Life on Earth depends on oceans for a number of reasons

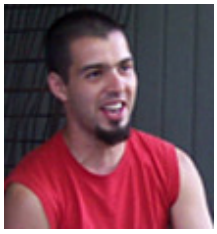
- The hydrologic cycle, e.g. the continental weather, is largely generated by evaporation, freezing of water and thawing of ice and by regional and global ocean currents.
- Rivers supply nutrients from continental erosion, and in upwelling regions, nutrients are recycled from the depth of the ocean most effectively.
- Nutrients feed marine organisms, which drive food webs from which we all profit.
- Microbial phototrophs produce a large portion of the oxygen in the atmosphere, while other microbes use oxygen to degrade the huge amount of primary productivity that is not channeled into higher food webs.
- Although much of the carbon fixed by photosynthesis is degraded during sedimentation, some gets burried in sediments where it eventually can be transformed and stored as future oil and gas deposits.
- Bacteria, Archaea, Protists, including Viruses are the major players of marine microbial ecosystems.
- Sediments also store biominerals, which can become proxies that archive environmental conditions at the time of their formation.





Many questions remain and during the course we will address some of them

- Why is the Humboldt current ecosystem of interest to researchers from all over the world?
- What can we learn from upwelling processes?
- How are microorganisms driving geochemical cycling of nutrient-type elements?
- How do we assess the diversity of microorganisms in oxygen transition zones?
- What does microbial diversity actually mean?
- What limits primary productivity, what makes it bloom?
- Why and when do sulfide eruptions occur and how are they linked to methane release from sediments?
- What resources for biomedical applications are still hidden in marine organisms?
- How can modern "..omic" technologies be applied to unravel physiological potentials in complex ecosystems?
- How can ocean geo-engineering help us to scavenge excess CO_2 from the atmosphere?

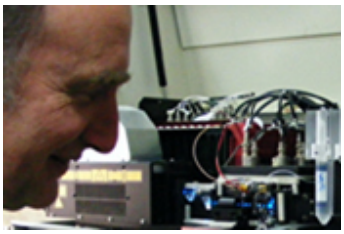
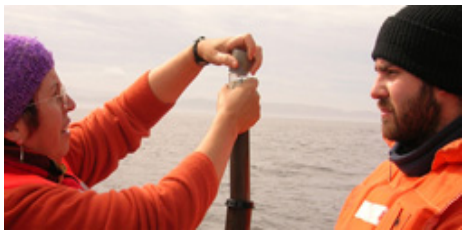

How ECODIM courses are structured

- We intend to develop an understanding of the relations between microbial diversity, metabolism and physico-chemical processes that regulate ocean biogeochemical cycles and trophic structures.
- For three weeks you will be able to focus on marine microbiology, participate in interesting presentations, have plenty of time for discussions, work in small research groups and summarize the results in poster sessions.
- You will learn about cutting-edge techniques, including molecular biology, microscopy, flow cytometry, bioinformatics, biogeochemistry, sedimentologyand many more.
- We will build on what you already know about certain physical concepts and ask you to recall the chemical principles which you learned earlier in your studies.
- We will show you some of the biomolecular, physical and IT tools available today for the characterization of diverse communities of bacteria, archaea and eukaryotic microbes.
- We will try to enrich and isolate microorganisms with specific metabolic activities.

- For three weeks you will be guided by expert instructors from different fields through a small research project whose results will be summarized in a poster.
- Mornings, you will hear presentations addressing a broad spectrum of topics.
- A full day is devoted to listening to and discussing with experts the newest research results and developments in" Nitrogen Fixation".
- During week 1 you will introduce the other course participants to the type of research that you are performing at your home institution and
- during week 2 you will prepare an innovative paper chosen from the scientific literature for discussion.
- The presentation of the research results at the end of week 3 will illustrate how successfully we worked as a group and how well we can understand what we discovered.

- All logistic course details as well as the information gathered during the course (research data, reading material, lecture slides, exercises, protocols, etc.) will become available on a specially designed learning platform on OLAT for which you will receive a login and a personal password. Please consult the file Course organization on OLAT for more details about the course.

Although we will emphasize the ***biochemistry and molecular and microbial ecology of today's oceans***, we will often make reference to changes that occurred in oceans in the past. These changes are archived in sediments, i.e. we will show you how paleo-oceanography uses ***geologic records*** to reconstruct past environmental changes and events, and we will experience how modern day sediments might change over time into rocks.


The Learning Process

- We will employ classical lectures and exercises in addition to your own presentation of literature searches in particular topics.
- During the practical work you will be exposed to a number of marine ecosystems and learn how to ask research questions and choose approaches to find answers.
- Field Sampling will take place between January 10 and 12. For details consult the Study Plan and be prepared with appropriate clothing.

- The internet accessible learning site on OLAT also allows you to upload information that you consider interesting and which can supplement the course contents.
- If you "subscribe" to folders, you will be informed by mail each time a new document was uploaded into a particular folder.
- Use the PRINT ICON at the top right to download "html:// pages" to the hard disc of your computer as pdf or to print them.

Our Expectations

- We are expecting you to fully imerse yourself in the course topics and make optimal use of the contents offered.
- We want you to ask questions during all phases of the course and via the discussion forum and to try to offer answers to questions posed by others.

Repetition of Contents

- Please consult the chapter summaries, which we uploaded from the textbook **"Invitation to Oceanography"**, Fifth Edition, 2009 by Paul R. Pinet. ISBN-13: 9780763759933 for repetition of terms and concepts in oceanography.

The Study Plan

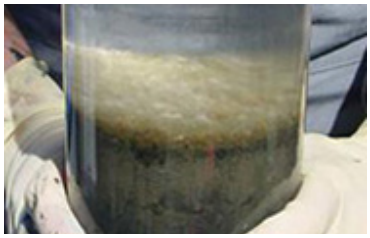
- informs you about the daily lecture topics, the exercises, the research time and other course activities.

Lecture notes

- All instructors will be asked to upload their lecture notes, handouts, tutorials, exercises and links to valuable internet pages (power point slides, text etc.) into this folder. You are welcome to use this material for your own work during the course a nd "at home". You must ask the author's permission, however, and give proper reference to the copy right owner(s) if you would like to use the material otherwise.

Research Results

- Research work is performed in groups. It is essential that each group member takes responsibility for the proper recording of data in the field and in the lab and make them available to everybody else. Please keep a well organized note book.

Enrolment

- in OLAT is mandatory before you can access most of the folders and files. Please enrol as a **"Regular Student"** if you take the course for credit. There is a special sign-up window for **Instructors, Staff and Tutors,** who are personally involved in the course. **Speakers and Guests** are welcome to follow the course; they need to enrol in the appropriate sign-up window in order to have access to the course folders. Access rights (login and password) will be sent to you before the course.

Paper Presentations

- will take place on Saturday, January 21. Sign up for a topic by Wednesday, January, 18 and upload the chosen paper(s)into the appropriate folder. Please label the paper(s) as suggested there.

Posters

- summarizing the research results will be designed on Friday morning, January 27, and discussed from power point presentations in the afternoon of the same day.

Exercises / Modeling

- Some exercises require the use of mathematical and statistical tools. Although we will have a number of desktop computers with internet connections available, it is recommended that you take your own laptop computer and a memory drive with you. You should have Microsoft Office (e.g. Excel (xls or xlsx), Word (doc or docx) and Power Point (ppt or pptx) installed and know about the possibility to store documents in older versions of the software (not everybody already has the newest version).
- **Phreeqc:** We would like to use this software package to calculate a number of geochemical conditions. Please download it as a stand-alone version onto your computer from http://wwwbrr.cr.usgs.gov/projects/GWC_coupled/phreeqc/
- **Thermodyn**: is a thermodynamic learning spread sheet that runs with Excel. It is freely available to you and we will use it during weeks 2 and 3. Please download it from the folder "Execises" onto the hard disc of your own computer and check before class that you can open it in your version of Excel.

Search on YouTube for short movies on "Ocean AND Microbes" or any of the microorganisms like "Diatoms", "Dinoflagelleates", etc.

- **The role of the oceans**
  Overview video by Partnership for Observation of the Global Oceans (POGO), for more information visit www.ocean-partners.org
  http://www.youtube.com/watch?v=dOmArd95-BQ&feature=player_embedded#at=225

- **Bio-Diversity**
  A video by the Census of Marine Life about why we need to monitor biodiversity in the oceans and how it can be done using existing technologies on a global scale. For more information visit http://www.coml.org.
  http://www.youtube.com/watch?v=kXXzvGJCVAc&feature=related

- **Microbes in the Ocean**
  Marine microbes play an important role in all marine environments. AIMS is investigating the functions they provide in tropical marine ecosystems and what benefits and insights they might offer and what role they play in helping reefs to adapt to threats such as climate change.
  http://www.youtube.com/watch?v=1TmHlcMDIOQ

- **How Desmids (freshwater green algae) divide**
  Time lapse video microscopyby Jeremy Pickett-Heaps of the University of Melbourne.
  http://www.youtube.com/watch?v=MrTw5D73xrU&feature=player_embedded

- **EARTH**
  A YouTube video making us aware of what we miss if we don't care http://www.youtube.com/watch?v=thuViaxRd_w&feature=related