 1-2 papers from the primary literature and one from reviews or perspectives on the designated topic (see Bibliography at end of syllabus for papers). Each student will serve as discussion leader during one class period during the semester on a topic chosen from the syllabus topics list (see Topic List, below). Discussions will occasionally include a skype call with the author of one of the discussed papers. Discussions will sometimes include breakout sessions for students to discuss the paper(s) in smaller groups. Students will write a paper in a short review article format resembling that of Current Opinion journals. A graded draft of the paper will be due at mid-term, which will be edited by the instructor and fellow students. Edits will be used to revise for the final paper. Participation during discussions students do not lead will require contribution of discussion questions prior to the course meeting on that topic. Active participation in discussion is expected from each student each week.

Learning objectives

1. Learn and understand questions and concepts important to the field of the origin of life presented in the course.
2. Discuss and learn about methods and leading hypotheses in the field from field experts during skype chats.
3. Become proficient in reading the relevant primary literature to evaluate competing hypotheses and discuss literature content in light of the history of the field.
4. Communicate your methods and findings to the scientific community (your peers, your instructors) in the form of discussion leadership and a term paper. Understand and apply the importance of peer review in the form of peer evaluations.

Expectations and policies

Students are expected to:

1. **Come to class on time.**
2. Submit discussion questions and papers by their due dates.
3. Participate in discussions and skype chats.
4. Be good citizens of discussion: speak to each other with respect despite differing views on certain hypotheses.
5. Adhere to the Duke Community Standard (see "Academic Integrity" below). A zero tolerance policy is in effect: any assignments violating the Standard will receive a 0 grade.

Missed class time and late submissions

Students are expected to attend and participate in every class session. In the case of illness or extraordinary personal circumstance students should notify the instructors and their academic deans by means of a Short-Term Illness Notification Form (STINF) **before** the class session in which work is missed. Or, in the case of long-term medical or personal circumstances, students should request a letter from their academic dean. Homework assignments that are submitted late without a STINF or instructor approval will receive half credit if submitted within 48 hours of the due date, or zero credit thereafter. If you are frequently ill, and submit more than two STINFs we will ask you to provide a doctor's or dean's letter explaining the circumstances.

Students who will miss a class session due to religious observance should submit a Religious Observance Notification Form *no later than one week prior to the date of the holiday*.

Students who are members of a varsity athletic team, and who may be required to miss some class time, should provide the instructors with a copy of their spring semester travel schedule during

the first week of classes. Students should also complete an online “Notification of Varsity Athletic Participation (NOVAP)” form *no later than one week prior to each absence*.

Students who are seniors, and will be travelling for interviews, should notify the instructors *at least one week in advance about missed class time*.

If you miss a quiz due to illness, religious observance, athletic participation, or any other approved reason *you must take a make-up quiz within 48 hours or a zero score will be assigned*.

Students with excused absences are still expected to complete and submit homework assignments on time.

Academic Integrity

All students are expected to adhere to, and have an obligation to act, in accordance with the Duke Community Standard. For more information about the community standard please refer to the documents available at: <https://studentaffairs.duke.edu/conduct/about-us/duke-community-standard>. Any violations of the community standard will be referred to the undergraduate judicial board.

Especially as it applies to written assignments and group posters, a strict adherence to the plagiarism policy described in the Community Standard will be observed. We have a zero tolerance policy. Any assignments suspected of plagiarism will receive a zero.

Topic List, Fall 2017

Please refer to the course wiki for detailed bibliography and downloadable PDFs of the readings

- **August 30. Defining life**
 - Sagan chapter from the Nature of Life; Koshland, 2002.
- **September 6. The early Earth**
 - *Primary*: Dodd et al., 2017
 - *Review*: PBS NOVA: “Origins: Earth is Born”
 - *Supplementary*: Nutman et al., 2016; Allwood, 2016; PBS NOVA: “Life’s Rocky Start”
 - **Discussion leader choices due**
- **September 13. No class.**
- **September 20. Prebiotic chemistry: Experimental synthesis**
 - *Primary*: Miller, 1953; Oparin, 1924.
 - *Review*: Hazen’s Genesis, chapter 2, part 6; NOVA: “Origins: how life began”
- **September 27. Prebiotic chemistry: metabolism first hypothesis**
 - *Primary*: Kelley et al., 2001.
 - *Review*: Lane and Martin, 2012; Lane online lecture; Arndt and Nisbet, 2012.
 - [Skype: Nick Lane](#)
- **October 4. RNA world and protocells**
 - *Primary*: Prywes et al., 2016; Mansy et al., 2008.
 - *Review*: Gilbert, 1986; Joyce et al., 2002.
 - **Paper drafts due**
- **October 11. LUCA**
 - *Primary*: Weiss et al., 2016a
 - *Review*: Martin et al., 2016, Gogarten and Deamer, 2016; Weiss et al., 2016b.
- **October 18. The Great Oxygenation Event**
 - *Primary*: Zerkle et al., 2017.
- **October 25. Discovery of the *Archaea***
 - *Primary*: Woese and Fox, 1977; Woese et al., 1990.
 - *Review*: Woese, 1987.
- **November 1. Rooting the tree of life**
 - *Primary*: Raymann et al., 2015; Zaremba-Niedzwiedzka et al., 2017
 - *Review*: Williams et al., 2013.
 - [Skype: Simonetta Gibrardo](#)
- **November 8. Universal molecular characters? The example of transcription**
 - *Primary*: Smollett et al., 2017
 - *Review*: Werner and Grohmann, 2011.
 - [Skype: Finn Werner](#)
- **November 15. Eukaryogenesis**
 - *Primary*: Sagan, 1967.
 - *Review*: Gray, 2017; Poole and Gibrardo, 2014.
- **November 22. Thanksgiving break**
- **November 29. Extremophiles**
 - *Primary*: Kashefi and Lovely, 2003.
 - *Review*: Rothschild and Mancinelli, 2001.
- **December 6. Astrobiology**
 - *Primary*: Vreeland et al., 2007; Goordial et al., 2016.
 - *Review*: Webb and DiRuggiero chapter, Polyextremophiles (eBook); NOVA: “Finding life beyond Earth.”
 - **Final papers due**
 - [Skype: Carlos Mariscal](#)