

# Chemistry 05/ Biology 06 / Astronomy 06: From the Big Bang to Humankind

*Please note: this is the spring 2010 syllabus.*

Tue – Thu 3:00pm – 4:15pm (J+ block)

Pearson Chemistry Laboratory, Room 104 - 1 credit

<p style="text-align: center;"><b>Professors</b></p> <p>David R. Walt <a href="mailto:david.walt@tufts.edu">david.walt@tufts.edu</a> (Lead Professor)</p> <p>Eric Chaisson <a href="mailto:eric.chaisson@tufts.edu">eric.chaisson@tufts.edu</a></p> <p>Andy Kurtz <a href="mailto:kurtz@bu.edu">kurtz@bu.edu</a></p> <p>Catherine Freudenreich <a href="mailto:Catherine.freudenreich@tufts.edu">Catherine.freudenreich@tufts.edu</a></p> <p>Lauren Sullivan <a href="mailto:lsulli03@tufts.edu">lsulli03@tufts.edu</a></p>	<p style="text-align: center;"><b>Teaching Assistant</b></p> <p>Trish Hredzak <a href="mailto:patricia.hredzak@tufts.edu">patricia.hredzak@tufts.edu</a></p> <p><b>Office Hours:</b> Tue/ Thu 4:20-4:45 P-112</p> <p style="text-align: center;"><b>Course Coordinator</b></p> <p>Meredith Knight <a href="mailto:Meredith.knight@tufts.edu">Meredith.knight@tufts.edu</a></p>
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**Course Description:** Chemistry 0005/ Biology 0006/ Astronomy 0006: “From the Big Bang to Humankind” will explore the origin and fate of the Universe, the formation of Earth and its structure, the chemistry of life, the evolution and development of complex organisms, and the onset of modern humans. The goal of the course is to understand these topics by examining the scientific evidence and the scientific arguments that enable scientists to have confidence in this knowledge. The course is designed to demonstrate the interdisciplinary nature of science, and to allow students to both reinforce and augment their knowledge of science through learning about the evolution of the universe.

**Assignments and Exams:** Your grade in this course will be based on two, hour long in-class exams (25% each), one final exam (37.5%) and five homework assignments (12.5%). To help prepare you for the exams, the homework assignment questions will be formatted similar to the questions you will encounter on the exams.

**Grading:** If you have a **dispute** regarding the grading of an item on a homework assignment or exam, you have one week after the paper has been returned to submit your test or assignment for regrading. After that week, the answer key will be posted on Blackboard and **no regrades will be accepted**. Regrades must be submitted in writing, and the professors and TA will review and regrade all questions on the assignment or exam, not just the one submitted for regrading.

**Review Sessions:** Between 4:20-4:45pm directly after the class is over, the TA and course coordinator will be available in Room 112 (across the hall from Pearson 104) to answer questions from students regarding the course material. On the **last lecture** of each professor’s section, the professor will also stay until 4:45pm to answer questions from students about the material. These sessions are marked with three asterisks.

**Blackboard:** Assigned readings and all PowerPoint slides used in class will be posted on Blackboard. An audio recording of the lecture will also be available as a podcast. Details about how to access the podcast are available on Blackboard. Students are encouraged to use the discussion board to post questions and answers and engage in discussion. The discussion board will be monitored by the course coordinator to ensure scientific accuracy.

**Readings:** all readings will be posted on Blackboard. No texts are required for the course.

## Course Schedule:

1 - Thu, Jan 21<sup>st</sup> - **Introduction of Faculty; Overview of the Course; Explanation of Assignments, Exams and Grades; Discussion of Scientific Evidence**

### **Astrophysics—Professor Chaisson**

2 - Tue, Jan 26th – **Cosmic Evolution: Seeking Unity Among the Natural Sciences**

Question: What is the source of order, structure and complexity in Nature?

3 - Thu, Jan 28th – **Distant Galaxies: The Keys to Cosmology**

Question: How well can we scientifically explore the origin of the Universe?

4 - Tue, Feb 2nd – **Relativity Theory: A Grand Einsteinian Idea**

Question: What evidence do we have regarding the ultimate fate of the Universe?

5 - Thu, Feb 4th – **The Sun: A Fusion Reactor in the Sky**

Question: How do stars shine, and how well do we understand their basic concepts?

6 - Tue, Feb 9th – **Stellar Evolution: Black Holes & Other Weird Stuff**

Question: What is the origin of the heavy elements comprising our planet and our bodies?

7 - Thu, Feb 11th – **Star Formation: Probing Interstellar Space\*\*\***

Question: How do stars and planets form in the dark realms of the Milky Way?

\*\*\*Professor Chaisson will attend the office hours in P-112.

### **Geology and Earth Science—Professor Kurtz**

8 - Tue, Feb 16th – **Origin of the Solar System, Earth and Moon**

Question: How can we use asteroids, comets, rocks and isotopes to learn about the really deep past of our planetary home in space?

Thu, Feb 18th – **President's Day - NO CLASS** – Monday's schedule substituted for Thursday

9 – Tue Feb 23<sup>rd</sup> - **From Continental Drift to Plate Tectonics**

Question: Why did it take geologists so long to figure out what now seems so clear?

10 - Thu, Feb 25th – **The Hydrosphere and Atmosphere**

Question: How does Earth's climate system work?

11 - Tue Mar 2nd – **Co-evolution of Climate and Life\*\*\***

Question: How has life on Earth influenced Earth's climate?

\*\*\*Professor Kurtz will attend the office hours in P-112.

12 - Thu Mar 4th – **EXAM 1—Astrophysics and Geology Exam** – 1 hour

### **Chemistry—Professor Walt**

13 - Tue Mar 9th – **The Biogeochemical Cycle**

Question: Why is carbon dioxide so important?

14 - Thu Mar 11<sup>th</sup> - **Atoms, Molecules, and Bonding. Organic Chemistry and the Molecules of Life**

Question: What's so special about carbon?

15 - Tue Mar 16<sup>th</sup> - **The Origins of Life and The Central Dogma - Molecular Genetics: Proteins, DNA, & RNA**

Questions: The Origins of Life—What is the Evidence? How do molecules transmit information?

16 - Thu Mar 18<sup>th</sup> - **Biochemistry: Photosynthesis, Glucose, Metabolic Pathways\*\*\***

Question: How do organisms obtain and use energy?

\*\*\*Professor Walt will attend the office hours in P-112.

**SPRING BREAK** - Mar 20<sup>th</sup> –Mar 29<sup>th</sup>

**Biology—Professor Freudenreich**

17 - Tue Mar 30<sup>th</sup> – **Cells – components and division**

Question: How do cells divide their contents evenly between two daughter cells?

18 - Thu Apr 1<sup>st</sup> – **DNA and Chromosomes – the good and the bad**

Questions: How can 2 meters of DNA fit into a 10 μm nucleus? How do chromosome rearrangements cause disease?

19 - Tue Apr 6<sup>th</sup> – **Genomes – organization and variation**

Questions: What percent of the human genome codes for proteins? How do genomes differ between individuals?

20 - Thu Apr 8<sup>th</sup> – **Mutations and Disease – examples and methods**

Question: How can the consequences of a mutation be determined?

21 - Tue Apr 13<sup>th</sup> – **Evolution: Finding Darwin in DNA\*\*\***

**Guest Lecturer: Professor Erik Dopman**

Question: How are adaptive traits and new species formed?

\*\*\*Professor Freudenreich will attend the office hours in P-112.

22 - Thu Apr 15<sup>th</sup> – **Chem/ Bio Exam**

**Anthropology—Professor Sullivan**

23 - Tue Apr 20<sup>th</sup> – **Anthropological and Archaeological Field Methods**

Question: How is the human past investigated?

24 - Thu Apr 22<sup>nd</sup> – **Early Human Ancestors**

Question: What evidence is there for human evolution?

25 - Tue Apr 27<sup>th</sup> – **Spread of Early Humans across the Globe**

Question: Where are early humans found after they expand out of Africa?

26 - Thu Apr 29<sup>th</sup> – **The Appearance of *Homo sapiens sapiens*\*\*\***

Question: How closely are modern humans and Neanderthals related?

\*\*\*Professor Sullivan will attend the office hours in P-112.

**FINAL EXAM** – 3:30-5:30pm on Thursday May 13, 2010 in Pearson Room 104