



## EU Network of Excellence



Marine Genomics Europe brings genomics into marine biology

- Scientific goals and research activities
- Strengthen and integrate the community of Marine biologists for structuring the European Research Area (ERA)

<http://www.marine-genomics-europe.org>

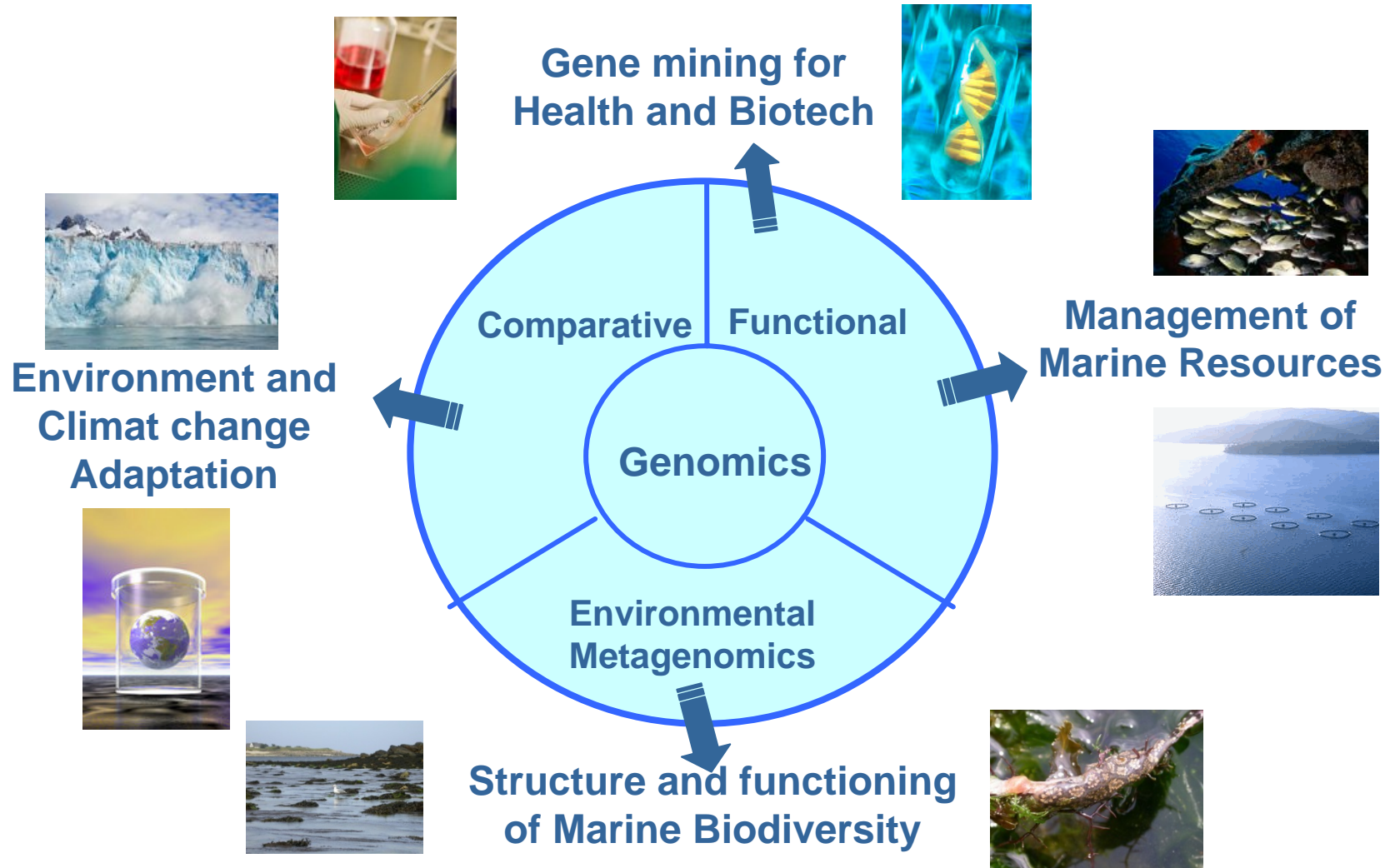


**Genomics is a key discipline  
of Marine Systems Biology**

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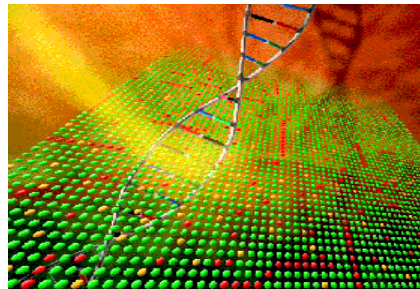
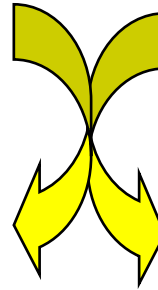
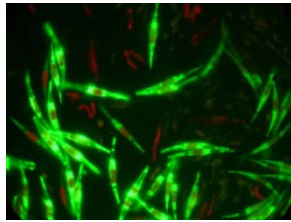
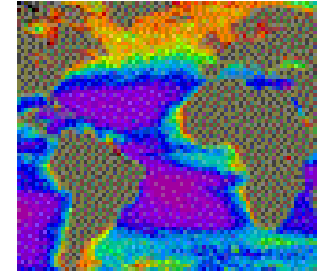
**Understanding the function of  
marine systems through  
interactions of different  
levels of organization**

# The Science of Genomics applied to the Marine Life



Marine genomics allows to draw **global conclusions** about our surrounding environment and takes a **holistic approach** to ocean management.

**Marine Genomics Europe** brings together scientists investigating a wide range of questions related to the biology of marine organisms as well as to the functioning of marine ecosystems

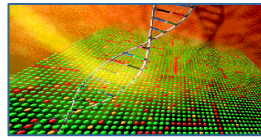


- To **assemble a critical mass** essential to achieve large scale genomic (and post-genomic) projects
- To **expand our expertise**
- To use **genomic tools** for studying **model organisms** and for exploring **marine ecosystems**

Management  
Scientific Steering Committee



Research



Integration



Spreading

Biological Model

Comparative Genomics

Transcriptomics

Training

Scientific Community

Ecological Model

Functional Genomics

Proteomics

Workshop

Companies

Economical Model

Environmental Genomics

Sequencing / Genotyping

Teaching

Policy Makers

Virtual Laboratory

Bioinformatics Platforms

Knowledge Management System

Knowledge portfolio, for various end-users

Society

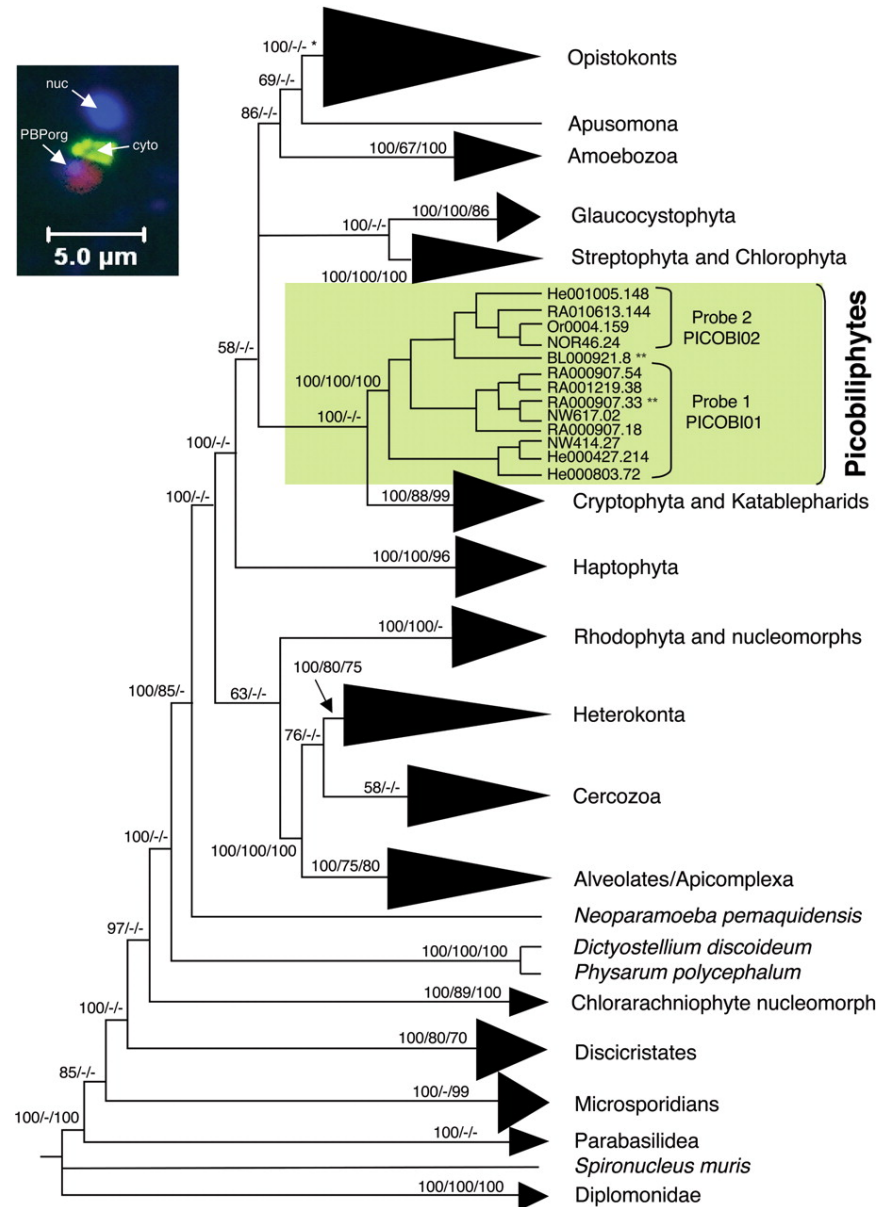
Gender Issues

One example...

Environmental sequencing has recently led to the discovery of a new major eukaryotic photosynthetic group from in various samples collected in the North Atlantic :  
**the Picobiliphytes**  
 a new algal phylum

Picobiliphytes are unicellular, slightly oblong, and approximately 2 μm

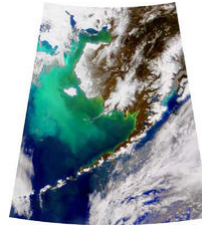
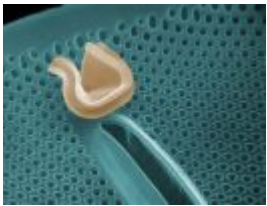
**Not et al . Science 12 January 2007:**  
 Vol. 315, no. 5, 809, pp. 253 - 255



# WHAT IS THE ADDED VALUE OF MARINE GENOMICS?

## The Ocean provides opportunities for Human health and for Innovative Technologies:

- Pathogens: seaborne infections (cholerae), harmful algal blooms
- Marine models for human health: for functioning of human body and enhance medical research
- Forensics and DNA-based traceability
- Bio-prospecting: exploring the potential of Marine biodiversity
- Marine biotechnology: discovery of new enzymes and bioactive compounds from stressed and extreme environments



## The Oceans provide a social and cultural space:

- MG contributes to the understanding, exploitation and management of the oceans.
- To the monitoring of anthropogenic impact on the blue planet
- To the detection and monitoring of alien invasive species
- To the monitoring of overfishing (quotas and by catch)
- To the monitoring of the effect of global change on ecosystem functioning

## The Oceans as a natural heritage

- The Oceans are the cradle of life and the long evolution has generated a wealth of biodiversity. MG helps in building the Tree of life which describes the relationships of all living organisms in an evolutionary context
- Genomics is a key tool in assessing the diversity, importance and functioning of the marine microbial organisms which are the drivers of the global biological pump (carbon and oxygen cycle)
- Marine Metagenomics has enabled us to start reconstructing the function of microbial communities in CO<sub>2</sub> sequestration, ocean dynamics and acidity. Discoveries: novel biochemical pathways, new biotech applications.

## The Oceans as a unique laboratory for basic research

The Oceans provide unique opportunities to carry out research investigations of numerous ecosystems, organisms and populations.

→ better understanding of the fundamentals of life

Cell biology, evolutionary & developmental biology, marine ecosystems and population structures, community ecology





# Marine Genomics and Biodiversity

- High throughput tools for rapid screening (sequencing and genotyping, microarrays as biosensors of biodiversity, etc)
- Discovering and exploring new biodiversity
- Metagenomics approaches and cyber-infrastructures
- Genomics approach for discovering the dark matter of the oceans
- Building the tree of life
- Population genomics for better predicting endangered biodiversity and help in designing protective measures
- Understanding the processes of species invasions

# An Agenda for Genomic Knowledge about the Oceans in 2010

1- Establishment of marine model systems

2- Exploitation of large metagenomics datasets

3- Increase genome sequencing for marine organisms and ecosystems

4- Develop integrated science and multidisciplinary approaches

5- Develop remote sensing stations

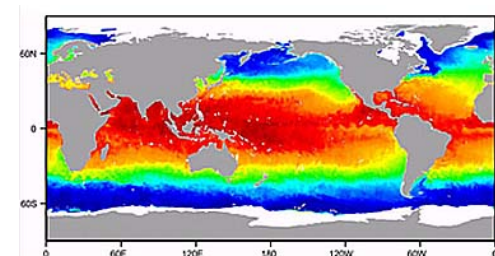
6- Promote education and training

7- Support the development of bio-prospecting infrastructures

8- Improve data and information management

9- Reach and maintain a critical mass of researchers

10- Foster and support Science mediation



# Long term integration – beyond MGE FP6 contract

## 1- Scientific Coordination and Education Program

- Coordination of activities (workshops, web site)
  - Cement and foster the MGE community
- Perpetuate the teaching and Education programme
  - International PhD programme

## 2 – Support to Common Infrastructures and Common Databases

- Development and coordination of access to Infrastructures
  - European Marine Biological Resources centres (ASSEMBLE II)
  - High throughput technological Platforms
  - Databases maintenance

## 3- Support Joint Research Programmes via transnational joint Calls

## Acknowledgments

The European Commission  
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FP6



All my colleagues from Marine Genomics Europe



Thank you for your attention

# The challenge: Understanding the complexity of the marine environment

Integration of multiple levels of data

From reductionism to holism

Evolutionary process

Merging multidisciplinary approaches

Understanding of Interactions

Combining different scales

The Omics approaches

Genomics

Transcriptomics

Proteomics

Metabolomics

.../...

Statistics & Computational sciences

Bioinformatics

Prognostic Modeling

New testable hypothesis

Chemist

Ecologist

Biologist

Physicist

Oceanographer

Geographer

Geologist

Meteorologist

Find a common language!

New disciplines: chemical ecology, community genomics, population genomics

The Marine Ecotron



Remote observation systems



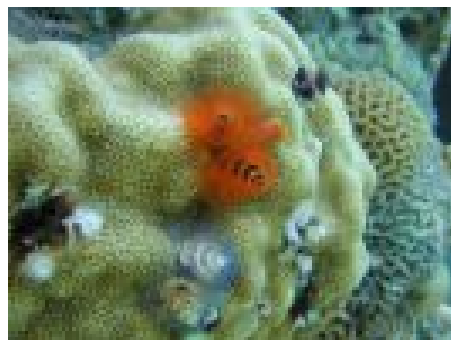
Ecotrons/mesocosms

# WHAT ARE THE MAIN CHALLENGES/NEEDS FOR THE FUTURE?

The real impact of marine genomic research on society will be impressive

- Better understanding of marine ecosystems functions
- Management of marine activities and sustainable exploitation of natural resources
- Measuring, monitoring, understanding and predicting the mechanisms of ocean-atmosphere feedbacks in climate change and their impact on the larger ocean environment

**This requires the address of a number of key issues  
grouped in ten actions recommendations**



**Position paper**

**“The European Flagship in Marine Sciences for a Sustainable Future”**