



UNIVERSIDAD DE CONCEPCIÓN
ESCUELA DE GRADUADOS
FACULTAD DE CIENCIAS NATURALES OCEANOGRÁFICAS
DEPARTAMENTO DE OCEANOGRAFÍA

AUSTRAL SUMMER INSTITUTE VI (ASI) & INTERNATIONAL GRADUATE COURSE SERIES IN OCEANOGRAPHY

Department of Oceanography and FONDAP COPAS Center
University of Concepción



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Microbial Oceanography

Ecology and Diversity of Marine Microorganisms (ECODIM IV)
January 2-22, 2006

Kurt Hanselmann, University of Zurich, Switzerland (Co-Director)
Osvaldo Ulloa, University of Concepción, Chile (Co-Director)
Edward DeLong, Massachusetts Institute of Technology, USA
Laura Farias, University of Concepción, Chile
Bernardo González, Catholic University of Chile, Chile
Mónica Vásquez, University of Chile, Chile
Daniel Vaultot, Station Biologique de Roscoff, France
Eric Webb, Woods Hole Oceanographic Institution, USA

Sediment Microbial Ecology
January 23- February 10, 2006

Victor Ariel Gallardo, University of Concepción, Chile (Director)
Bo Barker Jørgensen, Max Planck Institute for Marine Microbiology, Germany
Katrina Edwards, Woods Hole Oceanographic Institution, USA
Gijs Kuenen, Technical University Delft, The Netherlands
Stefan Sievert, Woods Hole Oceanographic Institution, USA

Coastal Sediments and Physical Processes

Partículas en Movimiento: Dinámica de Fluidos y Transporte de Sedimentos en el Ambiente Continental y Marino
Jacobus Le Roux, Universidad de Chile, Chile
Enero 2-6, 2006

Hidrodinámica de Sistemas Semicerrados: Estuarios y Bahías
Arnoldo Valle-Levinson, Old Dominion University, USA
Enero 9-20, 2006

Instituciones Patrocinantes

IOC UNESCO
Fundación Andes
Woods Hole Oceanographic Institution
Escuela de Graduados-Universidad de Concepción
Minera Escondida Ltda.
Centro FONDAP COPAS
Partnership for Observation of the Global Oceans (POGO)
W. Reichmann y Cia. Ltda.
Iniciativa Científica Milenio

Director Proyecto UdeC/WHO/FA

Dr. Silvio Pantoja G.
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AUSTRAL SUMMER INSTITUTE – VI TOPICS ON MICROBIAL OCEANOGRAPHY 2 January – 8 February 2006

Universidad de Concepción (UDEC) – Woods Hole Oceanographic Institution (WHOI) –
Fundación Andes (FA) Cooperative Program

I. Introduction

The Sixth Austral Summer Institute (ASI-VI) was held at the Marine Biology Station of the Oceanography Department, Universidad de Concepción, in Dichato, from 2 January through 8 February 2006. ASI-VI was organized in two modules:

- Ecology and Diversity of Marine Microorganisms (ECODIM-IV)
- Sediment Microbial Ecology

ASI-VI was developed as part of the UDEC-WHOI-FA cooperative project.

Graduate and advanced undergraduate students in the areas of Marine Sciences and Oceanography, academics, post-doctorates, and professionals interested in the areas of Marine Geology and Geophysics were all invited to apply.

II. Information on ASI-VI was also posted on the following websites:

<http://www.conicyt.cl/cgi-bin/w3-mysql/agenda/sigue.html?id=1145> (CONICYT)

<http://www.ocean-partners.org/fellowshipb.html> (POGO)

<http://www.cona.cl/inicioprincipal.htm> (CONA)

http://www.udec.cl/avisos/2006.01/oceanografia_enero.htm (UDEC)

<http://ioc.unesco.org/iocweb/index.php> (IOC / UNESCO)

<http://www.comisionunesco.cl/Unesco/> (COMISION UNESCO)

<http://www.mideplan.cl/milenio/articulos.htm>

http://www.mideplan.cl/milenio/noticia_44.htm (ICM)

III. Participants and Lecturers

15 students were accepted for each course (Ecology and Diversity of Marine Microorganisms -ECODIM-IV- and Sediment Microbial Ecology). 2 of them were accepted in both modules.

Therefore, twenty eight participants took part in ASI-VI. They were Chilean (19), Brazilian (2), Peruvian (2), Colombian (1), Venezuelan (1), Mexican (1), Argentine (1) and Costa Rican (1). The participant roster is included at the end of this report.

Thirteen instructors participated in ASI-VI.

ECODIM-IV	
Dr. Kurt Hanselmann, Co-Director	University of Zurich, Switzerland
Dr. Osvaldo Ulloa, Co-Director	Universidad de Concepción, Chile
Dr. Edward DeLong	Massachusetts Institute of Technology, USA
Dr. Laura Farias	Universidad de Concepción, Chile
Dr. Bernardo González	Universidad Católica de Chile, Chile
Dr. Mónica Vásquez	Universidad de Chile, Chile
Dr. Daniel Vaultot	Station Biologique de Roscoff, France
Dr. Eric Webb	Woods Hole Oceanographic Institution, USA
SEDIMENT MICROBIAL ECOLOGY	
Dr. Víctor Ariel Gallardo, Director	Universidad de Concepción, Chile
Dr. Bo Barker Jørgensen	Max Planck Institute for Marine Microbiology, Germany
Dr. Katrina Edwards	Woods Hole Oceanographic Institution, USA
Dr. Gijs Kuenen	Technical University Delft, The Netherlands
Dr. Stefan Sievert	Woods Hole Oceanographic Institution, USA

IV. Course contents

Ecology and Diversity of Marine Microorganisms (ECODIM-IV)

1. Marine microbial ecology: what we know, what we don't yet know. (Kurt Hanselmann)
2. Chemical basics and methodologies for the study of eco-metabolic processes. (Kurt Hanselmann)
3. Oceanographic conditions of the continental environment. (Osvaldo Ulloa)
4. Phylogenetics – evolutionary approaches to microbial diversity. (Kurt Hanselmann)
5. Applications of flow cytometry to water column microbial communities. (Osvaldo Ulloa)
6. A biogeochemical systems approach to microbial ecology. (Kurt Hanselmann)
7. Microbially mediated coupling of iron, manganese and phosphate cycling. (Kurt Hanselmann)
8. Biogeochemistry and photosynthesis in the oxygen minimum zone. (Osvaldo Ulloa)
9. New large bacteria below the oxygen minimum zone of the Eastern South Pacific: is it a Precambrian relict community? (V.A. Gallardo)
10. Earth history and what makes a marine microbe. (Edward DeLong)
11. Introduction to the microbial loop and marine microbial diversity. (Edward DeLong)
12. Diversity and distribution of bacteria in the ocean (Edward DeLong)
13. Microbiology of anammox and its role in geochemical cycling and in waste water treatment (Gijs Kuenen)

14. Planktonic Archaea (E. DeLong)
15. Ecological, biochemical and genetic aspects of harmful photosynthetic microorganisms. (Mónica Vásquez)
16. Microbial communities in an intertidal rocky ecosystem exposed to copper. (Bernardo González)
17. Biosynthetic pathways of algal toxins, what do we know? (Mónica Vásquez)
18. Microbial communities in soils exposed to chlorinated herbicides. (Bernardo González)
19. Introduction to the nitrogen cycle in the ocean and the main motivations for studying it. Autotrophic processes: Nitrification and anammox. (Laura Farias)
20. Introduction to oceanic picophytoplankton and techniques to study it. (Daniel Vaultot)
21. Heterotrophic processes: denitrification and nitrate-ammonification. Advances on understanding the N-cycle in the oxygen minimum zone of the eastern South Pacific. (Laura Farias)
22. Taxonomy of picophytoplankton. (Daniel Vaultot)
23. Photosynthesis and diazotrophy of marine picoplankton: ecology and genomics. (Eric Webb)
24. Diversity and ecology of oceanic cyanobacteria. (Daniel Vaultot)
25. Nutrient and trace metal limitations of oceanic cyanobacteria. (Eric Webb)
26. Energetics and genomics of marine heterotrophs in the microbial loop. (Eric Webb)
27. Diversity and ecology of eukaryotic picoplankton. (Daniel Vaultot)

Sediment Microbial Ecology

Dr. Bo Barker Jørgensen and Dr. Gijs Kuenen

1. The oceanography of the eastern South Pacific. (V.A. Gallardo)
2. The benthic communities of the eastern South Pacific with special reference to the communities of big microbes. (V.A. Gallardo)
3. The marine sulfur and carbon cycles. (Bo Barker Jørgensen)
4. The marine methane cycle. (Bo Barker Jørgensen)
5. The deep biosphere. (Bo Barker Jørgensen)
6. Life at a small scale. (Bo Barker Jørgensen)
7. Introduction to thermodynamics and physical chemistry of biological systems. (Gijs Kuenen)
8. The chemostat as a tool for ecophysiological studies of microorganisms. (Gijs Kuenen)
9. Microbiology of anaerobic ammonium oxidation (anammox) and its role in geochemical cycling and in waste water treatment. (Gijs Kuenen)
10. Exotic chemolithotrophs from soda lakes: Halophilic sulfur oxidizing bacteria. (Gijs Kuenen)
11. Exercises with thermodynamic data. (Gijs Kuenen)
12. Nitrogen cycling processes and how to study them in sediments. (Lars Peter Nielsen)
13. Microbial photosynthesis in sediments. (Niels Peter Revbesch)
14. Introduction to electrochemical micro-sensors and their use in investigating sediment chemistry and metabolism. (Niels Peter Revbesch)
15. Big sulfur bacteria in sediment biogeochemistry. (Lars Peter Nielsen)

16. Microbial molecular phylogeny and ecology (Andreas Teskes)
17. Microbial physiology in complex environments (Jeppe Lund)

Dr. Katrina Edwards

1. Introduction to geomicrobiology [kje]
2. Microbially mediated redox reactions, including energetics [tmm]
3. Marine geology [tmm]
4. Properties and classification of minerals [kje]
5. Chemistry & microbiology of deep-sea hydrothermal environments [tmm]
6. Fe and Mn (will include oxidation, reduction, respiration, biofilms) [kje]
7. Sample acquisition, experimentation, and analysis in deep-sea geomicrobiology studies [kje]
8. Chemistry & microbiology of deep marine sediments [tmm]
9. Microbial weathering at and below the seafloor [kje]
10. Ocean chemistry & microbiology of the early Earth (and Mars?) [tmm]

Student research projects for presentations:

1. Early Earth
2. Iron and Manganese cycling
 - a. electron transfer
 - b. Fe and Mn bacteria
 - c. Fe and Mn minerals
3. Origins and records of Early Life
4. Subsurface Biosphere
 - a. deep sedimentary biosphere
 - b. hydrothermal deep biosphere
5. Deep ocean weathering

Dr. Stefan Sievert

SULFUR CYCLING AND CARBON FIXATION AT HYDROTHERMAL VENTS

Submarine Hydrothermal Vents: Introduction to the System and the Microbes

1. Geological Setting
2. Physicochemical Setting
3. Microbial Ecology
 - a. Habitats
 - b. Metabolic Diversity
 - c. Approaches to study microbial communities
 - d. Cultivation: Isolating organisms remains important
 - e. Structure-function analyses: Who is active and what do they do?

Microbially Mediated Sulfur Transformations in Hydrothermal Systems

1. Sulfur cycle in hydrothermal systems
2. Sulfur compounds as e-donors and e-acceptors: Oxidation and Reduction

3. Sulfur oxidation at the nexus of the biogeochemical carbon and sulfur cycles:
 - a. Organisms and strategies
 - b. Filamentous sulfur formation as a special case

Beyond the Calvin Cycle: Microbiology and Biogeochemistry of Autotrophic Microbes at Hydrothermal Vents

1. Energy sources and physiological diversity
2. Nutrient sources: Nitrogen, phosphorous, and trace metals
3. Carbon fixation pathways
 - a. Calvin Cycle
 - b. Reductive TCA cycle
 - c. Hydroxypropionate pathway
 - d. Reductive acetyl-CoA pathway
4. Where, how, and who?
 - a. Some like company: Chemosynthetic invertebrates
 - b. Autotrophic epsilon Proteobacteria: The silent majority at hydrothermal vents
 - c. Some like it hot: Carbon fixation at high temperatures
5. The emerging picture, future directions and challenges



**Universidad de Concepción – Departamento de Oceanografía y Centro FONDAP –
COPAS**

**PROGRAM
AUSTRAL SUMMER INSTITUTE VI & INTERNATIONAL GRADUATE
COURSE SERIES IN OCEANOGRAPHY**

	ECOLOGY AND DIVERSITY OF MARINE MICROORGANISMS (ECODIM-IV) (January 2 – 22, 2006) Marine Station – Dichato
Lecturers	Topics
Dr. Kurt Hanselmann (University of Zurich, Switzerland)	Co-Director
Dr. Osvaldo Ulloa (University of Concepción, Chile)	Co-Director
Dr. Edward DeLong (Massachusetts Institute of Technology, USA)	Molecular microbial oceanography – diversity, function and dynamics
Dr. Laura Farias (Universidad de Concepción, Chile)	Microbial nitrogen transformations in hypoxic-anoxic environments
Dr. Bernardo González (Catholic University of Chile, Chile)	Microbial communities in polluted ecosystems
Dr. Mónica Vásquez (University of Chile, Chile)	Ecology, biochemistry and genetics of harmful photosynthetic microorganisms
Dr. Daniel Vault (Station Biologique de Roscoff, France)	Oceanic Picoplankton
Dr. Eric Webb (Woods Hole Oceanographic Institution, USA)	Open ocean cyanobacterial ecology and genomics
	SEDIMENT MICROBIAL ECOLOGY (January 23 – February 10, 2006) Marine Station – Dichato
Dr. Victor Ariel Gallardo	Director
Dr. Bo Barker Jørgensen (Max Planck Marine Microbiology, Germany) Dr. Gijs Kuenen (Department of Biotechnology, Technical University Delft, The Netherlands)	Biogeochemistry and ecophysiology of (marine) sulfur and nitrogen cycling
Dr. Katrina Edwards (Woods Hole Oceanographic Institution, USA)	Geomicrobiology and microbial biogeochemistry: Between a rock and a hard place
Dr. Stefan Sievert (Woods Hole Oceanographic Institution, USA)	Sulfur cycling and carbon fixation at hydrothermal vents

	COASTAL SEDIMENTS AND PHYSICAL PROCESSES Main Campus, Concepción
Dr. Jacobus Le Roux (Universidad de Chile, Chile)	Partículas en movimiento: Dinámica de fluidos y transporte de sedimentos en el ambiente continental y marina 2 – 6 enero, 2006
Dr. Arnoldo Valle-Levinson (Universidad de Florida, USA)	Hidrodinámica de Sistemas Semicerrados: Estuarios y Bahías 9 – 20 enero, 2006

Proyecto E-13852 Universidad de Concepción – Woods Hole Oceanographic Institution –
Fundación Andes

PARTICIPANT ROSTER

Ecology and Diversity of Marine Microorganisms- ECODIM-IV

January 2 – 22. 2006, at the Marine Biological Station Dichato of the University of
Concepción, Chile

Course home pages <http://www.profc.udec.cl/ecodim/> and
<http://www.microeco.unizh.ch/chile/chile.html>

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PARTICIPANT ROSTER

SEDIMENT MICROBIAL ECOLOGY

January 23 – February 8, 2006, at the Marine Biological Station Dichato of the University of Concepción, Chile

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