Revised proposal to add Chem360 “Origins of Life on the Earth” to the Global Environmental Change Cluster as a University Studies course.

Dr. Niles Lehman  
Associate Professor  
Department of Chemistry

1. COURSE DESCRIPTION.

Origins of Life on the Earth (4)
Scientific description of the chemical events leading to life on the Earth. Current and past theories of how life arose and experiments that support these ideas will be presented. Cultural and societal issues surrounding the origins of life will also be discussed.

A. DEVELOPMENT
Chemistry 360 was taught in the Winter of 2003 for the first time at PSU under a “special topics” label (Ch299). The course has subsequently been approved as a regular course in Chemistry.

B. AVAILABILITY
This course will be offered alternate Winter Quarters (2003, 2005, etc.) by Dr. Lehman.

C. PREREQUISITES
One college-level course in biology, chemistry, geology, or physics.

2. COURSE OUTLINE.
See attached syllabus from Ch299, Winter 2003. Dr. N. Lehman will teach this course.

3. GENERAL EDUCATION GOALS.

A. CONTENT & SUITABILITY
This course is very interdisciplinary in nature. The origins of life involved chemical, biological, geological, astronomical, and physical phenomena. In addition, the study and current perception of the origins of life have deep philosophical and cultural aspects. All of these angles are explored in this class, challenging students to think across traditional disciplinary boundaries and integrating disparate ways of thinking.

The Global Environmental Change Cluster has a goal of discussing “the physical, chemical, and biological changes that are recorded” on the Earth. The origin of life is clearly one of the most significant, if not the most significant, change that Earth has ever experienced. Thus this course fits squarely within the framework for this cluster. The extreme interdisciplinary nature of the course will augment the cluster and complement other courses within the cluster. In addition, Ch360 would be only one of two chemistry classes at PSU integrated into the University Studies program, with the other (Ch371U) not having been taught regularly of late.

B. UNST GOALS
1) Inquiry and Critical Thinking. In Ch360, the concept of the origins of life on the Earth is explored from a highly interdisciplinary viewpoint as discussed above. The students are forced to consider the myriad of challenges abiotic systems would have faced in acquiring the characteristics that we now ascribe to “life”. Because these events occurred 4 billion years ago, and prior to any fossil record, the students become aware of the enormity of reconstructing these events today, and should gain deep insight into the limits, and powers, of the scientific method. Consequently the material of Ch360 falls squarely within the critical thinking rubric, perhaps even more so than most other science courses.
2) Communication. Because this course employs, for the most part, traditional pedagogy, admittedly relatively few communication skills are developed in the course. However, all students are required to perform a term project, which involves the students going out into the general population and performing a survey of backgrounds and beliefs related to the origins of life. This forces the students to interact and communicate with others in a fashion that mandates impartiality in the face of the intrinsic biases that most people have about this subject. Students are also encouraged to ask questions and discuss topics in the classroom.

3) Diversity of Human Experience. In addition to the deep interdisciplinary nature of this course as explained above, a significant portion of the course is devoted to the history and the sociology surrounding the study of the origins of life. This subject strikes deep at philosophical divisions between scientific thought and other types of worldviews. The term project (see above) necessarily exposes the students to the teeth of human diversity at a very personal level. From the last time this course was taught, it is apparent that these experiences, both inside and outside the classroom, expose students to a variety of thought processes and force them to think critically about the way science has impacted our culture. The student responses on the instructor evaluation forms were very positive in this regard.

4) Ethical Issues and Social Responsibility. While this course is taught from a strictly scientific point of view, it is stressed that other viewpoints are very common in the world and that respect for those views by scientists is critical. The first time the course was taught, the last couple of lectures were devoted to exploring the various creation myths that have existed in recorded history, such as aboriginal peoples' creation myths, Greek and Roman mythology, East Asian mythology, Judeo-Christian mythology, and others. It is anticipated that these exposures will allow the students to become more socially aware of the science/religion/philosophy interfaces. This coming year I hope to have a representative of one of the Northwest native tribes speak to the class about their culture and creation stories.

C. CLASSROOM ENVIRONMENT

Although this course employs standard pedagogy, the environment is very discussion oriented and students are strongly encouraged to initiate dialogs among themselves during the lectures. Material is presented from the textbook, from websites, from past and current scientific literature, and even from guest lectures. Last Winter, we were fortunate enough to have Dr. Anne Kinney, Director of NASA's Space Flight programs, come and address the class. The term project includes a research portion and, as mentioned above, a student-society interaction portion.
Chemistry 299 – Origins of Life
Portland State University, Winter 2003

General Information
Class meetings (required) – TuTh 4:40 pm – 6:30 pm in Cramer Hall, room 53 (initially)
Dr. Lehman’s Office Hours – Tu & Th 3:30 pm – 4:30 pm; and by appt.
Best way to contact Dr. Lehman – by email! (niles@pdx.edu)

Prerequisites
The prerequisite for enrollment in Chem 299 is completion of at least one college-level science course in any of the following subjects; biology, chemistry, geology, or physics.

Course Overview
Chem 299 is the precursor to Chem 360, a regular course that will be taught in alternate years. We will survey just exactly what the scientific definition of life is, and how it might have arisen from non-life on the Earth some 4 billion years ago. In doing so, we will concentrate on the use of the scientific method to investigate this important problem. We will cover some of the many challenges that this field of study has presented to science and examine some of the powerful and exciting discoveries that have been made in the last century to figure out just how the origins of life came about from a scientific perspective. Without degrading into philosophical arguments about biogenesis, we will also take a look at a few of the cultural ramifications that the study of the origins and early evolution of life have brought.

Grading
Grading will be done on a straight scale, with some curving to accommodate inconsistencies. Your grade will be determined by the total number of points that you accumulate on exams and on the term assignment. There are a total of 400 points possible in the course. If you accumulate 350 points or greater (87.5%) you will receive an "A" or an "A-". If you accumulate 300 points or greater (75%) you will receive a "B-" or a "B" or a "B+". If you accumulate 250 points or greater (62.5%) you will receive a "C-" or a "C" or a "C+". If you accumulate 200-250 points you will receive a "D". If you accumulate fewer than 200 points you will receive a failing grade. Exams will be about 50% multiple choice and 50% short answer.

Points can be obtained from the following:
Midterm I (January 28th) - 100 points
Midterm II (February 25th) - 100 points
Term assignment (due March 17th at 9:00 am) – 100 points
Final Exam – (March 18th) 100 points

Term Assignment
An out-of-class assignment due on Monday, March 17th at 9:00 am will be worth a total of 100 points. This assignment will be described in more detail during the first few weeks of the course. It will involve a 4-5 page written analysis of some aspect of the Origins of Life.
Course Policies
Some general principles are as follows:

- Cheating will not be tolerated.
- Plagiarism (passing off someone else’s work as your own) will not be tolerated.
- Late assignments will not be accepted.

The policies described above reflects an expectation to behave as independent, mature adults. All students must take the first midterm and the final. If you miss the second midterm, then you can use you score from the first midterm in its place, with a 10-point penalty. You may, by at least one-week prior arrangement with me, take the final exam early, should you anticipate some conflict with the scheduled final exam time (Tuesday, March 18th, 2003 A.D. from 4:40 to 6:30 pm Pacific Time). You may not take the final exam late. The term assignment (see above) will be expected (in hard copy in my hands or by email in my “IN” box) by 9:00 am on the day that they are due. Late assignments will be graded for potentially enlightening comments, but will receive a zero point score.

Lecture Schedule

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<thead>
<tr>
<th>Date</th>
<th>Reading</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Tues, Jan 7</td>
<td>none</td>
<td>Introduction – Life’s Origins &amp; Timeline</td>
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<tr>
<td>Thurs, Jan 9</td>
<td>Introduction, pp. i-xx</td>
<td>What is the scientific definition of life?</td>
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<tr>
<td>Tues, Jan 14</td>
<td>Chapter 7, pp. 143-158</td>
<td>Information and thermodynamics (º)</td>
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<tr>
<td>Thurs, Jan 16</td>
<td>Chapter 3, pp. 59-84</td>
<td>The origin of the planet Earth (º)</td>
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<td>Tues, Jan 21</td>
<td>TBA</td>
<td>Atomic &amp; molecular components of life (º)</td>
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<td>Thurs, Jan 23</td>
<td>Chapter 1, pp. 1-33</td>
<td>Spontaneous generation?</td>
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<tr>
<td>Tues, Jan 28</td>
<td></td>
<td><strong>MIDTERM I (covering chapters 1, 3, and 7)</strong></td>
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<tr>
<td>Thurs, Jan 30</td>
<td>Chapter 2, pp. 35-58</td>
<td>Oparin and the primordial ooze (º)</td>
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<tr>
<td>Tues, Feb 4</td>
<td>Chapter 2, pp. 35-58</td>
<td>The Miller-Urey experiments (º)</td>
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<td>Thurs, Feb 6</td>
<td>Chapter 4, pp. 85-105</td>
<td>Chirality and polymerization (º)</td>
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<tr>
<td>Tues, Feb 11</td>
<td>Chapter 4, pp. 85-105</td>
<td>The Thioester World, clay-based life, etc.</td>
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<tr>
<td>Thurs, Feb 13</td>
<td>Chapter 5, pp. 108-122</td>
<td>Proteinoids, microspheres &amp; liposomes (º)</td>
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<td>Tues, Feb 18</td>
<td>Chapter 6, pp. 123-142</td>
<td>The RNA World (º)</td>
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<tr>
<td>Thurs, Feb 20</td>
<td>Chapter 6, pp. 123-142</td>
<td>Spiegelman’s Monsters!</td>
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<td>Tues, Feb 25</td>
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<td><strong>MIDTERM II (covering chapters 2, 4, 5, and 6)</strong></td>
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<tr>
<td>Thurs, Feb 27</td>
<td>Chapter 6, pp. 123-142</td>
<td>Evolution in the test tube I</td>
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<tr>
<td>Tues, Mar 4</td>
<td>Chapter 6, pp. 123-142</td>
<td>Evolution in the test tube II</td>
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<tr>
<td>Thurs, Mar 6</td>
<td>Chapter 8, pp 159-181</td>
<td>Where on Earth? (º)</td>
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<tr>
<td>Tues, Mar 11</td>
<td>Chapter 9, pp. 183-210</td>
<td>Early Cellular Life (º)</td>
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<tr>
<td>Thurs, Mar 13</td>
<td>TBA</td>
<td>The Cultural Implications...</td>
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<tr>
<td>Tues, Mar 18</td>
<td></td>
<td><strong>FINAL EXAM (covering the entire course)</strong></td>
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PROPOSING FACULTY: Niles Lehman

COURSE TITLE AND NUMBER: CH360: Origins of Life on the Earth

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OBTAIN CHAIR AND CLUSTER COORDINATOR SIGNATURES
BEFORE SUBMITTING TO UNIVERSITY STUDIES OFFICE

DEPARTMENT CHAIR(S): [Signature], DATE: 7/27/04

[Signature], DATE:

CLUSTER COORDINATOR: [Signature], DATE: 7/37/04

All changes to Clusters must be approved by PSU’s Senate Curriculum Committee.

THE ORIGINAL + 12 COPIES OF THE PROPOSAL
MUST BE RECEIVED AT UNIVERSITY STUDIES (CH 163)
BY OCTOBER 31, 2003

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COURSE APPROVED FOR CLUSTER INCLUSION

CHAIR, CLUSTER COORDINATORS: ____________________________. DATE: ____________.

CHAIR, UNST COMMITTEE: _________________________________________. DATE: ____________.
Cluster: Environmental Change - Global Env. Change
Title of course: Origins of Life on the Earth
Course Number: CH 360
Proposing Faculty: Niles Lehman
Cluster Coordinator: [Name]

Cluster Course to New Cluster

Other clusters this course is assigned to:

Non 'U' course proposed to Cluster

Removal

UNST Committee-- PASS: Yes ☑ No ☐
If no, reason: ____________________________________________

UCC Committee-- PASS: Yes ☐ No ☑
If no, reason: ____________________________________________