

Curriculum vitae

CARMEN PALACIOS, Ph.D.

Updated: Marzo 2007

Family name: **PALACIOS DE LA CRUZ** Name: **MARIA DEL CARMEN**

Address:

Laboratoire microbiologie BP 44
Observatoire Oceanographique Banyuls
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Telephone: + 33 0468887318

Birthplace: Madrid Spain

Date: 2nd May 1969

Passport Number: Y887588

INTERNET: <http://www.tusti.net/Carmen/Palacios.html>

<http://www.obs-banyuls.fr/UMR7621/fiche.php?id=142>

<http://www.obs-banyuls.fr/UMR7621/SARST-V6/>

CURRENT POST AND DETAILS OF CONTRACT

Department/Affiliation: Laboratoire oceanologique de Banyuls CNRS 7321

Faculty, School or Institute: Observatoire Oceanographique Banyuls

Mailing address: 66651 Banyuls sur mer FRANCE

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URL: <http://www.tusti.net/Carmen/Palacios.html>

Professional category: Marie Curie EU Postdoctoral fellow

Advisors: Prof. Philippe Lebaron

Current Research Projects:

- Study microbial community composition and ecological diversity in the extreme acidic and high metal ladden Tinto River (Spain)
- Microbial ecological diversity and functions of sunken woods in deep oceans.

Research notes:

I am interested in the study of biodiversity and ecological functioning of microbial communities in particular and natural ecosystems in general. During my postdoc at the Marine Biological Laboratory (USA) I developed a new tag method called SARST-V6 to tackle both the main components of a microbial community, involved in energy and carbon flows, but also the less abundant members that might have escaped detection from conventional microbial ecology methods. This new molecular method, in concomitance with physico-chemical parameters measurements and proper analytical tools has allowed us to revisit the bacterial diversity of the Tinto River -a heavy metal and low pH stream in Southwestern Spain- following an evolutionarily ecological perspective that have given insights into bacteria population dynamics and biography hypothesis.

Currently I hold a Marie Curie postdoctoral fellowship at the Laboratoire Oceanologique de Banyuls (France) to study diversity and functions in a totally unexplored habitat from a microbial point of view, sunken woods in marine waters. These ecosystems are very abundant in the ocean basin and might serve as stepping-stones for the dispersion of chemosynthetic communities. We are using culture independent methods like SSCP fingerprinting and 16S rRNA gene libraries to get clues on the Bacteria and Archaea free-living communities growing in and around sunken woods both at coastal and deep sea environment. The analysis of this data is revealing interesting patterns in marine chemosynthetic bacterial communities dispersion.

PREVIOUS RESEARCH FELLOWSHIPS AND CONTRACTS

November 2004-June 2005

Department/Affiliation: Habitat group

Faculty, School or Institute: Max Planck Institute for Marine Microbiology

Professional category: Postdoctoral stipend

Research project/s:

-Development of methods to study the microbiology in sunken woods.

Advisor: Antje Boetius

December 2001-August 2004

Department/Affiliation: The Josephine Bay Paul Center for Comparative Molecular Biology and Evolution

Faculty, School or Institute: The Marine Biological Laboratory

Professional category: Postdoctoral Scientist

Research project/s:

-Development of new technologies for sampling microbial population structure of natural environments

-Study microbial community composition and ecological diversity in the extreme acidic and high metal concentration environment Rio Tinto (Spain)

-Ecological genomics: exploring gene expression patterns in microbial biofilms of Lagunas de Guerrero Negro in Baja California.

Advisors: Mitchell L. Sogin and Linda Amaral-Zettler

February 2001-December 2001

Department/Affiliation: The Josephine Bay Paul Center for Comparative Molecular Biology and Evolution

Faculty, School or Institute: The Marine Biological Laboratory

Professional category: Postdoctoral Scientist

Research project/s: Study the molecular evolutionary consequences of bacterial endosymbiosis and the evolutionary forces that drive the evolution of their genes and genomes. We use most up-to-date bioinformatics and statistical analysis techniques to investigate codon and amino acid usage in *Buchnera* endosymbiont.

Advisor: Jennifer J. Wernegreen

December 1998-January 2000.

Department/Affiliation: Centro de Astrobiología (CAB)

Faculty, School or Institute: Instituto Nacional de Técnica Aeroespacial (INTA)
Consejo Superior de Investigaciones Científicas (CSIC)

Professional category: FEDER Postdoctoral Fellowship Award

Research project/s: "Determinación del genoma completo del endosimbionte de los pulgones, *Buchnera* sp." (Complete genome sequencing of the endosymbiont of aphids, *Buchnera* sp.). During my two years postdoc in this lab my main task was to characterize the genome of the endosymbiont by using pulse field gel electrophoresis and restriction digestion analysis. I was also involved in the fieldwork and the output sequencing part of the project.

Advisor: Andres Moya Simarro

September 1998-November 1998

Department/Affiliation: Institut Cavanilles de Biodiversitat i Biologia Evolutiva

Faculty, School or Institute: Universidad de Valencia

Professional category: Researcher for Conselleria de Medi Ambient Scientific Aid

Research project/s: "Estudio de la variabilidad genética intra e interpoblacional del endemismo alicantino *Limonium rigualii* MB Crespo & Erben" (Study of the intra- and interpopulation variability of the endemism from Alicante province *Limonium rigualii* MB Crespo & Erben). This was a research project for which I got a grant from the local government to study biodiversity in this endemism. We used microsatellites markers already developed in our lab for this genus.

Advisor: Fernando Gonzalez Candelas

March 1998-September 1998.

Department/Affiliation: Departamento de Genética

Faculty, School or Institute: Universidad de Valencia

Professional category: Profesor Asociado (Associate Professor)

Research project/s: “Estudio de las relaciones evolutivas de varias especies del genero *Limonium* (*Plumbaginaceae*) usando marcadores moleculares, nucleares y citoplasmáticos” (Study of the evolutionary relationships among *Limonium* Species (*Plumbaginaceae*) using nuclear and cytoplasmic molecular markers).
As a continuation of my doctorate research I investigated the evolutionary relationships of the species of this genus with markers already developed during my Ph.D.

Advisor: Fernando Gonzalez Candelas

January to June 1997

Department/Affiliation: Departamento de Genètica

Faculty, School or Institute: Universidad de Valencia

Professional category: Fellowship Award by Universtitat de València

Research project/s: “Análisis de la estructura genético poblacional mediante marcadores moleculares en *Limonium dufourii*” (Population genetic structure analysis using molecular markers in the species *L. dufourii*).
This was part of my dissertation for which I was awarded with a fellowship from Universidad de Valencia.

Advisor: Fernando González Candelas

September 1992 to September 1996

Department/Affiliation: Departamento de Genètica

Faculty, School or Institute: Universidad de Valencia

Professional category: Fellowship Award by Conselleria de Cultura, Educacio i Ciencia

Research project/s: “La genética en la conservación de especies vegetales: Estudio de la variabilidad genética intra e interespecífica en especies del género *Limonium* (*Plumbaginaceae*)” (Genetics and conservation of plant species: An study of the intra and interspecific variability in *Limonium* species)). This was part of my dissertation for which I was awarded with a fellowship from the state government.

Advisor: Fernando González Candelas

September 1991 to September 1992

Department/Affiliation: Departamento de Genètica

Faculty, School or Institute: Universidad de Valencia

Professional category: Undergraduate Research Fellowship Award by Conselleria de Cultura, Educacio i Ciencia

Research project/s: “Beca de iniciacion a la investigacion: Aprendizaje de tecnicas moleculares para el estudio de variabilidad genética” (Learning to use molecular markers to determine genetic variability”) During my last undergraduate year I was awarded with a fellowship during my undergraduate studies from the state government.

Advisor: Fernando González Candelas

POST-SCHOOL EDUCATION

Licenciature in Biology at Universidad de Valencia in June 1992 with Premio Extraordinario de Licenciatura (Extraordinary Honor). Five years undergraduate university studies.

Ph.D. at Departamento de Genética (Facultad de CC. Biológicas, Universidad de Valencia) in December 1997. European Doctorate. Premio Extraordinario de Doctorado (Extraordinary Honor).

Title: LA GENÉTICA EN LA CONSERVACIÓN DE ESPECIES VEGETALES: ESTUDIO DE LA VARIABILIDAD GENÉTICA INTRA E INTERESPECÍFICA EN EL GÉNERO *LIMONIUM* (PLUMBAGINACEAE) [Genetics and conservation of plant species: Study of the intra- and interspecific genetic variability in the genus *Limonium* (*Plumbaginaceae*)]

Date: 22nd December 1997

Note: Apte *cum laude*

Comite: V. Heywood, M. Pérez de la Vega, J. A. Roselló i Picornell, J. Rozas Liras, A. Moya

Director: **Fernando González Candelas**

Ph.D. courses (listed below) to fulfill the requirements of the Ph.D. Program of the Departamento de Genética with the title: **Genética Molecular y Evolutiva (Molecular and Evolutionary Genetics)**, from 1992 until 1994:

- Comparative biochemistry and evolution (30 hours)
- Nucleic acid sequencing (20 hours)
- Nucleic acid sequence analysis (30 hours)
- Genomic DNA clonation in viral vectors (30 hours)
- Evolutionary quantitative genetics (20 hours)
- Analysis of population genetic structure (20 hours)
- Endemism and speciation in plants (40 hours)
- Evolutionary and molecular genetics seminars (30 hours)
- Molecular biology in plant development (30 hours)
- Molecular evolution (40 hours)
- Genetics and conservation (20 hours)
- In vitro enzymatic amplification of DNA (PCR) (20 hours)
- Multivariate analysis of environmental studies (20 hours)

Certified Advanced Courses:

Biodiversidad y su Conservación (Biodiversity and its conservation). Universidad Internacional Menéndez y Pelayo (UIMP). November 1993 30 hours

Análisis del Proceso Evolutivo (Analysis of the Evolutionary Process). Fundación General de la Universidad Complutense de Madrid. August 1994 30 hours

Molecular Tools for Biodiversity. DGXII EU-Advanced Practical Workshop in Biotechnology at the IACR-Long Ashton (Bristol, UK). April 1996 100 hours

Utilización de Redes y Bases de Datos en Biología Molecular (Use of Networks and Data Bases in Molecular Biology). Advance graduate course Universidad de Valencia. July 1996 100 hours

Conèixer per a conservar: l'aplicació del coneixement científic en la conservació de la Biodiversitat (To know to preserve: the application of the scientific knowledge to Biodiversity conservation). XIV Universitat d'Estiu de Gandía: Els usos del coneixement (The use of knowledge). July-August 1997. 25 hours

Salir de la Tierra para conocer nuestros orígenes (Go out of the Earth to know our origins). Fundación General Universidad Complutense de Madrid. 26-30 August 1994 30 hours

Workshop in Molecular Biology and Evolution. Workshop Marine Biological Laboratory. 29 July-10 August 2001. 90 hours

Perl Programming Fundamentals. Woods Hole Oceanographic Institute. Fall 2001. 36 hours.

Initiation aux bases de données relationnelles (Initiation to relational databases). Observatoire Oceanographique Banyuls. September 2006. 24 hours.

Non-Certified Advanced Courses:

Cladistic Analysis. University of Reading. July 1995. 30 hours

Microbial diversity. Marine Biological Laboratory. All lectures in Summer 2002 and 2003 courses.

Advances in Genome Technologies and Bioinformatics. Marine Biological Laboratory. All lectures in Fall 2002 and 2003 courses.

Symposium on Single Cell Analysis of planktonic microbes. Observatoire Oceanographique Banyuls. All lectures. October 2005.

Atelier Phylogeographie Comparee (Workshop Comparative Phylogeography). Observatoire Oceanographique Banyuls. Lectures. June 2006.

Mini-Workshop: Carbon fluxes within and between microbial food web components. Palavas-les-flots. November 2006.

Languages

Spanish: mother language

English: read, written and spoken

First certificate exam. University of Cambridge

Superior level Centro de Estudios Norteamericano (Spain)

Superior level Limerick Language Centre (Ireland)

French: read, written and spoken

Level L1INT. Institute Français (Spain)

Fourth level. Escuela Berlitz (Spain)

Catalan: read, written and spoken

Medium level Xunta Cualificadora Coneixements en Valencià (Spain)

Superior level Cursos de Llengua per al Personal Docent Investigador de la Universidad de Valencia (Spain).

German: read, written and spoken basic level

Eight months in Germany

First level. Max Planck Institute (Germany).

Others

Adult AED and CPR/ Pediatric CPR. Heartsaver AED of the American Heart Association (2004 Woods Hole MA, USA)

Diving Level 1 (CMAS 1 star) 2006 Banyuls sur mer (France)

RESEARCH SUPERVISION. INVOLVEMENT IN RESEARCH PROJECT FORMATION AND DEVELOPMENT

Project title: **Ayuda para actividades de conservación de la naturaleza (Research aid for nature conservation)**

Funded by: Consellería de Medio Ambiente de la Generalitat Valenciana

Partners: Universidad de Valencia

Period: 1992

Scientist in charge: Carmen Palacios de la Cruz

Number of research staff: 1

Role: Undergraduate

Project title: **Evaluación del riesgo genético de extinción en especies vegetales del género *Limonium* (*Plumbaginaceae*) (Genetic extinction risk evaluation in genus *Limonium*)**

Funded by: Programa Sectorial de Promoción General del Conocimiento, Subprograma de Proyectos de Investigación y Desarrollo Tecnológico de la Generalitat Valenciana (GV-1020/93)

Partners: Universidad de Valencia

Period, from: 1993 to: 1995

Scientist in charge: Fernando González Candelas

Number of research staff: 1

Role: PhD

Project title: **Estudio de la variación genética en especies vegetales del género *Limonium* (*Plumbaginaceae*): estructura poblacional, sistemática molecular y conservación (Genetic variation study of plant species from genus *Limonium*: population structure, molecular systematics and conservation)**

Funded by: Dirección General de Investigación Científica y Técnica (PB93-0350)

Partners: Universidad de Valencia

Period, from: 1994 to: 1997

Scientist in charge: Fernando González Candelas

Number of research staff: 4

Role: PhD

Project title: **Realización de los planes de recuperación de dos especies amenazadas de flora, *Limonium dufourii* y *Chaenorrhinum tenellum* (Conservation management of two endangered, plant species: *L. dufourii* and *C. tenellum*)**

Funded by: Consellería de Medio Ambiente de la Generalitat Valenciana

Partners: Universidad de Valencia

Period, from: 1st July 1994 for 16 months

Scientist in charge: Fernando González Candelas

Number of research staff: 4

Role: PhD

Project title: **Desarrollo de un mapa genético de cítricos para su utilización en mejora y caracterización de cultivares (Genetic map development of citrics for improvement and characterization of crop species)**

Funded by: Proyectos de Investigación Científica y Despliegue tecnológico de la Generalidad Valenciana

Partners: Universidad de Valencia, IVIA, Universidad Politécnica de Valencia

Period, from: 1996 to: 1998

Scientists in charge: Fernando González Candelas, M^a José Asins Cebrián y Antonio Granell Richart

Number of research staff: 6

Role: PhD

Project title: **Estudio de la variabilidad genética intra e interpoblacional del endemismo alicantino *Limonium rigualii* M.B. Crespo & Erben (Intra- and interpopulation genetic variability study of the endemic species *Limonium rigualii*)**

Funded by: Consellería de Medio Ambiente de la Generalitat Valenciana

Partners: Departamento de Genética de la Universidad de Valencia

Period from: July 1998 to November 1998

Scientist in charge: Carmen Palacios de la Cruz

Number of research staff: 1

Role: Researcher

Project title: **Secuenciación de tres genomas de *Buchnera aphidicola*, endosimbionte bacteriano de los áfidos (Sequencing three genomes of the bacterial endosymbiont of aphids, *Buchnera aphidicola*)**

Funded by: Programa de Proyectos cofinanciados con fondos FEDER 1999-2001

Partners: Instituto Nacional de Técnica Aeroespacial "Esteban Terradas"

Period, from: 2000 to: 2002

Scientist in charge: Federico Morán

Number of research staff: 7

Role: Post Doc

Project title: **Testing molecular evolutionary consequences of endosymbiosis**

Funded by: National Institute of Health

Partners: Josephine Bay Paul Center for Comparative Molecular Biology and Evolution. Marine Biological Laboratory

Period, from: 2001 to: 2006

Scientist in charge: Jennifer J. Wernegreen

Number of research staff: 3

Role: Post Doc

Project title: **Ecological Genomics**

Funded by: NASA Astrobiology Augmentation proposal

Partners: Marine Biological Laboratory and NASA Ames Research Center

Period, from: 2001 to: 2003

Scientist in charge: Mitchell L. Sogin and David de Marais

Number of research staff: 12

Role: Post Doc

Project title: **Environmental Genomes and the Evolution of Complex Systems in Simple Organisms (NCC2-1054)**

Funded by: NASA Astrobiology Institute
Partners: Marine Biological Laboratory and NASA Ames Research Center
Period, from: 1998 to: 2003
Scientist in charge: Mitchell L. Sogin
Number of research staff: 14
Role: Post Doc

Project title: **From Early Biospheric Metabolisms to the Evolution of Complex Systems (NNA04CC04A)**

Funded by: NASA Astrobiology Institute
Partners: Marine Biological Laboratory and NASA Ames Research Center
Period, from: 2003 to: 2008
Scientist in charge: Mitchell L. Sogin
Number of research staff: 14
Role: Post Doc

Project title: **Diversity, Establishment, And Function Of Organisms Associated With Marine Wood Falls (DIWOOD)**

Funded by: CNRS
Partners: University Pierre et Marie Curie, CNRS, Museum National d'Histoire Naturelle, Planck Institute for Marine Microbiology, University of Liège in Belgium.
Period, from: 2005 to: 2007
Scientist in charge: Françoise Gaill
Number of research staff: 17
Role: Post Doc

FIELD WORK

1992-1997 Numerous sampling missions to sample the different populations of plants along the regions of Alicante and Valencia (Spain) to study during my PhD

1999 Sampling of aphid gills within the project FEDER "Sequencing three genomes of the bacterial endosymbiont of aphids, *Buchnera aphidicola*" at CAB (Madrid, Spain)

Octobre 2002 Sampling mission Tinto River (Huelva, Spain) within the project Environmental Genomes and the Evolution of Complex Systems in Simple Organisms (NCC2-1054) at the Marine Biological Laboratory

Septembre 2003 Sampling mission Tinto River (Huelva, Spain) within the project From Early Biospheric Metabolisms to the Evolution of Complex Systems (NNA04CC04A) at the Marine Biological Laboratory

Janvier 2004 Sampling mission Tinto River (Huelva, Spain) within the project From Early Biospheric Metabolisms to the Evolution of Complex Systems (NNA04CC04A) at the Marine Biological Laboratory

Janvier 2006 Sunken wood immersion within the project DIWOOD at SOLA Mediterranean station

Juillet 2006 Sampling of immersed woods within the project DIWOOD at SOLA Mediterranean station

PUBLICATIONS AND SCIENTIFIC DOCUMENTS

Peer-review articles

1.
Authors: **Carmen Palacios** and Fernando González-Candelas
Title: Lack of genetic Variability in the rare and endangered *Limonium cavanillesii* (*Plumbaginaceae*) using RAPD markers
Reference: Molecular Ecology Volume: 6 Issue: 7 Pages: 671-675 Year: 1997

2.
Authors: **Carmen Palacios** and Fernando González-Candelas
Title: Analysis of population genetic structure and variability using RAPD markers in the endemic and endangered *Limonium dufourii* (*Plumbaginaceae*)
Reference: Molecular Ecology Volume: 6 Issue: 12 Pages: 1107-1122 Year: 1997

3.
Authors: **Carmen Palacios**, Stephen Kresovich and Fernando González-Candelas
Title: A population genetic study of the endangered plant species *Limonium dufourii* (*Plumbaginaceae*) based on amplified fragment length polymorphism (AFLP)
Reference: Molecular Ecology Volume: 8 Issue: 4 Pages: 654-657 Year: 1999

4.
Authors: **Carmen Palacios** and Fernando González-Candelas
Title: AFLP analysis of the critically endangered *Limonium cavanillesii* (*Plumbaginaceae*)
Reference: Journal of Heredity Volume: 90(4) Pages: 485-489 Year: 1999
Note: This paper has been cited in W. S. Klug and M. P. Cummings (eds.) Concepts of Genetics (7th Edition) Chapter 27: Conservation Genetics.

5.
Authors: **Carmen Palacios**, Josep A. Rosselló and Fernando González-Candelas
Title: Study of the evolutionary relationships among *Limonium* species (*Plumbaginaceae*) using molecular and cytoplasmic molecular markers.
Reference: Molecular Phylogenetics and Evolution Volume:14 Pages: 232-249 Year: 2000

6.
Authors: María Luisa Palop, **Carmen Palacios** and Fernando González-Candelas
Title: Development and across species transferibility of microsatellites markers in the genus *Limonium* (*Plumbaginaceae*)
Reference: Conservation Genetics Volume: 00 Pages: 1-3 Year: 2000

7.
Authors: **Carmen Palacios** and Jennifer J. Wernegreen
Title: A strong effect of AT mutational bias on amino acid usage in *Buchnera* is mitigated at high expression genes.
Reference: Molecular Biology and Evolution Volume:19 Pages: 1575-84 Year: 2002

8.
Authors: Sacramento Rodríguez, María Luisa Palop, **Carmen Palacios** and Fernando González-Candelas
Title: Molecular and morphological differentiation in *Limonium dufourii*
Reference: Conservation Genetics Volume: 4 Pages: 386-391 Year: 2003

9.
Authors: Roeland CHJ van Ham, Judith Kamerbeek, **Carmen Palacios**, Carolina Rausell, Federico Abascal, Ugo Bastolla, Jose M. Fernandez, Luis Jimenez, Marina Postigo, Francisco J. Silva, Javier Tamames, Enrique Viguera, Amparo Latorre, Alfonso Valencia, Federico Moran and Andrés Moya
Title: Reductive genome evolution in *Buchnera aphidicola*.
Reference: Proc. Natl. Acad. Sci. U S A Volume:100 Pages: 581-586 Year: 2003

10.

Authors: Jennifer J. Wernegreen, Patrick H. Degnan, Adam B. Lazarus, **Carmen Palacios** and Seth R. Bordenstein
Title: Genome evolution in an insect cell: distinct features of an ant-bacterial partnership.
Reference: Biological Bulletin Volume: 204 Pages:221-231 Year: 2003

11.

Authors: David L. Kysela, **Carmen Palacios** and Mitchell L. Sogin
Title: Serial Analysis of V6 ribosomal sequence tags (SARST-V6): A method for efficient, high-throughput analysis of microbial community composition
Reference: Environmental Microbiology Volume: 7 Pages: 356-364 Year: 2005

12.

Authors: **Carmen Palacios**, Magali Zbinden, Amy R. Baco, Tina Treude, Craig R. Smith, Françoise Gaill, Philippe Lebaron and Antje Boetius.
Title: Microbial ecology of deep-sea sunken woods: achieving quantitative measurements for bacterial biomass and cellulolytic activities.
Reference: Cahiers de Biologie Marine 47: 415-420 Year: 2006

Books

13.

Authors: **Carmen Palacios**
Title: La genética en la conservación de especies vegetales: Estudio de la variabilidad genética intra e interespecifica en especies del género *Limonium* (*Plumbaginaceae*) [Genetics and conservation of plant species: Study of intra and interspecific genetic variability in genus *Limonium* (*Plumbaginaceae*)]
Editorial: Universidad de Valencia Key: B Year: 1998 Place: Valencia (Spain)

Book chapters and Proceedings

14.

Authors: Fernando González-Candelas and **Carmen Palacios**
Title: Analyzing molecular data for studies of genetic diversity in plants and animals.
Reference: Ayad W.G., Hodgkin T., Jaradat A., Rao V.R. (eds.)
Molecular genetic techniques for plant genetic resources
Report of an IPGRI workshop, 9-11 October 1995, Rome, Italy
Editorial: International Plant Genetic Resources Institute Pages: 55-80 Year: 1997

15.

Authors: **Carmen Palacios**, D.T. Kysela and M.L. Sogin
Title: Serial Analysis of rRNAs (SARS): A novel molecular strategy for sampling microbial diversity throughout the universe
Reference: Proceedings of the Second European Workshop on Exo/Astrobiology Graz, Austria, 16-19 September 2002
Editorial: ESA SP-518 Pages: 481-482 Year: 2002

16.

Authors: **Carmen Palacios**, David Kysela and Mitchell L. Sogin
Title: Consolidation of Serial Analysis of Ribosomal RNAs (SARS) as a unique molecular biology method for sampling microbial diversity in natural environments
Reference: Astrobiology Volume: 2 Pages: 546-547 Year 2002

17.

Authors: **Carmen Palacios**, Linda Amaral-Zettler, Erik Zettler, Felipe Gómez Gómez, Elena González Toril, Ricardo Amils, Mitchell L. Sogin
Title: Evolutionary bacterial ecology of Rio Tinto (Huelva, Spain), an extremely acidic and high metal laden ecosystem
Reference: International Journal of Astrobiology Supplement: 1 Page: 69 Year 2004

18.
Authors: Linda Amaral Zettler, Abby Laatsch, Ashita Dhillon, **Carmen Palacios**, Erik Zettler, Felipe Gómez Gómez, Elena González Toril, Ricardo Amils, Mitchell Sogin
Title: Microbial Diversity in Spain's Río Tinto: A Three-Domain Approach
Reference: International Journal of Astrobiology Supplement: 1 Page: 61 Year 2004

19.
Authors: Jillian Ward, Mitchell L. Sogin, **Carmen Palacios**, Hilary Morrison, John Waterbury
Title: Expression Profiling of the Microbial Mat Organism: Microcoleus chthonoplastes
Reference: International Journal of Astrobiology Supplement: 1 Page: 77 Year 2004

20.
Authors: Linda Amaral Zettler, **Carmen Palacios**, Abby Laatsch, Erik Zettler, Ashita Dhillon, Elena González Toril, Ricardo Amils, Mitchell Sogin
Title: Progress in microbial diversity and population structure studies in the Río Tinto. Astrobiology
Reference: Astrobiology Volume: 5 Number: 2 Page: 246 Year 2005

21.
Authors: Linda Amaral Zettler, **Carmen Palacios**, Erik Zettler, Ricardo Amils, Mitchell Sogin
Title: A Three-Domain Approach to Microbial Diversity and Population Structure in the Río Tinto
Reference: Astrobiology Volume: 6 Number: 1 Page: 256-257 Year 2006

22.
Authors: **Carmen Palacios**, Bertil Olsson, Philippe Lebaron, Mitchell L. Sogin.
Title: New high-throughput biotechnologies for sampling the microbial ecological diversity of the oceans: the informatics challenge.
Reference: Vanden Berghe E., Appeltans W., Costello M.J., Pissierssens, P (eds.)
Proceedings 'Ocean Biodiversity Informatics'
International Conference on Marine Biodiversity Data Management, Hamburg, Germany, 29 November–1 December 2004 IOC Workshop Report No. 202
Editorial: BSH/ VLIZ Special Publication No. 37 pages: 145-150 Year: 2007

Manuscripts in preparation

Authors: **Carmen Palacios**, Linda Amaral Zettler, Erik Zettler, Ricardo Amils and Mitchell Sogin
In-depth analysis of bacterial community structure with concomitant physicochemical parameters using a Serial Analysis of Ribosomal Sequence Tag (SARST-V6) give insights into bacterial community dynamics and biogeography hypothesis (in revision)

Authors: **Carmen Palacios**, Magali Zbinden, Marie Pailleret, Nima Saedlou, Catherine Privé-Gill, Françoise Gaill and Philippe Lebaron.
Comparison of Archaeal and Bacteria community profiles in natural and artificially immersed woods from around the world seas (in preparation).

Authors: **Carmen Palacios**, Craig Smith, Antje Boetius and Philippe Lebaron.
Microbial diversity of sunken woods provides insights into ocean chemosynthetic communities dispersion (in preparation)

INVITED TALKS

Title: **Case studies of SAGT (Serial Analysis of Gene Tags). A novel molecular method for high-throughput analysis of microbial community composition**

Date: 30th September 2003

Institution: Institute de G n t c et Microbiologie. University Paris-Sud (France)

(<http://leo.igmors.u-psud.fr/seminaires.htm>)

Host: Purificacion Lopez-Garcia and Patrick Forterre

Title: **How to adequately explore microbial community composition and ecological diversity of natural environments? SAGT is the answer**

Date: 5th October 2003

Institution: Station de Recherche Forestiere de Cestas (INRA) Bordeaux (France)

Host: Remy Petit

Title: **Evolutionary bacterial ecology of the extremely acidic and high metal laden Rio Tinto (Huelva, Spain)**

Date: 10th October 2003

Institution: Observatoire Oceanographique Banyuls, Banyuls sur mer, France

Host: Philippe Lebaron

Title: **Ecologia evolutiva bacteriana del R o Tinto, un ambiente extremadamente  cido y cargado de metales pesados**

Date: 9th January 2004

Institution: Instituto Cavanilles de Biodiversitat i Biologia Evolutiva. Universitat de Valencia, Valencia, Spain

Host: Fernando Gonz lez-Candelas and Andr s Moya

Title: **Astrobiologia en espa ol. Bacterial ecological diversity of Rio Tinto (Huelva, Spain), an extremely acidic and high metal laden ecosystem.**

Date: 28th March 2004

Institution: Astrobiology Science Conference at AMES Research Center, USA

Host: Hector D'Antoni

Title: **Nuevas tecnolog as para el estudio de ecosistemas extremos: SARST-V6 en el R o Tinto espa ol**

Date: 12th August 2004

Institution: Universidad Politecnica and Museo de Antropologica y Arte Contemporaneo, Guayaquil, Ecuador

Host: Jorge Marcos and Consejo de Investigaciones en Ciencia y Tecnologia (CICYT-ESPOL)

Title: **Microbiology of sunken woods in deep seas**

Date: 21th Avril 2005

Institution: Universit  Paris VI CNRS UMR 7138 Syst matique Adaptation et Evolution, Paris, France

Host: Fran oise Gaill

Title: **Microbial ecological diversity of the R o Tinto revisited using a new high-throughput technology, SARST-V6**

Date: May 2005

Institution: Max Planck Institute for Marine Microbiology

Host: Dirk de Beer

Title: **Microbial ecological diversity of sunken woods in the deep sea**

Date: 13th October 2005

Institution: Laboratoire d'Océanologie Biologique de Banyuls, CNRS UMR 7621, Banyuls sur mer, France

Host: Ingrid Obernosterer and François Charles

Title: **Case studies to link microbial diversity to environmental physico-chemical parameters**

Date: 6th December 2006

Institution: Reseaux Trophiques Aquatiques (CNRS-GDR 2476). UMR 5119 "Ecosystèmes lagunaires", CNRS-Université Montpellier II

Host: Behzad Mostajir

PARTICIPATION TO SCIENTIFIC CONGRESSES

Category: Personal attendance

Congress: **XXIX Jornadas de Genética Luso-Españolas**

Place: Lerida (Spain) Date: 6-8th October 1995

Authors: Fernando González-Candelas & Carmen Palacios

Title: Variación genética y relaciones filogenéticas en especies vegetales del género *Limonium* (*Plumbaginaceae*)
(Genetic variation and phylogenetic relationships in the genus *Limonium*)

Category: Talk

Congress: **X Seminario de Genética de Poblaciones y Evolución**

Place: Madrid (Spain) Date: 25-28th April 1995

Authors: Carmen Palacios & Fernando González-Candelas

Title: Phylogenetic relationships in the genus *Limonium* (*Plumbaginaceae*) inferred from chloroplast DNA restriction analysis

Category: Poster

Congress: **V Congress of the European Society for Evolutionary Biology (ESEB)**

Place: Edimburgo (Scotland) Date: 4-8th September 1995

Authors: Fernando González-Candelas & Carmen Palacios

Title: Analyzing molecular data for studies of genetic diversity

Category: Talk

Congress: **Workshop on Molecular Genetic Techniques for Plant Genetic Resources** organised by IPBRI
(International Plant Genetic Resources Institute)

Place: Roma (Italy) Date: 9-11th October 1995

Authors: Carmen Palacios & Fernando González-Candelas

Title: Use of RAPD analysis for detection of genetic variability in the rare and endangered plant species *Limonium cavanillesii* (*Plumbaginaceae*)

Category: Poster

Congress: **EU-Advanced Practical Workshop in Biotechnology: Molecular Tools for Biodiversity**

Place: Long Ashton (Bristol, England) Date: 18-28th April 1996

Category: Personal attendance

Congress: **The Genetic Harvest: Automated DNA Analysis Tools For Plants and Animals Workshop**

Place: Atlanta (Georgia, USA) Date: 18th November 1996

Category: Personal attendance

Congress: **Plant Center Retreat Workshop**

Place: Hellen (Georgia, USA) Date: 16-17th December 1996

Authors: Fernando González-Candelas & Carmen Palacios

Title: Variabilidad y estructura genético-poblacional en *Limonium dufourii* (*Plumbaginaceae*) (Variability and genetic population structure in *Limonium dufourii*)

Category: Talk

Congress: **XI Seminario de Genética de Poblaciones y Evolucion**

Place: Santiago de Compostela (Spain) Date: 15-18th April 1997

Authors: Fernando González-Candelas & Carmen Palacios
Title: The population structure of *Limonium dufourii*: a comparative analysis with RAPDs and AFLP
Category: Talk
Congress: **VI Congress of the European Society for Evolutionary Biology (ESEB)**
Place: Arnhem (Holland) Date: 24-28th August 1997

Authors: Maria Luisa Palop, Carmen Palacios and Fernando González-Candelas
Title: Development of microsatellite primers and across-species transferability in the genus *Limonium* (*Plumbaginaceae*)
Category: Poster
Congress: **VI Congress of the European Society for Evolutionary Biology (ESEB)**
Place: Arnhem (Holland) Date: 24-28th August 1997

Authors: Carmen Palacios, Maria Luisa Palop and Fernando González-Candelas
Title: Genética de poblaciones y conservación de endemismos vegetales: el género *Limonium* (*Plumbaginaceae*)
(Population genetics and conservation of plant endemisms: the genus *Limonium*)
Category: Poster
Congress: **I Congreso de la Sociedad Española de Genética (SEG)**
Place: Valencia (Spain) Date: 11-13th September 1997

Authors: Roeland Van Ham, Carmen Palacios, Carolina Rausell and twelve authors more
Title: The search for minimal genetic complements of life: Comparative genome sequencing of *Buchnera Aphidicola*, endosymbiont of aphids
Category: Poster
Congress: **Workshop Glaxo-Wellcome-Red Nacional de Bioinformática**
Place: Madrid (Spain) Date: March 1999

Authors: Sacramento Rodríguez, Carmen Palacios, Maria Luisa Palop and Fernando González-Candelas
Title: Molecular and morphometric differentiation in *Limonium dufourii* (*Plumbaginaceae*), an endangered Mediterranean plant
Category: Talk
Congress: **VII Congress of the European Society for Evolutionary Biology (ESEB)**
Place: Barcelona (Spain) Date: 23-29th August 1999

Authors: Maria Luisa Palop, Carmen Palacios and Fernando González-Candelas
Title: Identification and application of polymorphic microsatellite loci in the genus *Limonium* (*Plumbaginaceae*)
Category: Poster
Congress: **VII Congress of the European Society for Evolutionary Biology (ESEB)**
Place: Barcelona (Spain) Date: 23-29th August 1999

Authors: Roeland Van Ham, Carmen Palacios, Carolina Rausell, and 8 authors more
Title: The search for minimal genetic complements of life: Comparative genome sequencing of *Buchnera aphidicola*, endosymbiont of aphids
Category: Poster
Congress: **I Minisymposium Centro de Astrobiología.**
Place: Torrejón de Ardoz (Madrid, Spain) Date: 28-29th October 1999

Authors: Roeland Van Ham, Carmen Palacios, Carolina Rausell, and 8 authors more
Title: The search for minimal genetic complements of life: Comparative genome sequencing of *Buchnera aphidicola*, endosymbiont of aphids
Category: Talk
Congress: **First Astrobiology Science Conference**
Place: Torrejón de Ardoz (Madrid, Spain) Date: 3-5th of April 2000

Category: Personal attendance
Congress: **Workshop Evolution: From Molecules to Ecosystems**
Place: Valencia (Spain) Date: 2-4th November 2000

Category: Personal attendance
Congress: **NASA Astrobiology Institute General Meeting**
Place: Washington (USA) Date: 10-12th April 2001

Authors: Carmen Palacios and Jennifer J. Wernegreen
Title: Comparison of amino acid usage patterns indicates that different selective pressures drive genome evolution in *Buchnera* sp. and *E. coli*.
Category: Talk
Congress: **New England Molecular Evolutionary Biologists**
Place: Northampton (MA, USA) Date: 4th of November 2001

Authors: Jennifer J. Wernegreen, Patrick H. Degnan, Adam B. Lazarus, Carmen Palacios
Title: Effects of genetic drift and mutational bias on the evolution of endosymbiont genomes
Category: Invited Talk
Congress: **Gordon Research Conference in Molecular Evolution**
Place: Ventura (CA, USA) Date: 13th-18th of January 2002

Authors: Jennifer J. Wernegreen, Patrick H. Degnan, Adam B. Lazarus, Carmen Palacios
Title: Evolution of ant and aphid symbionts: Effects of drift and mutational bias on the evolution of endosymbiont genomes
Category: Invited Talk
Congress: **Wesleyan University, Biology Department seminar**
Place: Middletown (CN, USA) Date: 28th of February 2002

Authors: Jennifer J. Wernegreen, Patrick H. Degnan, Adam B. Lazarus, Carmen Palacios
Title: Evolution of ant and aphid endosymbionts: Insights from phylogenetics and genomics
Category: Invited Talk
Congress: **Boston University, Biology Department seminar**
Place: Boston (MA, USA) Date: 22 of April 2002

Authors: Carmen Palacios, David Kysela and Mitchell L. Sogin
Title: Serial Analysis of rRNAs (SARS): A novel molecular strategy for sampling microbial diversity throughout the universe
Category: Poster
Congress: **Second European Workshop on Exo/Astrobiology**
Place: Graz (Austria) Date: 16th-19th September 2002

Authors: Jennifer J. Wernegreen, Patrick H. Degnan, Adam B. Lazarus, Carmen Palacios
Title: Evolutionary consequences of endosymbiosis: Genome reduction and degradation in a bacterial mutualist of ants
Category: Invited Talk
Congress: **Outcomes in Genome-Genome Interactions**
Place: Woods Hole (MA, USA) Date: 1st-2nd May 2002

Authors: Carmen Palacios, David Kysela and Mitchell L. Sogin
Title: Consolidation of Serial Analysis of Ribosomal RNAs (SARS) as a unique molecular biology method for sampling microbial diversity in natural environments
Category: Poster
Congress: **NASA Astrobiology Institute General Meeting**
Place: Temple (AZ, USA) Date: 10th-12th February 2003

Authors: Carmen Palacios, Linda Amaral-Zettler, Erik Zettler, Felipe Gómez Gómez, Elena González Toril, Ricardo Amils, Mitchell L. Sogin
Title: Evolutionary bacterial ecology of Rio Tinto (Huelva, Spain), an extremely acidic and high metal laden ecosystem
Category: Poster
Congress: **NASA Astrobiology Institute General Meeting**
Place: San Jose (CA, USA) Date: 28th March-1st April 2004

Authors: Linda Amaral Zettler, Abby Laatsch, Ashita Dhillon, Carmen Palacios, Erik Zettler, Felipe Gómez Gómez, Elena González Toril, Ricardo Amils, Mitchell Sogin
Title: Microbial Diversity in Spain's Río Tinto: A Three-Domain Approach
Category: Talk
Congress: **NASA Astrobiology Institute General Meeting**
Place: San Jose (CA, USA) Date: 28th March-1st April 2004

Authors: Jillian Ward, Mitchell L. Sogin, Carmen Palacios, Hilary Morrison, John Waterbury
Title: Expression Profiling of the Microbial Mat Organism: Microcoleus chthonoplastes
Category: Talk
Congress: **NASA Astrobiology Institute General Meeting**
Place: San Jose (CA, USA) Date: 28th March-1st April 2004

Authors: Carmen Palacios, Bertil Olsson, Antje Boetius, Philippe Lebaron, Mitchell L. Sogin
Title: New biotechnologies for sampling the ecological diversity of the oceans: the informatics challenge
Category: Poster
Congress: **Ocean Biodiversity Informatics**
Place: Hamburg (Germany) Date: 29th November-1st of December 2005

Authors: **Carmen Palacios**, Magali Zbinden, Amy R. Baco, Tina Treude, Craig R. Smith, Françoise Gaill, Philippe Lebaron and Antje Boetius
Title: Microbial ecology of sunken wood in deep marine waters
Category: Poster
Congress: **Third International Symposium on Hydrothermal Vent and Seep Biology**
Place: La Joya (CA, US) Date: 12-16th September 2005

Authors: **Carmen Palacios**, Linda Amaral-Zettler, Erik Zettler, Ricardo Amils, Mitchell L. Sogin
Title: SARST-V6 Reveals Interesting Aspects of the Ecological Diversity in the Extremely Acidic Rio Tinto (Spain)
Category: Poster
Congress: **AGU Ocean Sciences Meeting**
Place: Honolulu (Hawaii, US) Date: 20-24th February 2006

Authors: Linda Amaral-Zettler, **Carmen Palacios**, Erik Zettler, Ricardo Amils, Mitchell L. Sogin
Title: A Three-Domain Approach to Microbial Diversity and Population Structure in the Río Tinto
Category: Poster
Congress: **Astrobiology Science Conference**
Place: Washington DC (WA, US) Date: 26-30th March 2006

Authors: **Carmen Palacios**, Linda Amaral-Zettler, Erik Zettler, Ricardo Amils, Mitchell L. Sogin
Title: When fingerprinting joins sequencing comprehensive microbial ecology studies become possible: The Río Tinto model revisited through the new SARST-V6 ribotyping method
Category: Talk
Congress: **EGU General Assembly 2007**
Place: Vienna (Austria) Date: 15-20th April 2007

Authors: **Carmen Palacios**, Magali Zbinden, Fraçoise Gaill, Philippe Lebaron
Title: Microbial diversity of sunken woods provides insights into ocean chemosynthetic communities dispersion
Category: Poster
Congress: **EGU General Assembly 2007**
Place: Vienna (Austria) Date: 15-20th April 2007

CURRENT COLLABORATIONS

Dr. Linda-Amaral Zettler, Erik Zettler and Dr. Mitchell L. Sogin, Marine Biological Laboratory, Woods Hole, MA, USA

Dr. Ricardo Amils, Universidad Complutense de Madrid and Centro de Astrobiologia (CSIC, INRA), Madrid, Spain

Dr. Craig Smith, Hawaii Department of Oceanography, University of Hawaii at Manoa, Honolulu, HI, USA

Dr. Antje Boetius, Max Planck Institute for Marine Microbiology, Bremen, Germany

Dr. Nadine Le Bris, Département Etude des Ecosystèmes Profonds, Laboratoire Environnement Profond, IFREMER, France

Dr. Françoise Gaill and Dr. Magali Zbinden, AMEX UMR CNRS 7138, Systematique Adaptation Evolution, Université Pierre et Marie Curie, 75005 Paris, France

RESEARCH VISITS ABROAD SPAIN

(KEY: D = doctorate, P = postdoctoral, I = invited, C = contract)

Centre: **Plant Science Department Reading University**

Place: Reading Country: Reino Unido Year: 1995 Period: 12 weeks

Issue: Nuclear rDNA ITS sequencing of several species of genus *Limonium*.

Key: D

Fellow: Beca Bancaixa-Europa (III Ciclo-Doctorado) funded by Obra Social y Cultural de la Caja de Ahorros de Valencia, Castellón y Alicante (Bancaixa)

Centre: **Plant Genetic Resources Conservation Unit USDA-ARS (United States Department of Agriculture-Agricultural Research Service)**

Place: Griffin (Georgia) Country: EE. UU Year: 1996 Period: 12 weeks

Issue: Nuclear rDNA ITS region sequencing of several species of genus *Limonium*. Intra and interpopulation genetic variability studies in two *Limonium* species using AFLP as markers.

Key: D

Fellow: Beca para la Realización de Estancias Temporales en el Extranjero de la Consellería de Educación y Ciencia

Centre: **Josephine Bay Paul Center for Comparative Molecular Biology and Evolution. Marine Biological Laboratory Institution**

Place: Woods Hole (Massachusetts) Country: USA. Year: 2001 until date

Issue: Astrobiology research.

Key: P

Fellow: MBL employee as Postdoctoral Scientist financed by NASA Astrobiology Institute

Centre: **Max Planck Institute for Marine Microbiology**

Place: Bremen Country: Germany. Year: 2004-2005

Issue: Start setting up methodologies to study microbial communities in sunken woods in deep marine ecosystems

Key: P

Fellow: Postdoctoral Stipend by MPI

Centre: **Observatoire Oceanologique de Banyuls sur mer. Laboratoire d'océanographie biologique de Banyuls CNRS UMR 7126**

Place: Banyuls sur mer Country: France. Year: 2005-2007

Issue: Microbial ecology of sunken woods in ocean waters

Key: P

Fellow: Marie Curie Postdoctoral fellowship

TEACHING EXPERIENCE

(KEY: A = Associate Professor; T = Assistant Professor)

School year: 1994-1995

Subject: **Genética General (Basic Genetics)**

Nº of hours: 55

University: Universidad de Valencia (Spain)

Key: T

School year: 1995-1996

Subject: **Prácticas de Genética (Laboratory of Genetics)**

Nº of hours: 48

University: Universidad de Valencia (Spain)

Key: T

School year: 1997-1998

Subject: **Técnicas de Análisis Genético (Genetic Analysis Techniques)**

Nº of hours: 90

University: Universidad de Valencia (Spain)

Key: A

Course: Advances in Genome Technologies and Bioinformatics 2003

Subject: **Perl for bioinformatics**

Institution: Marine Biological Laboratory (Woods Hole, MA, USA)

Key: T

REVIEWER FOR INTERNATIONAL JOURNALS AND ENTITIES

Natural Environmental research council- Research grant assessment 2002
Molecular Phylogenetics & Evolution
Genome Biology
Marine Ecology
Aquatic Ecology

DEPARTMENT AND UNIVERSITY CONTRIBUTIONS

Responsible of the laboratory for two years at Departamento de Genética Universidad de Valencia 1995-1996

Responsible of forming undergraduate students at the laboratory during my PhD

Member of the Universidad de Valencia committees:

- Comisión de Extensión Universitaria y Medio Ambiente of the Biology Faculty from 1993 to 1997
 - Comisión de Contratación del Departamento Bioquímica i Biología Molecular in 1995
-

PROFESSIONAL CONTRIBUTION OUTSIDE UNIVERSITY

Scientific congresses organization, seminars, etc

Title: I Congreso de la Sociedad Española de Genética

Work: **Organizing committee** As: fellow FPI (Formación de Personal Investigador, Research Staff Education)

Year: 11-13th September 1998

HARDWARE, SOFTWARE AND LAB TECHNIQUES AND EQUIPMENT EXPERIENCE

-Platforms with the following operating systems:

Open VMS, Solaris, UNIX, LINUX, MS-DOS
Mac OS 9.0 and OS X (my favorite!)
Windows Millenium and XP

-Programming experience in the following languages:

Cobol
Basic
HTML
Unix Shell
Perl
Relational databases (Access and MySQL)

-Software experience:

Molecular Biology and Data Analysis:

Sequence analysis: GCG, Sequencher, CONSED, PHRED, PHRAP, and customized Perl scripts

Sequence Alignment: MUSCLE, ARB, ClustalW and ClustalX

Genotype analysis: GeneScan, Genotyper

Phylogenetic analysis: Mega, PHYLIP, PAUP, McClade, Model Test, MrBayes

Database search: BLAST, SEARS, Pfam and HMM, in conjunction with customized Perl scripts

Statistical analysis: NTSYS, SPSS, JMP SAS, CANOCO

Ofimatics:

Word, Excel, PowerPoint...

Web page design:

Macromedia dreamweaver

Database management:

File manager

Image and Drawing:

Adobe Photoshop, Nikon Capture, Adobe Illustrator

Network access:

WWW browsers: Internet Explorer, Netscape

Transfer/Connection protocols: ftp, scp, fetch / Telnet, ssh

Communications: E-mail, NetMeeting, Webex

-Molecular biology techniques:

Restriction enzyme digestion and mapping

DNA amplification through PCR

Genomic, virus, and plasmid DNA extractions

Large molecular weight genomic DNA extractions

Vacuum plasmid DNA extractions

Genomic library construction using BAC, phage and plasmid vectors

Microbiological techniques for bacteria and phages

Hybridization techniques through non-radioactive methods

SARST-V6, SSCP, DGGE, RAPD, AFLP, RFLP and microsatellites genetic markers

Manual radioactive DNA sequencing

Automatic fluorescence DNA sequencing

Fluorescence In Situ Hybridization (FISH) and CARD-FISH

-Laboratory equipment:

Applied Biosystems 3730, 3700, 373 and 377 and Beckman CEQ capillary automated DNA sequencers

TECAN Miniprep 75 for high-throughput robotic productions

Ultracentrifuges and microcentrifuges

PCR thermocyclers and robocyclers

Conventional electrophoresis

Pulse Field Gel Electrophoresis

Spectrophotometer and spectrofluorimeter

Binoculars and basic microscopes

Cryotome

Epifluorescence microscopy

Anaerobic chamber