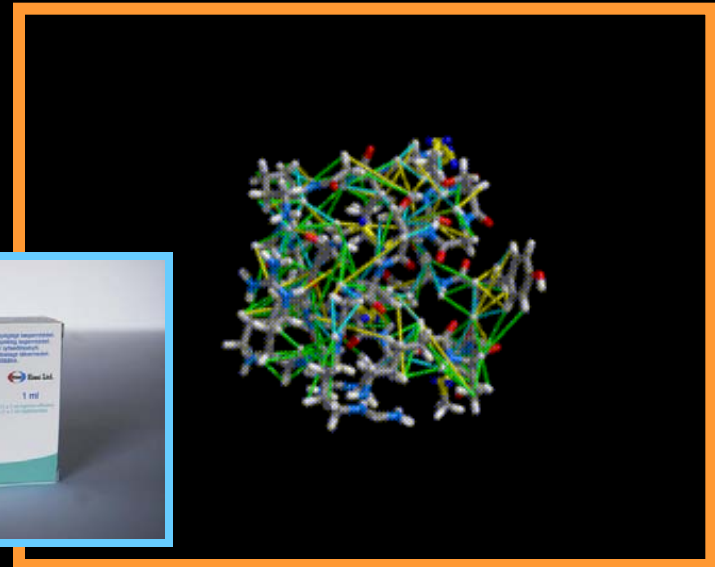
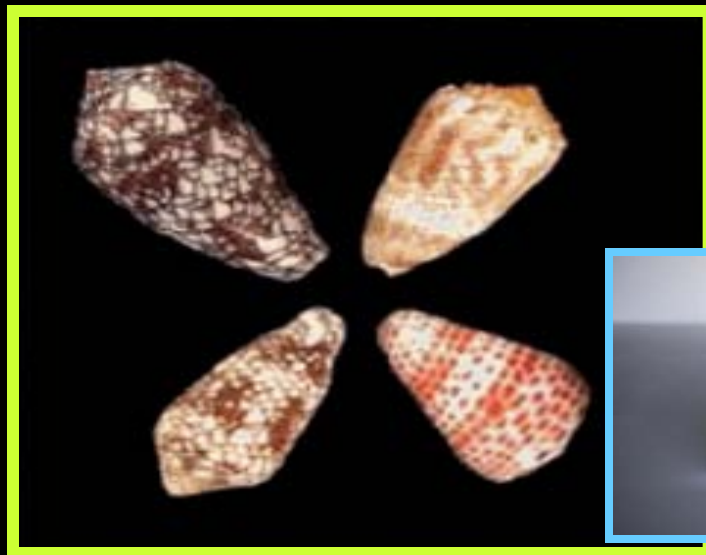


Blue Biotechnology for Europe: **Challenges and Opportunities for Industry and Society**

- *The use of organisms or their components to provide goods and services*
- *Application of cutting-edge molecular or genomic biological techniques whereby molecular or genetic material is manipulated to achieve a desired goal.*



Historical development of biotechnology

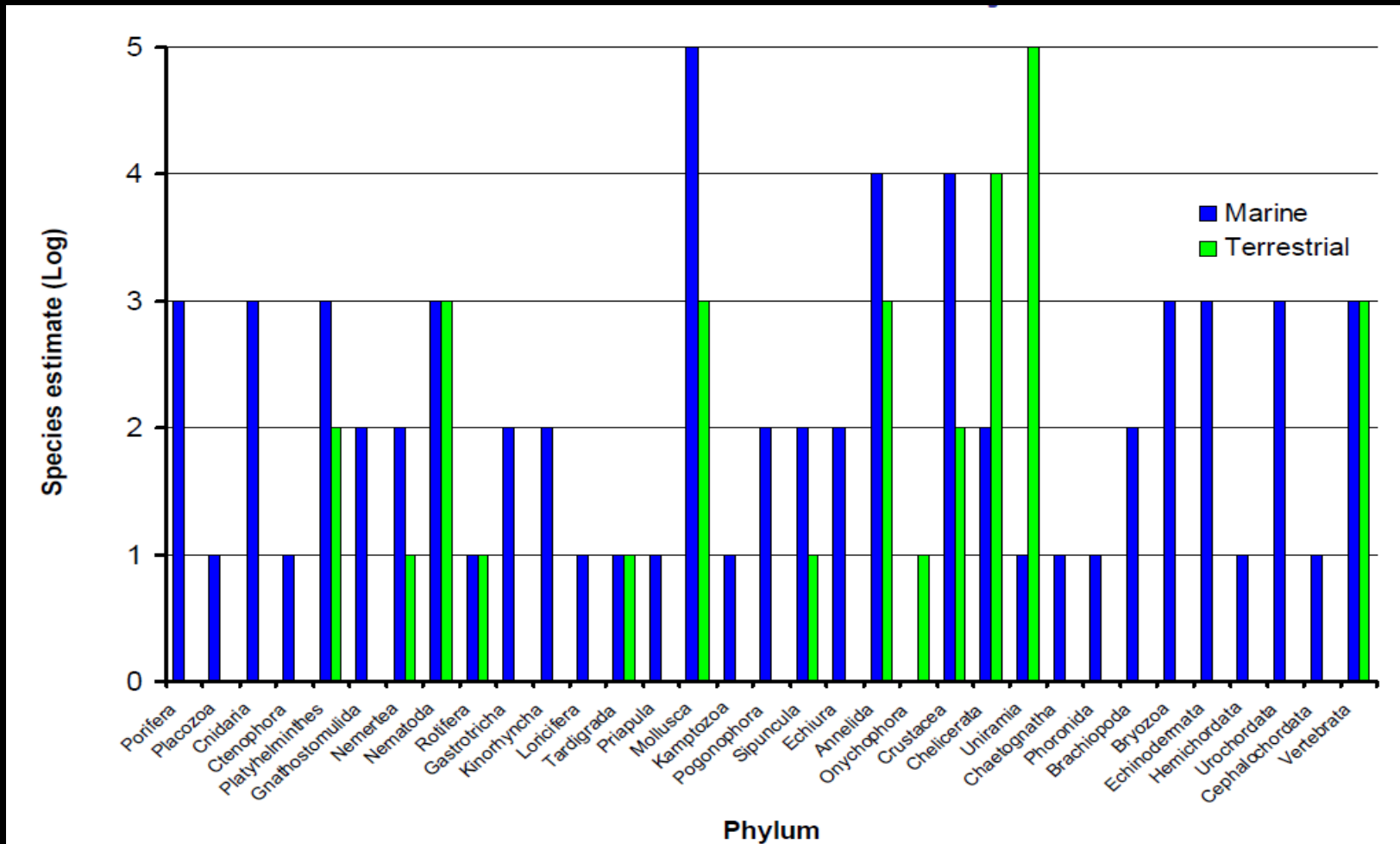
- Babylonians were drinking beer by 6000B.C.
- Egyptians were baking leavened bread by 4000 BC
- Wine was known in the Near East by the time the book of Genesis was written
- In ancient Rome, togas dyed purple were imperial symbols.
- Pasteur- the father of modern biotechnology- demonstrated the fermentative ability of microorganisms between 1857 and 1876
- The new biotechnology revolution began in the 1970 and early 1980s when scientists learned to precisely alter the genetic constitution of living organisms beyond traditional breeding practices



Murex trunculus



Marine biodiversity vs terrestrial



Does not include the even greater microbial diversity (Bacteria, Archaea, viruses)

Batteshill/Jaspars (2009)



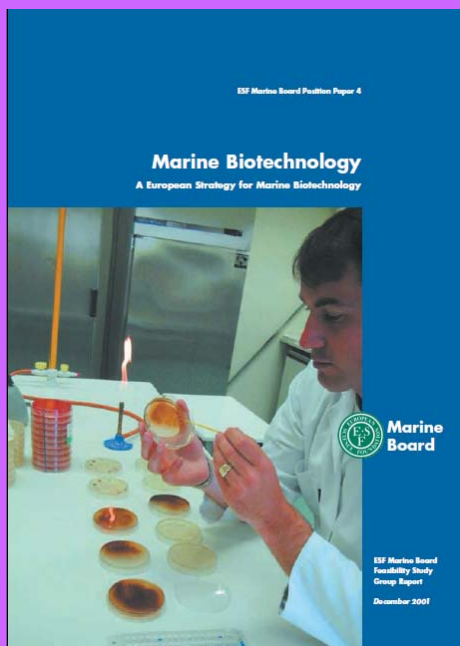
State of the Art

- *Global market currently €2.8 billion (2010)*
- *Annual growth predicted at 4-5%*
- *Successes:*
 - *Anticancer drugs*
 - *Food and feed (PUFAs/antioxidants/immunostimulants)*
 - *Cosmetics*
 - *Microbial enhanced oil recovery*
 - *Enzymes (PCR/SAP/GFP/antifreeze)*
 - *Biomaterials (chitin/silica/polymers)*

**Chaired by: Joel Querellou
(Ifremer)**

**Marine Board (Jan-Bart
Calewaert)**

**14 experts in marine bio-
engineering, aquaculture,
chemical ecology, natural
products chemistry, "omics"
technologies, bio-informatics,
etc.**



EUROPEAN SCIENCE FOUNDATION
SETTING SCIENCE AGENDAS FOR EUROPE

COST
MARINE BOARD

During the last decade, the scientific and political landscape of marine biotechnology has been deeply modified. Despite significant achievements, marine biotechnology is not contributing to its full potential in addressing the numerous challenges European countries are facing now with the present global crisis. How marine biotechnology can contribute to these challenges is therefore an even more relevant question nowadays than ten years ago.

The Marine Board ESF and COST are organizing a conference to provide scientific excellence in marine biotechnology by providing leading scientists and young researchers with a platform to present their work, to discuss current scientific understanding and recent developments in key areas of marine biotechnology, and to identify the priorities for further research and infrastructure.

The Conference will draw from a broad range of scientific disciplines focusing on identified themes, research tools and approaches of strategic importance for Europe, including on aquaculture, bioprospecting, algae and seaweed biomass, health, marine biotechnology and biomaterials, marine models, marine genomics, oceanomics and research infrastructure. The emphasis of the Conference is on innovation and vision for the future of marine biotechnology in Europe, moving from exploitation to sustainability.

Conference format:

- lectures by invited high level speakers
- short talks by young & early stage researchers
- poster sessions, round table and open discussion periods
- focused but general discussion about future developments

The conference will be held at Hotel Villa del Mare in Acquafredda di Maratea. Acquafredda di Maratea is situated on the coast, on the Gulf of Taranto, about 200 km south of Naples.

RESEARCH CONFERENCES

ESF-COST High-Level Research Conference

**Marine Biotechnology:
Future Challenges**

Hotel Villa del Mare, Acquafredda di Maratea • Italy
20-26 June 2010

Chair: **Jan Olsen** - University of Tromsø, NO
Vice-Chair: **Adrianna Iannone** - Stazione Zoologica Anton Dohrn, IT

Organizing Committee:
Jan-Bart Calewaert - Marine Board-ESF, BE, **Amos Tandler** - Institut Océanographique et Limnologique Research, IL

Application Form & Programme available from
www.esf.org/conferences/10330
Closing Date for Application: **28 February 2010** noon

www.esf.org

Scope and Aim:

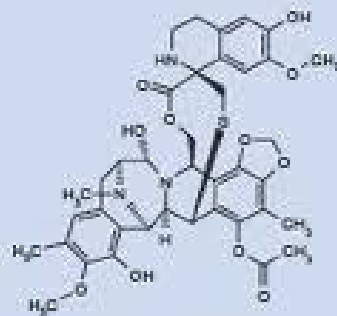
- (i) analyse the main achievements of Europe in Marine Biotechnology**
- (ii) identify future R&D needs and update the European vision/strategy for marine biotechnology.**
- (iii) propose recommendations for actions.**



Yondelis® (trabectedin)



1. Health



Trabectedin



Marine Drugs in Clinical Trials.

Cancer

Drug-like Molecule

MoA	Compound	Source	Company	Reference
Oxidative stress Inducer	Aplidin®	Mediterranean Ascidian	PharmaMar	Moneo et al., (2007) Mol Cancer Ther
Lysosome disturbing	Kahaladide F	Sea Slug/ Alga /Bacteria	PharmaMar	Gracia et al., (2006) J Org Chem
Protein C Kinase Inhibitor	Bryostatin-1	Bryozoan/ Symbiont	NCI/ Bristol Myers	Wang et al., (1998) Biochem Pharmacol
Proteasome Inhibitor	Salinosporamide A	Marine Bacteria	Nereus	Fenical & Jensen (2006) Nat Chem Biol
Microtubule Interfering agents	Dolastatin 10 Discodermolide Halichondrins	Sea Slug Sponge Sponge	NCI/ Knoll Novartis Eisai	Jordan et al., (2005) Mol Cancer Ther

... and 12 more compounds....

colonial tunicate

Ecteinascidia turbinata



Fernando de la Calle PharmaMar, SPAIN

Other applications for natural products

Neutraceuticals and Cosmeceuticals

- as nutritional supplements including color additives and antioxidants
- vitamins, oils, and cofactors which enhance general well-being
- The carotenoid market alone is projected to reach 77,000 million Euro by 2010

astaxanthin



Dunaliella salina



fucoxanthin



2. Improve aquaculture production

Marine aquaculture is one of the fastest growing sectors in “agriculture”

- areas closed to commercial fishing***
- increased demand to supply food and high quality wholesome products***

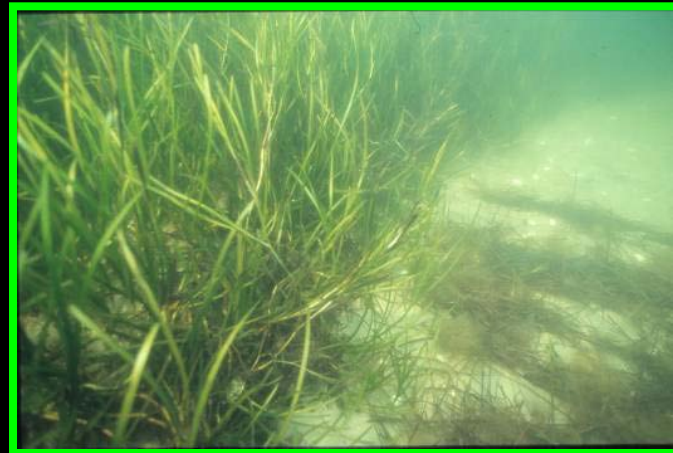
In 2007 the EU-27 production of aquaculture increased to nearly 1 306 thousand tonnes (+ 6.3 %) with Iceland and Norway increasing their aquaculture production by 56 %



3. Probing the marine environment

Biotechnology has contributed to marine research in many ways:

- 1. Bioremediation after major oil spills**
- 2. Monitoring toxic blooms**
- 3. Restoration of certain habitats**
- 4. Identifying the country of origin of endangered species (forensic biotech)**



4. Energy

Alternatives to fossil fuels may be photosynthetically generated biomass:



1. Microalgae (e.g. Chlorella) are renewable and there is no damage to the environment. Unfortunately, biomass is not economically competitive with current sources of energy.

2. Biomass can be converted by bacteria and microalgae to fuels such as methane and biodiesel

3. Biotechnology may make biomass more viable by enhancing photosynthesis to produce more of a fuel, or modifying biomass to favor fuel production.



Vision for the future

By 2020 European Union will develop and apply advanced tools, platforms and infrastructures to support Marine Biotechnology in order to address key societal challenges in the next decade in the areas of food and energy, development of novel drugs and the sustainable use and management of the seas and oceans.



Grand Challenges

Many issues must be resolved before Blue Biotechnology in the EU can realise its full potential:

- **Access to resources (especially) very deep specimens**
- **Increased understanding of physiology of marine species**
- **Culturing marine microorganisms**
- **Sustainable aquaculture of algae, fish, and shellfish for food, fuels and high value products and processes.**
- **New policies for the protection of marine genetic resources**



Strategy and recommendations:



(1) Create a strong identity and communication strategy to raise the profile and awareness of European marine biotechnology research

how?

Create a central European portal

www.marinebiotech.eu

(2) Stimulate the development of research strategies and programmes for marine biotechnology research at the national, regional and pan-European level

how?

Create a European Marine Biotechnology Institute or Centre

Strategy and recommendations



(3) Improve technology transfer and strengthen the basis for proactive interaction between academic research and industry

how? *Develop a common European position on regulations for access benefit sharing and exploitation of marine genetic resources*

(4) Improve training and education to support marine biotechnology in Europe

how? *Create a European School on Marine Biotechnology (virtual or distributed) and a PhD programme both including business and entrepreneurship training*

Concluding remarks:

Implementing the Strategy

In Europe we are very good at making strategies and plans for the future

We are now at a crucial time where the conditions are as such (infrastructures, capabilities in molecular biology and bioinformatics, ...) that a decisive support via a well developed strategy will allow European marine biotechnology research to make giant leaps forward

If Europe does not act now by increasing its support through focussed funding and coordinated research, it will further lag behind in comparison to other leaders in this field such as the USA, Japan, China etc. – especially Asian countries such as China and India that are investing heavily in marine biotechnology

There is a time for assessing and discussing, there is a time to make plans for the future and there is a time for action and that time is now



EuroOCEAN
2010



Thank you for your attention