

# **The Little Things, and their influence on planet earth: Spring 2012; CERC, Columbia University**

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## ***Course Hypothesis***

The teachings in this class will highlight how in the last century, we witnessed the incredible “environmental” leaps in our understanding of planet Earth. This course attempts to investigate how the smaller organisms living in the oceans and rain forests, influence the comfortable temperature you are experiencing, air that you breathe, food that you eat, and global economy. The little things on earth may be looked at as maintaining the “biosphere”, which is the global sum of all ecosystems.

A theory that evolved in the 1970s called the ***Gaia Hypothesis***, proposes that our planet functions as a single organism that maintains conditions necessary for its survival. Formulated by James Lovelock in the mid-1960s and published in a book in 1979, this controversial idea has spawned several interesting ideas and many new areas of research that gave us a better understanding of the how the little things influence the atmospheres and oceans. The idea of the Earth acting as a single system has provoked a new learning tool of the connectedness of all the living and non-living process on our planet. One such example; how can the life functions and interactions between the little things, such as plankton-zooplankton within the upper ocean regulate the global climate cycle, food you eat and biodiversity? Can rainforests influence climate and food production in a similar manner? Can tropical coral reefs maintain coastal fisheries, coastal ecosystem stability and biodiversity all over the tropics?

While this hypothesis is still scientifically debated, it provides a basic understanding on the functions and interactions of physical, chemical, geological, and biological processes on earth. Hence, this class will serve as a good starting point for our study of the “little”

living and non living things associated with biological oceanography, marine ecology, and rainforest biology, thereby providing an overview of the kinds of natural processes and examples that will interest all of us throughout this class.

### ***Human Impacts on the “Little Things”***

All human productivity and growth that occurs on the planet, such as, marine pollution, rain forest deforestation, the increase of emissions of carbon dioxide from fossil fuel production, the massive planting of croplands - all have an effect on our planets natural ecosystems. The most difficult part of this idea is how to qualify these effects, i.e. to determine whether these effects are positive or negative. If the earth is indeed self-regulating, then can it adjust to the heavy foot-print of man? Can the natural ecosystems on earth , or the biosphere, maintain the climate and the atmospheric composition at an optimum level for rain forests, wetlands and coral reefs to survive?

How can the primary production in tropical rain forests, and the upper 90 feet in the ocean control and stabilize global warming?

How can rainforests, plankton and fisheries help maintain a balance within the atmosphere, on planet earth, that benefits human survival at no cost?

Will this changing climate, and the pollution in the water and atmosphere cause the demise of the “little things” within the biosphere?

Will the worlds wetlands and coral reefs survive in a heavy handed human footprint ?

This homeostasis is much like the internal maintenance of our own bodies; processes within the human body ensure a constant temperature, blood pH, electrochemical balance, etc. The inner workings of earth or *Gaia*, therefore, can be viewed as a study of the physiology of the earth, where the oceans and rivers are the earth's blood, the atmosphere functions as the earth's lungs, the

land is the earth's bones, and the living organisms are the earth's senses.

The realization that humans greatly influence the environment and its ecology in urban and natural areas is now understood. This class covers a foundational understanding how the chemical, biological and physical cycles influence climate, weather, health, food and global economies. This course will present the state of our knowledge of Marine Oceanography and Rain Forest Biology in its interdisciplinary format at a level appropriate for all.

Attendance is mandatory. It will be impossible for a letter grade of A if you have more than one absence. You can drop the lowest quiz grade. If you miss the midterm or final you will not receive a make up unless it is due to hospitalization or death in family, you must provide evidence if this occurs.

Pass/Fail Grade: Class participation and take home final.

**COURSE BOOK:**

Lalli, C.M. and Parsons, T.R. 1993. Biological Oceanography: An Introduction. Pergamon Press. FREE OF CHARGE!! See PDF.

**FIRST CLASS:** (Week 1) Introduction to class. Powerpoint lectures by professor on ocean circulation and primary productivity. Controlling factors of the oceans biological, physical, and chemical systems will be presented and allow you to then begin reading the chapters below. asic Foundation of how the upper ocean functions.

Readings first week:

Lalli and Parsons PDF: Pages 1-7. & Chapter 2 (read entire chapter).

Chapter 3 pages 39-49; page 58-60; pp 67 through pp72.

Chapter 4 (complete).

**STOP**

After 2<sup>nd</sup> week. I will highlight what you need from this chapter.

Chapter 5

### First Module:

Introduction to earth's biogeochemical cycles:

- a) Ocean chemistry; the carbon, oxygen, phosphorous and nitrogen cycle in the oceans.
- b) The little things, including light, that regulate global ocean biogeochemical cycles (bacteria-protists).
- c) How the little things such as Plankton-zooplankton-fisheries regulate the climate on earth?
- d) A "Brief" description of Physical characteristics in the oceans.

### Second Module:

- a) Rainforests biogeochemical cycles; the carbon, oxygen, phosphorous and nitrogen cycle.
- b) How the little things in the first 2 millimeters of the soil all the way to the top of the forest canopies, regulate the worlds atmospheric conditions and temperature.
- c) Ice is nice!; the little things in the Arctic and Antarctic and how they, and ice, control the global thermostat.

### Third Module

- a) The little colorful things; **Coral Reefs**
- b) Symbiotic Planet; dedication to Lynn Margulis.

### Fourth Module

- a) Rain forest deforestation
- b) Marine pollution
- c) Ocean Acidification
- d) Human induced global warming and the fate of *GAIA*.
- e) Case Studies and law suits linked to environmental crimes

### Fifth Module

- a) Sustainability
- b) Wetlands and Coral Reef Restoration
- c) Final Exam

