

The Global Environment: a trip from the Big Bang to Climate Change
(BISC 427 or GEOL 427 or ENST 427)

Class Time: MW 2:00-3:20 pm; ZHS 360

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Text: No text required. All readings will be posted on the class web site

We focus on the development of Earth as a habitable planet, from its origin to human impacts on global biogeochemical cycles in the ocean, land, and atmosphere. We seek to define the scientific basis for understanding the magnitude and temporal scales of recent global environmental changes. The class is divided into three sections; Section I describes the major processes (from the Big Bang to the Earth's formation) that provided the raw materials for the evolution of life on planet Earth. In this section, we will also study how the different biochemical pathways evolved and how some of them have influenced Earth's climate and chemical composition. Section II describes human impact on the planet. Section III concentrates on potential solutions to human-induced changes.

Class Approach: In this class, we will use a "follow the carbon approach". We are going to learn about how the world functions through the carbon atom because: Life is based on carbon, the availability of carbon to life is maintained by a natural flow among the biosphere, atmosphere, geosphere and hydrosphere, modern civilization is built on carbon (energy, plastics, chemicals, medicines, etc.), and carbon is the basis of some of the major environmental and political problems that we are facing.

Grading:

- 1) Class attendance and participation (3 absences = - 5%)
- 2) Weekly quizzes and homework (25%)
- 3) Student presentation and final paper based on the class presentation. Presentations will be 12 minutes long and will be based on any topic covered in the class (15%). Paper needs to be 5 pages long; single-space (5%).
- 4) Exams (15 % each-30%)
- 5) Final exam; cumulative (20 %).

January

- 9 Introduction and overview-class discussion
- 11 Scheffers, B. R., et al. (2016). "The broad footprint of climate change from genes to biomes to people." Science
- 16 MLK
- 18 Evolution of the Chemical Elements, Universe, Solar System and Earth
- 23 Functioning of planet Earth (plate tectonics, atmospheric and ocean circulation, long-term elemental cycling)
- 25 Origin of life I
- 30 Origin of life II

February

- 1 Carbon fixation, nitrogen fixation and metallo-enzymes evolution
- 6 Evolution of metabolic pathways I
- 8 Evolution of metabolic pathways II
- 13 Co-evolution of Life and atmospheric composition (life in extreme environments,)
- 15 Key events in biological evolution
- 20 President's day
- 22 What makes us human? What makes an alien? Class Discussion
- 27 **Exam 1**

March

- 1 Climate evolution: The Nature and causes of Climate change (including Human perturbations to global biogeochemical cycles)- I
- 6 Climate evolution: The Nature and causes of Climate change (including Human perturbations to global biogeochemical cycles)-II
- 8 Six degrees could change the world (NG movie-part 1)
- 13 Spring Recess
- 15 Spring Recess
- 20 Climate transitions, tipping points and myths and facts about climate change
- 22 Historical Perspective: Climate change, societal collapse and human health
- 27 Environmental solutions-I
- 29 Environmental Solutions-II

April

- 3 Energy wedges and Climate geo-engineering
- 5 **Exam 2**
- 10 Presentations
- 12 Presentations
- 17 Presentations
- 19 Presentations
- 24 Presentations
- 26 Final Discussion and "State of the Planet"