

# **Environmental Biology**

## **ESPM 6**

### **Fall 2018**

The Environment is Us, Life Unfolds Irretrievably  
A Course in Critical Biology as a Historical Science

Our times are marked by unprecedented environmental disruption. The role of the Scientist changes rapidly from being a passive observer to becoming a critical practitioner with no less than global security in her hands. At the same time, rapid environmental disruption touches the life of every citizen. This course aims at providing basic conceptual and analytical tools, from a perspective of Critical Biology, for a generation of environmental practitioners in all fields, from the natural sciences to the social sciences, the humanities and the professional trades. First, we explore modes of understanding living things: this understanding gives us no less than an understanding of ourselves and of our place in the world. Students then gain abilities to “read” the environment and identify critical aspects of biological systems. Students become conversant with biological aspects of selected, current environmental questions, and they make explicit the connections between their own disciplinary interests and the field of environmental biology. Questions are raised throughout regarding the environmental interventions that we do, consciously or not, and those that we could do for an environment that is not only survivable, but desirable.

<b>Instructor:</b>	Ignacio H. Chapela 334 Hilgard Hall Contact <b>in person during office hours</b> or, less desired, through bCourse messaging.
<b>Office Hours:</b>	Mon, Wed, 12:00 - 2:00 (or by appointment).
<b>Lecture:</b>	5 - 6 pm Mon & Wed, A1 Hearst Field Annex

## Evaluation

There is no Final Exam.

Two alternative Tracks can be followed to complete the course and obtain a grade. Students will choose one of the two tracks by the end of the Semester and will be evaluated accordingly.

### Track I:

The course is articulated around two main papers (midterm and final), in which students will approach problems of their choosing in their own disciplines with the tools of critical science and environmental biology. A microcosm, practice and field participation are offered in addition. Both midterm and final papers are thesis-based (not descriptive), and require the student to learn how to use primary and secondary sources, as well as to evaluate internet-based resources. On occasion, and with careful evaluation and approval by the instructor, media other than written papers can be allowed.

### Track II:

Bi-weekly study guides are provided for students to pursue specific questions through the course. Students prepare for evaluation using textbooks, internet resources and in-class discussion, learning in the process how to master the difficulties in using such resources. Evaluation of progress on each guide is through in-class quiz examination. A microcosm, practice and field participation are offered in addition.

## Grading System\*

Track I	
Mid-term paper	max 40
Final paper	max 60
Field work/Microcosms	max 30
Track II	
In-class quizzes	max 70
Field work/ Participation	max 30
Microcosms	max 30

\*Track to be chosen by student in the first two weeks of the course (deadline: 10 September, 2018). Each student has the option of choosing a unique combination of points for each component of the track's elements, not to exceed the marked values. For example, 100% credit on Track I can be obtained either with a midterm at 40% and a final at 60%, or with a final at 50%, Field/Microcosm at 20% and midterm at 30%.

## Text and Readings

### August Readings

This year, two major readings will be used to start the semester. These are:

1. Yinon M. Bar-On, Rob Phillips, and Ron Milo. The Biomass Distribution on Earth. *Proceedings of the National Academy of Sciences*. June 19, 2018. 115 (25) 6506-6511.  
<https://doi.org/10.1073/pnas.1711842115> (Links to an external site.)
2. Rich, Nathaniel, & Steinmetz, George. "Losing Earth: The Decade We Almost Stopped Climate Change. A Tragedy in Two Acts." *New York Times Magazine*. August 5, 2018. 1-66.  
<https://www.nytimes.com/interactive/2018/08/01/magazine/climate-change-losing-earth.html>

### Textbook

**No textbook is required**, but materials for class are reserved or distributed throughout the semester. General guides and concepts used in class are covered in some of the following materials (optional):

**Keys to conceptual approach:**

Jablonka, Eva & Marion Lamb. 2005. **Evolution in four dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Variation in the History of Life**. MIT Press., 474 pp  
Margulis, Lynn, Matthews, Clifford and Haselton, Aaron (Eds.). 2000. **Environmental Evolution**. MIT Press.  
Geus, Armin & Ekkehard Höxtermann. 2007. **Evolution durch Kooperation und Integration**. Basiliken-Presse. Marburg.  
Krimsky, S. & Gruber, D. 2013. **Genetic Explanations: Sense and Nonsense**. Harvard University Press.

### For established texts on general Environmental Science and Ecology:

Ricklefs, R.E. 2001. *The economy of nature*. 5<sup>th</sup> ed. W.H. Freeman, New York.  
Brennan, S.R. & Withgott, J. 2004. *Environment: The Science Behind the Stories*. Benjamin Collins, New York.  
Begon, M., Harper, J.L. and Townsend, C.R. 1998. *Ecology: Individuals, Populations and Communities*. 4th Edition. Blackwell Scientific Publications. Oxford.

### For more specific concepts:

Margulis, L. Matthews, C. and Haselton, A. 2000. *Environmental Evolution*. MIT Press, Cambridge, MA.  
Maturana, H.R. & Varela, F.J. 1980. *Autopoiesis and cognition: the realization of the living*. D. Reidel Pub. Co. Boston.  
Pianka, E. 1994. *Evolutionary Ecology*. Fifth Edition. HarperCollins College Publishers. New York.  
O'Neill, RV, DeAngelis, DL, Waide, JB and Allen, TFH 1986. *A hierarchical Concept of Ecosystems*. Princeton University Press. (#23 in the Monographs in Population Biology, ed. by RM May).  
Kropotkin, P. 1914 (2005 Reprint). *Mutual Aid: A Factor in Evolution*. Extending Horizons Books, Boston.  
Lewontin, R. 2002. *The Triple Helix*. Harvard University Press.

**Recommended readings for the semester will be assigned.**

## Track I: Midterm Paper and Final Paper

For those choosing Track I, the core of this course's grade is based on two original, thesis-based papers. The papers should be written from the disciplinary perspective of each student, but in a manner that places the subject in a direct relationship with environmental biology.

Successful papers have:

1. A thesis.
2. A logical structure (therefore acceptable grammar) that addresses the thesis.
3. Three (five) primary references (three for midterm, five for final), at least.

**Examples of questions addressed in prior years' successful papers—these are only examples:**

- The legal standing of forests: who can speak for the trees?
- What is an acceptable environment for life on Mars?
- Can biology reverse global warming?
- How many species are necessary for planetary survival?
- Is the Golden Mean a sign of design or human signification?
- What is an indigenous community?
- Why invasive species? Why not?
- Which poetry for human-non human understanding?
- What rhetorical tools drive the conservation debate?
- Can transgenesis be democratic and benign?
- How will reproducing nanorobots interact with carbon-based biological systems?
- Science, extinction and morality: The Sea Shepherd case.
- Saving the Vaquita in the Sea of Cortez—Biological or Political Question?

## Calendar of Lectures and Important Dates

*Note:* For this Fall, Prof. Chapela will be giving a series of talks in Europe on the dates indicated as NO LECTURE. Students will meet during Discussion Sections, working on two assigned readings/activities under the guidance of Graduate Student Instructors. Instructions and Materials are posted on bCourses site. Two quiz-based evaluations (on bCourse site) of these readings/activities are due on September 10th.

### August

- Wed 22. **LECTURE 1. Welcome, introduction and logistics.** What this course is NOT—the discipline of Biology. Two Sciences: little s vs. big S "science." Introduction to references and literature work. Why Environmental Biology and how to study it. Environmental situations, environmental interventions. Our situation in 2018. Description→modelling→interpretation→normativity. Evaluation of references. Microcosms introduced.
- Mon 27. NO LECTURE (see Note Above)
- Wed 29. NO LECTURE (see Note Above)

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### September

- Mon 3. **Labor Day: No Class.**
- Wed 5. NO LECTURE (see Note Above)
- Mon 10. **2 Online Quizzes Due (See Note above)**  
**1 Micro-essay due online.**  
**2 Declarations Due: (a) Track I or II, (b) Microcosm Declaration. On paper, in class (See notes in the Files>Microcosm section of bCourse site, as well as in the Assignment section).**  
**LECTURE 2. Life Forms** and living things. Biology as a historical science: the unyielding Arrow of Time. Iteration, innovation and evolution (I). First approach to Heritability. Biology of nouns vs biology of verbs. What is a thesis, and what "testing" a thesis means. Falsifiable statements vs Truth.
- Wed 12. **LECTURE 3 .** The problem with The Individual. Self-Non-Self recognition and dynamic regulation. Complexation. Non-individualistic Life Forms. Chimaeras in human and non-human life forms. Competition vs cooperation, distinction vs integration. First approach to symbiontism. First story: Jeon's amoebae. Scales of dynamic behavior/trans-formation. Evolution (II) as behavioural trajectories in time/space/phylogeny. The ideology of Determinism.
- Mon 17. **LECTURE 4. First Workshop on Thesis-Writing. Track I students especially encouraged.**
- Wed 19. **LECTURE 5.** Multi-Species assemblages. Populations. Communities—large-scale to microscopic complexation. Life tables, growth curves, limiting factors. Reticulate phylogenies. Darwin, Malthus and Kropotkin, Bernard and Mereschkowski.
- SAT 22 FIELD TRIP I. The Hayward Fault: dynamics of boundaries and edges.**
- Mon 24. **LECTURE 6. A first approach to Diversity.**  
Diversity loss: Conservation vs restoration. What is "necessary" and from what perspective? What is the meaning of "native"? Diversity: definitions, measurements and estimations. Rapid Ecological Assessments. Keystone species, umbrella species.

Wed 26. **LECTURE 7. Constructivist Biology.** Biosynthesis, organic matter. The current planet in geological context. Enzymes. Three key reactions: polymerization, anabolism, catabolism. A closer look at cellulose, protein and RNA.

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*October*

**Mon 1.** **LECTURE 8 . Water and "Nutrients."** Matter, Energy, Information. Time, Space, Phylogeny. Lithosphere, atmosphere as contrasting sources of nutrients. C, N, P. Micronutrients.  
**TURN-IN Field Trip NOTES: Boundaries.**

Wed 3. **LECTURE 9. Dawksian Biology.** DNA in biological context. Central Dogma and other preconceptions.

Mon 8. **LECTURE 10.** Columbus Day.  
**Odumsian Ecology. "Energy" frame for structural biology.** Thermodynamics in molecular, cellular and ecosystem processes. Optimization ideologies in Environmental Biology. Cycling. Rates.

Wed 10. **LECTURE 11. Lecture Buffer. TBA**

Mon 15. **LECTURE 12. TBA**

**Wed 17.** **LECTURE 13. TBA**  
**Midterm Paper due (Track I).**

Mon 22. **LECTURE 14. TBA**

Wed 24. **LECTURE 15. TBA**

Mon 29. **Second Workshop on Thesis Writing.**

Wed 31. **LECTURE 16. TBA**

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*November*

Mon 5. **LECTURE 17. TBA**

Wed 7. **LECTURE 18. TBA**

**Tues 12. No Class. Veterans' Day.**

Wed 14. **LECTURE 19. TBA**

**Mon 19.** **LECTURE 20. TBA. Final Essay due (Track I).**

Wed 21. **THANKSGIVING**

Mon 26. **LECTURE 21. TBA**

Wed 28. **LECTURE 22: TBA**

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*December*

Mon 3. **RRR Week: Rejoinder. Microcosm Diary due.**

Wed 5. **RRR Week: Microcosm Festival**