Astronomy 106: The Cosmic Origins of Life

Fall 2015

In Astronomy 106 we learn about the evidence for habitats and the building blocks of life in extraterrestrial space; the possibilities for the development of life elsewhere; and the light that these ideas cast on the origins of life on Earth. We also discuss the future of civilizations like ours, the possibilities of travel to other habitable planets and communication between advanced cultures spread widely through space. Life’s origins are perhaps the ultimate interdisciplinary subject: the material we discuss will be drawn from astronomy, physics, geology, chemistry, biology, paleontology, and history – and will be presented with a minimum of mathematical complexity.

Professor: Dan Watson. Office: 206 Bausch and Lomb (B&L); phone: 275-4344; Internet: dmw@pas.rochester.edu; Web site: http://www.pas.rochester.edu/~dmw. Dan is an astrophysicist whose research specialties include star and planetary-system formation. He is also Chair of the Physics and Astronomy Department. He created AST 106 and taught it twice before, in Springs 2010 and 2012.

Teaching assistants: Ryan Rubenzahl ’18, Adam Stenson ‘18, and Saad Usmani ‘17; email addresses respectively rrubenza@u.rochester.edu, astenson@u.rochester.edu, and susmani@u.rochester.edu.

Web site: http://www.pas.rochester.edu/~dmw/ast106. This is the main reference for the course. In these pages one can find complete lecture presentations; the electronic homework, practice exams and real exams; and many other useful resources, even a copy of this document.

BlackBoard: Not in this class.

Lectures: Tuesdays and Thursdays, 2:00-3:15 PM, in 109 B&L, conducted by Dan. All of material for each lecture will be available, for you to browse or to download in a form suitable for taking additional notes, on our Web site, a day or two before the lecture is actually delivered. Note that about a quarter of the material we will introduce in lecture is not found in the textbook. In lectures we use the Turning Technologies Response NXT clickers for real-time student feedback and participation. Each student needs his/her own Response transmitter. These devices are available at the UR Bookstore.

Required textbook: Only one, Neal Evans’s Extraterrestrial Life, fifth edition (Pearson, 2003). This book covers about three-quarters of the material we will study in AST 106, and covers it very well. It is available in the UR bookstore. As it is a print-on-demand textbook, it is usually not available at all of our favorite online bookstores. And, alas, there still isn’t a Kindle version.

Recommended (supplementary) books, mostly about the biological, paleontological and historical aspects of the course, which you should not feel compelled to buy, but which at least are inexpensive. Dan likes them and occasionally cites material from them in the AST 106 lectures.

Jared Diamond
Guns, germs and steel: the fates of human societies Norton, 1999
Collapse: how societies choose to fail or succeed Viking, 2004

Nick Lane
Life Ascending: the ten great inventions of evolution Norton, 2009

Colin McEvedy

Svante Pääbo
Neadertal man: in search of lost genomes Basic, 2014

Chris Stringer
Lone survivors: how we came to be the only humans on Earth Henry Holt, 2012
The cost of course materials: We have tried hard to hold costs down. Our textbook ($87.65 new, $65.75 used; up $30 in the past three years, and the author’s not getting all the increase!) is a better book, and much better suited to our needs, than anything in its price range, and costs far less than most of its competitors ($200-$300). New TT Response transmitters cost $58.00 ($44.65 used) but can be turned back in to the bookstore at the end of the semester for a refund just $15 less than you paid. So your total costs for AST 106 course materials – presuming you keep your book and return your clicker – will lie in the range $85-100, including sales tax, which is still less than 2% of the full price for a four-credit UR course.

Recitations: Tuesdays, 3:25-4:40 PM, in 502 Morey; Wednesdays, 3:25-4:40 in 315 B&L and 4:50-6:05 PM in 138 Hutchison; and Thursdays, 4:50-6:05 PM, in 101 Hylan. They begin the second week of classes. Saad, Ryan and Adam will conduct the recitations. You may attend any or all but you must register for one. See the Recitations page of the AST 106 website for a schedule of events.

Class participation: All members of the class are expected to attend all of the lectures, and encouraged to attend one recitation per week. This is for your own good, of course. To emphasize this importance of class meetings, class participation will comprise 6% of your grade. Your class-participation score will be based upon the submission of answers to in-class questions with your Response clickers, and upon attendance of recitation.

E-mail list server: ast106@mail.pas.rochester.edu. Messages sent to this address will be resent to everybody in the class. Obviously this provides a good way to make general announcements. We also encourage use of the list server to ask questions about readings, lectures, homework problems and the like; the rest of the class will probably also be interested in your questions and the answers you’ll receive. (We will answer e-mail questions privately, too.)

Homework assignments: six problem sets, due at 7PM on: Wednesdays, 16 and 30 September, and 21 October; Friday, 6 November; and Wednesdays, 25 November and 9 December. Each problem set will involve use of the WeBWorK system, a computer program that enables students to answer homework questions interactively, with immediate feedback and immediate, automatic grading. Your problem sets will in general be different from those of your classmates. Once assigned, your personalized problem set will be accessible on the World Wide Web. Your percentage score on each problem set will count as 2% of your grade in the course – that is, all six comprise 12% of your final grade.

We strongly encourage students to discuss the homework problems, and to work together toward their solution. We demand only that the solutions you submit be the result of your own thought and expressed in your own words, in accordance with the University’s academic honesty policies.

Examinations: three tests, given on line with WeBWork during the hours 11-6 PM on Thursday, 1 October; Tuesday, 10 November; and Thursday, 10 December. One hour and fifteen minutes will be allowed to complete the exam once you begin, but you can begin at any time consistent with starting and finishing within the seven-hour window. Each exam will emphasize subjects that haven’t yet appeared on a test; that is, no comprehensive final exam will be given. You must take all three tests in order to pass the course. Your percentage score on each exam will count as 27.33%.

If you miss an exam due to illness or emergency, a makeup exam may be scheduled by appointment. All makeups will be oral examinations, an hour and fifteen minutes in length. Whether a situation counts as an emergency will be judged by Dan, and his judgment may differ from yours. Suddenly finding yourself with airline tickets for an exam date, for example, does not count as an emergency; you will also find Dan very well informed about such things as actual mortality statistics of grandparents in December. Oral exams will be administered and graded by Dan.
The best way to study for the examinations is to do the homework, and to work out the sample exams that will appear in WeBWorK a few days before each exam. Review sessions, hosted by the TAs, will be given the night before each exam.

**Academic honesty:** For our purposes, and according to the new UR Academic Honesty Policy, *cheating* consists of submission of homework or exam solutions that are not your own work, or submission of solutions under someone else’s name. According to University rules, any detected act of cheating that is not the result of a simple misunderstanding will be handed over to the Board on Academic Honesty for investigation.

**Grades:** As listed above, grades are based 6% on class participation, 12% on the six homework assignments, and 82% on the three examinations. **No extra-credit projects will be assigned, that cannot be assigned to the whole class.** Final grades will be set by an absolute scale, rather than “by the curve.” In terms of the maximum possible percentage score, the grading scale will be as follows:

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<tr>
<th>Percentage score</th>
<th>Final grade</th>
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<tbody>
<tr>
<td>≥ 90</td>
<td>A</td>
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<td>≥ 85</td>
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<td>&lt; 45</td>
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Last time Dan taught AST 106, the average total percentage score was 75.9, for a B.

**Extra help:** Check out the class-meeting and office-hours calendar on the Contacts page in the Astronomy 106 Web site. Appointments can also be arranged. Please come in and see us. We will also answer questions by e-mail (privately or through the list server), and will often be electronically accessible late into the night when homework due dates or exams approach. By either means we will be happy to answer any questions you have concerning the course. We will be even happier to help those who find the material or presentation so confusing that they’re not even sure what to ask.