ECODIM VI 2010

MICROBIAL OCEANOGRAPHY:

ECOLOGY & DIVERSITY OF MARINE MICROORGANISMS

January 4 – 23, 2010
at the Marine Biological Station Dichato / University of Concepción (UdeC), Chile

Course Report
by
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Over the years, more than 90 students from 12 countries (Chile, Argentina, Uruguay, Brazil, Venezuela, Colombia, Ecuador, Peru, Mexico, Cuba, Canada, France) have participated in the ECODIM course since it was established in 2000 as part of the International Graduate Course Series in Oceanography at the Austral Summer Institute of the University of Concepción, Chile

The 2010 advanced course on the ECOLOGY AND DIVERSITY OF MARINE MICROORGANISMS (ECODIM) was offered for the sixth time as part of the International Postgraduate Course Program in Oceanography, at the Universidad de Concepción. For the forth time, the course took place at the Marine Station in Dichato (UdeC).

The course was organized by the 10th Austral Summer Institute at the Departamento de Oceanografía, Universidad de Concepción and also supported by the Pontificial Catholic University of Chile. Funding for the course and the minisymposium was provided by the Agouron Institute, the Gordon and Betty Moore Foundation, the Graduate School of UdeC, the Reichmann company, GenExpress, Andes Import and Arquimed .

Course Participants and Staff of ECODIM-VI

The 2010 course was attended by 15 students from 12 different academic departments in 6 Latin American countries (Argentina, Brazil, Chile, Colombia, Peru and Uruguay). Instructors and speakers for the symposium were from Chile, the USA, France and Switzerland.

Course Description & Contents

It is the main purpose of ECODIM courses to build intellectual capacity in a field of growing scientific interest by teaching concepts and providing an overview of the fields of microbial ecology, genomics and diversity. The main topics of ECODIM-VI related to the richness of microbes and their metabolic activities in the oxygen minimum zone of the Coastal South Pacific Ocean. The research part focused on various trophic and organismic interactions, and the role microbes play in the geochemical cyling of matter in this particular marine environment.

ECODIM courses are aimed at bringing together various aspects of environmental, molecular and microbiological, as well as chemical, physical and bioinformatics methodologies needed to approach questions of biogeochemical, ecological and phylogenetic interests. Students were trained in molecular and culturing methodologies, microscopy and flow cytometry for the study of the molecular ecology of microorganisms in marine waters and sediments. Molecular techniques for the study of the diversity and abundances of marine prokaryotic and eukaryotic microbes and their genomes were particularly emphasized in ECODIM-VI. The techniques were applied to small research projects, and their range of applicability and the limitations were studied by two student research groups. Course participants gained experience in the collection and preservation of samples in the field, and they were trained in culturing of microbes, in bio-thermodynamics and in the analysis and interpretation of results using phylogenetic methods as well as biosystem modelling with the aid of databases.

Introductions into the particular oceanographic conditions in the oxygen minimum zone (OMZ) and in the sediments along the continental shelf of the west side of South America during the first few days were followed by a one day cruise to collect samples from the water column and the sediments. Introductory lectures and practical exercises emphasized the chemical, phylogenetic, metagenomic and energetic basics of marine microbial ecology, photosynthesis and ocean biogeochemical cycling.

The 2010 course addressed more than 30 topics in lectures, workshops and minisymposia, among them the following key themes:

- How flow cytometry is applied to the study of picoplanktonic microbial communities
- Which major eukaryotic and prokaryotic micro-, nano- and picoplankton groups are present in oceanic habitats
- How the microbial loop is driven by the diversity of planktonic bacteria and archaea
- Which role marine picoheterotrophs play in the microbial loop
- How microbes contribute to the cycling of nitrogen and sulfur in the OMZ
- How energetic considerations can be used to determine microbial life styles in the ocean
- How culture-independent approaches can be applied to microbial ecology in marine ecosystems
- How one designs proper media for the cultivation of microbes
- How genome libraries can aid in explaining the reasons for the plankton diversity
- What we know about genomics in photosynthetic and nitrogen-cycling picoplankton
- How culture-independent methods, such as metagenomics, can provide insights into the species diversity of communities and the functional potential of microbial populations in the environment.

Computer labs were designed to familiarize students with the most common data bases available for phylogenetic and metagenomic analyses. The tutorials focused on the design and validation of nucleic acid probes and the application of bio-thermodynamic models to examine metabolic processes in geochemical cycles.

During the first week the lectures were delivered by the course instructors. The goal of the first week was to illustrate how basic concepts in microbial ecology and chemistry can be applied to a number of questions relating to microbial oceanography. Additional speakers were invited to deliver special lectures during the second and third week of the course and the mini-symposium in Concepción. All lectures and the details of the course activities are outlined in the weekly schedules.

Course Structure

The course comprised lectures and exercises in the morning, laboratory work and computer exercises in the afternoon, colloquia in the evening, field trips and independent research. Exercises on particular course subjects, introductions to bioinformatics and computer aided thermodynamics in geochemical processes and metabolism were offered as group activities. With the didactic mix between lectures and symposium presentations by experts, workshops with turorials and the students' own efforts (paper presentations, experimental design, practical laboratory work), participants were introduced into topics from the research front in microbial oceanography. Students were also asked to suggest special topics and thus to define their particular needs.

On a cruise to neaby sampling stations, some course participants gained first-hand experience of CTD measurement and water and sediment sampling and observation techniques of coastal and shelf environments. They were exposed to characteristic marine habitats (water column, sediment), and collected samples for the enrichment of microbes and the isolation of DNA. They investigated the presence of major genes employing molecular techniques and examined the morphological and functional diversity of microbial communities using DAPI staining and fluorescence in-situ hybridization (FISH) combined with advanced epifluorescence microscopy and flow-cytometry.

The laboratory part was designed to educate students in current techniques and to encourage independent research. Students carried out investigations in groups and independently with the aid of faculty and teaching assistants. The course culminated with the student project presentations whose results are summarized in two posters available as pdf on the internet page of the ECODIM-VI course under http://www.microeco.unizh.ch/chile/chile.html and http://www.profc.udec.cl/ecodim/ .

Mini-Symposia

A mini-symposium on the "AQUATIC MICROBIAL FOOD-WEB: FROM COMMUNITY STRUCTURE TO ECOSYSTEM FUNCTIONING" took place as a public presentation of the course on Friday January 15 at the main University Campus in Concepción. Established investigators representing different research institutions from Chile and from abroad presented their research, stimulated discussion on newest approaches, initiated new research ideas among the symposium participants and strengthened interactions between different research groups and centers. The course students were in charge of hosting some of the guest speakers for after-symposium discussion groups. The symposium was sponsored by the Agouron Institute, the Gordon and Betty Moore Foundation and the Graduate School of UdeC.

A second mini-symposium (RECENT DISCOVERIES IN MARINE MICROBIOLOGY) was organized in Dichato as a final course activity on January 22, with 15 presentations offered by the course participants themselves. Each student selected a published research paper which represented a recent discovery in microbial oceanography and which was linked to the student's research interest. The one-day symposium was open to the course participants as well as to interested researchers and students from the Marine Station and the University of Concepcion.