Blue BIO COFUND

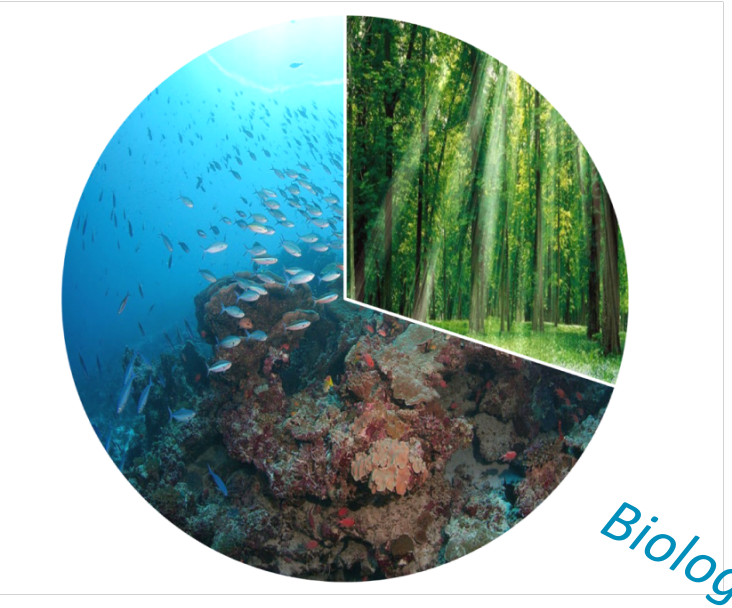
blueMed Research and Innovation for blue jobs and growth in the Mediterranean Area

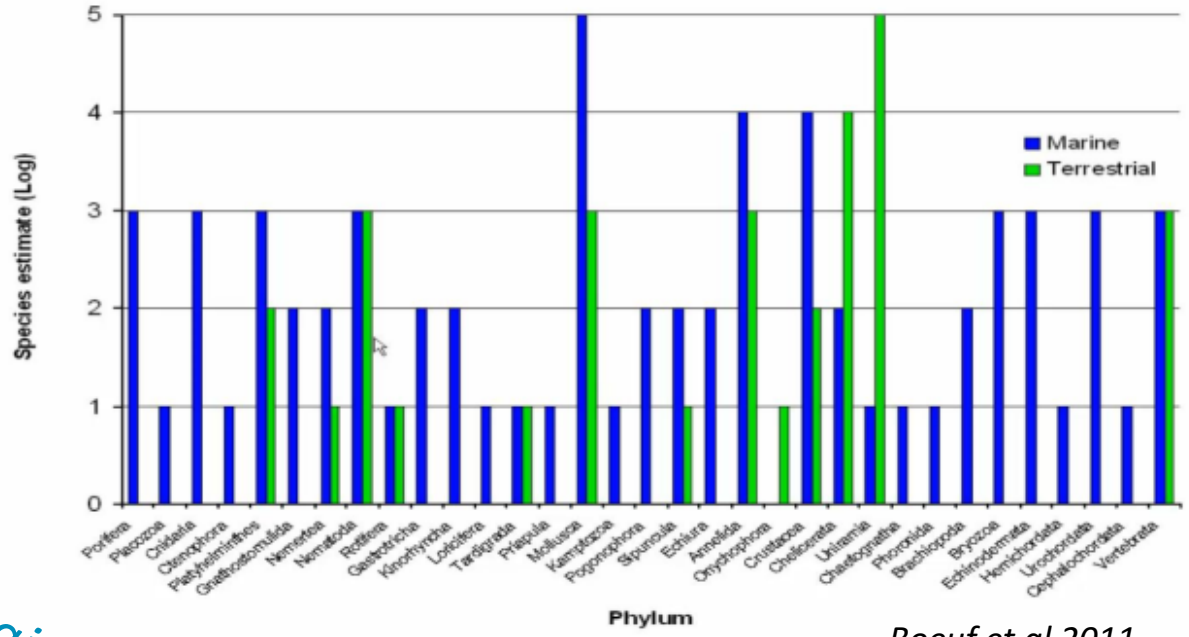
Marine bioresources, biodiversity, bioproducts, biomaterials, services

Renata Denaro

Integrated advanced training on blue biotechnology aquatic products and blue bioeconomy

Why Blue





Boeuf et al 2011

Biological diversity =chemical diversity= functional diversity

Oceans

- provide of high quality of living (food) and non-living resources (minerals)
- are source of sustainable energy,
- buffer large amounts of carbon dioxide and offer other ecosystem services
- sustain maritime activities securing economy and jobs.

Blue biotechnology and Blue Bioeconomy

- Primary and secondary industries
- Services

Blue biotechnology is concerned with the exploration and exploitation of the marine organisms in order to develop new products.

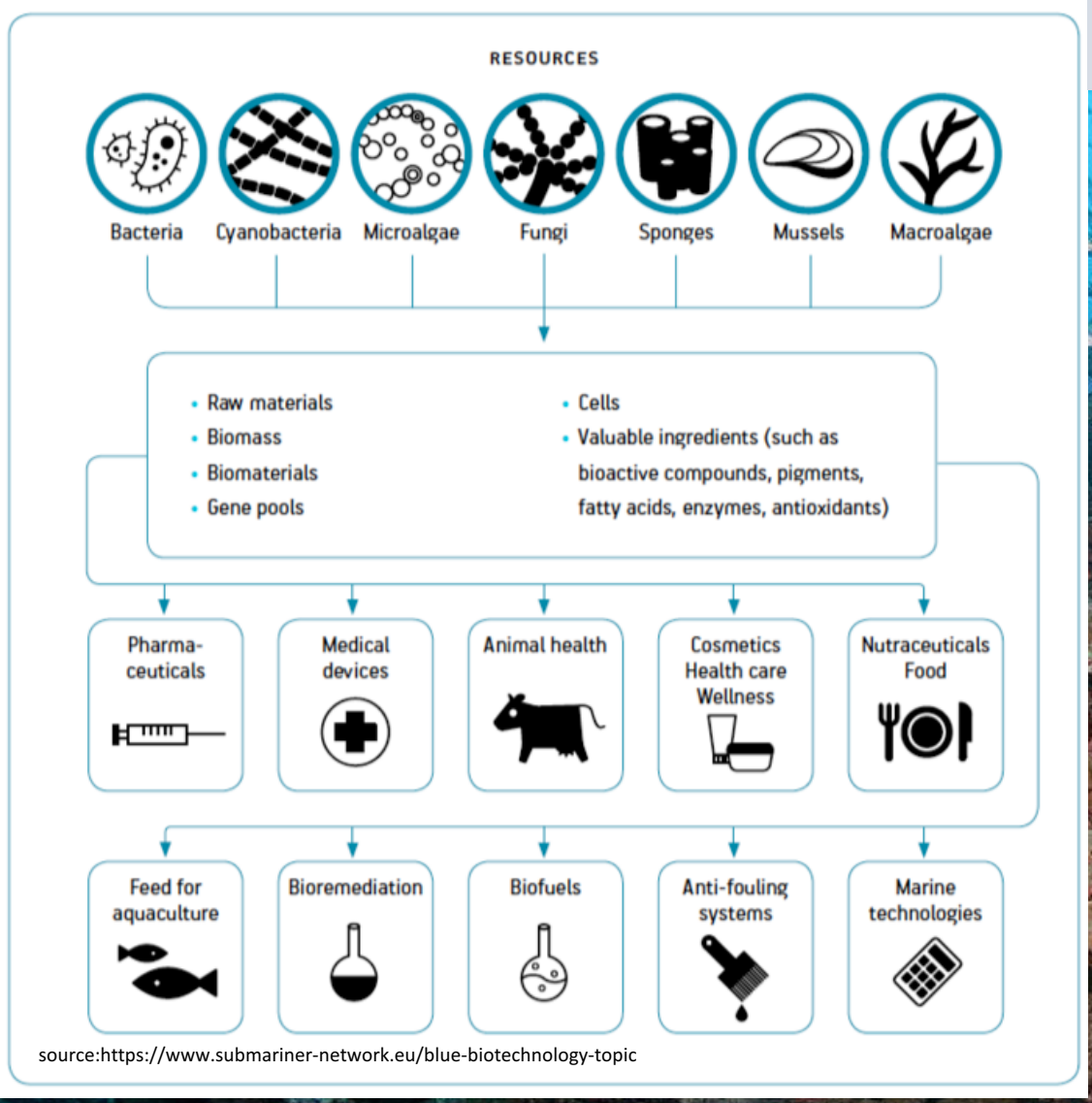
COM(2012) 494 final

Blue bioeconomy, is intended any economic activity associated with the use of renewable aquatic biological resources to make products.

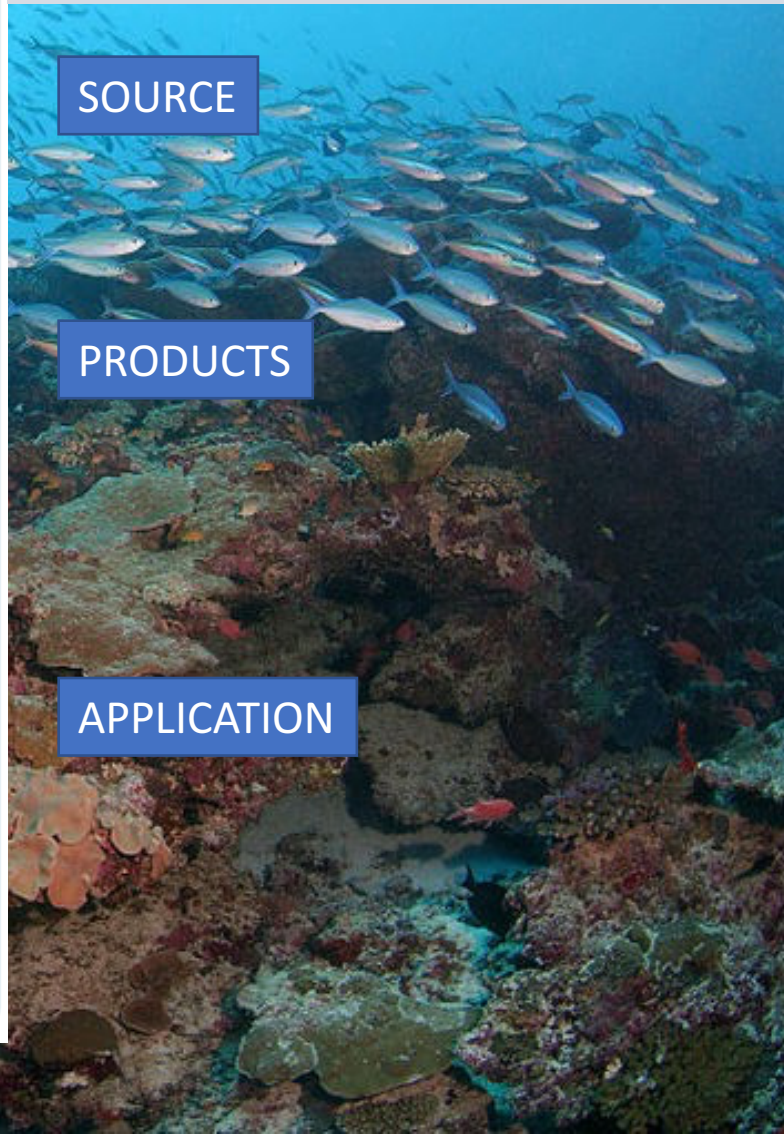
www.eumofa.eu

BIOINSPIRED SOLUTIONS

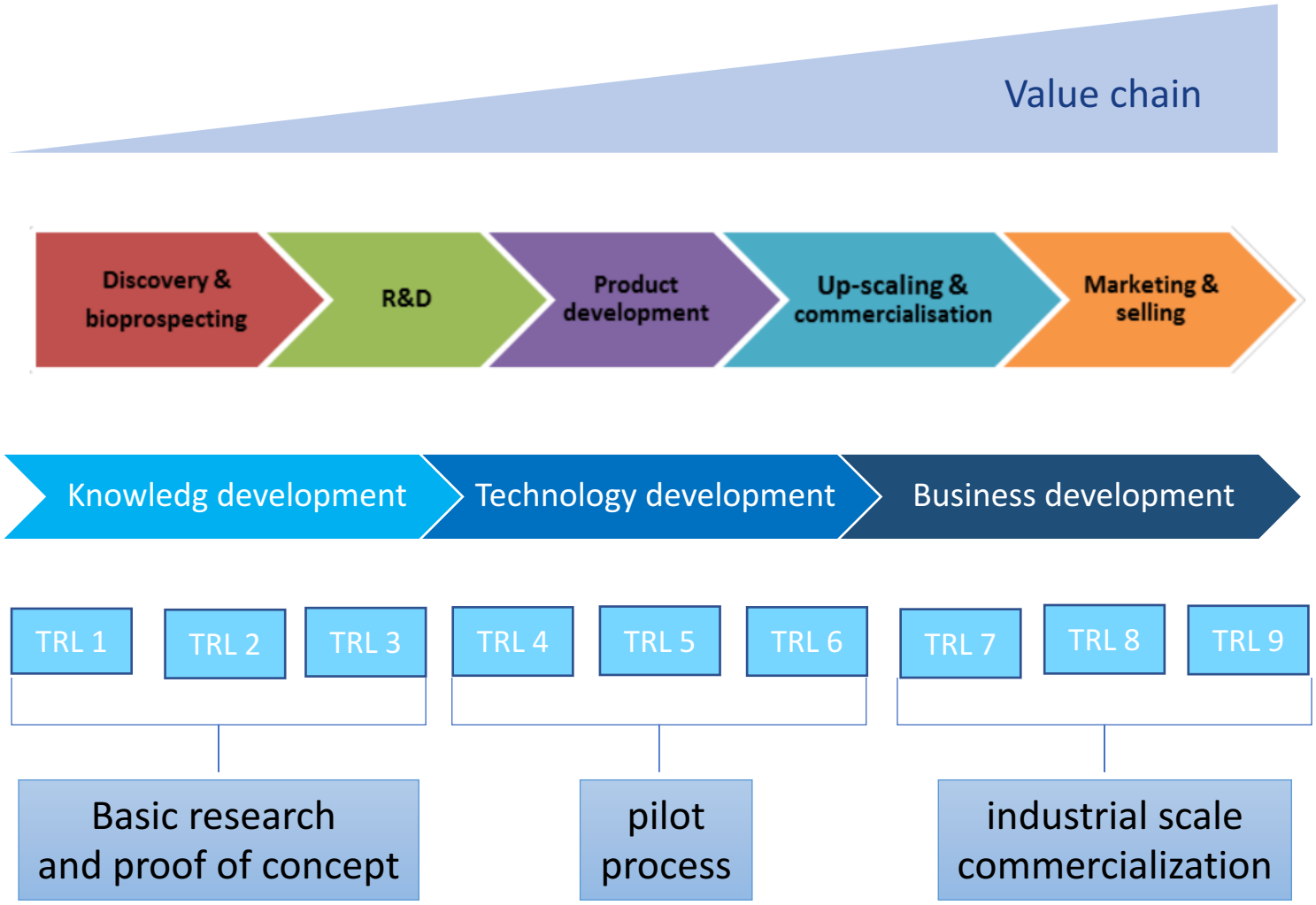
The global market for marine biotechnology has the potential to reach $6.4 billion by 2025 (Hurst, D. et al. 2016)



source:https://www.submariner-network.eu/blue-biotechnology-topic



THE VALUE OF THE DISCOVERY



Success stories

and

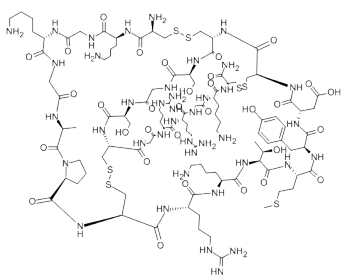
unfinished stories

Benefits from the sea: *Pharmaceuticals*

Market

Conus magus Olivera et al. 2015

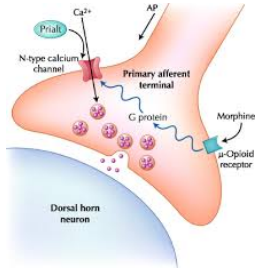
ω-conotoxin



Terneus 2007

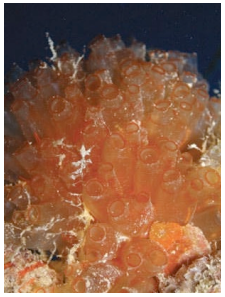
ziconotide (synthetic)

PRIALT® is a registered trademark of TerSera Therapeutics LLC

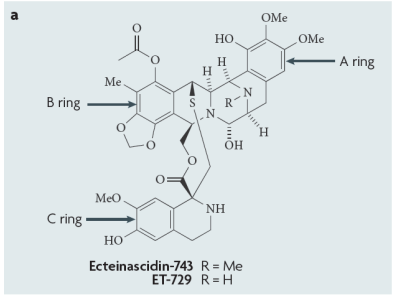


Schmidtko et al. The Lancet 2010

Market



Ecteinascidia turbinata

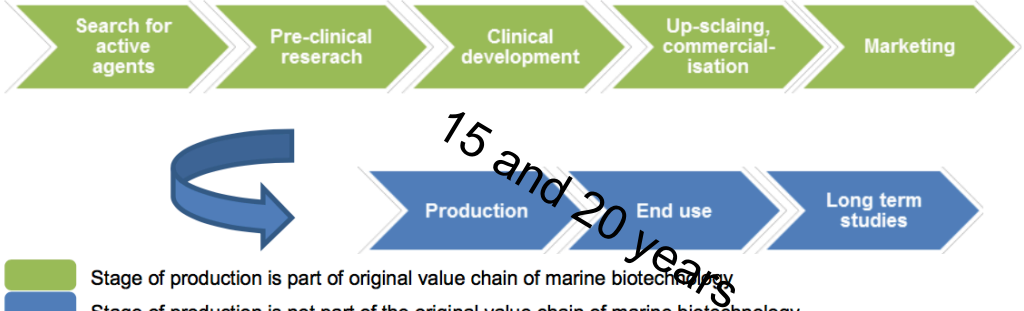


Chu et al. 2010

Zeltia e Johnson & Johnson

sales
$ 60million
2010

Value chain pharmaceutical from marine bioresources



Very long time efforts

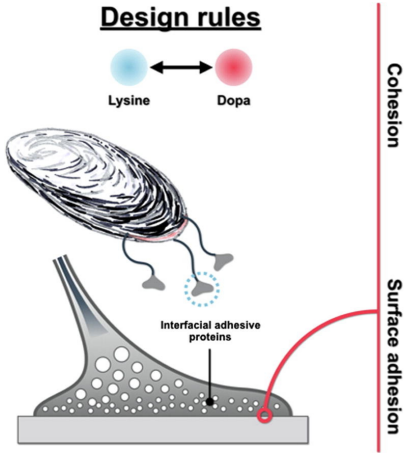
- time and cost
- harvesting the organism
- low production
- tricky isolation purification procedures
- ecological impact
- insufficient investment

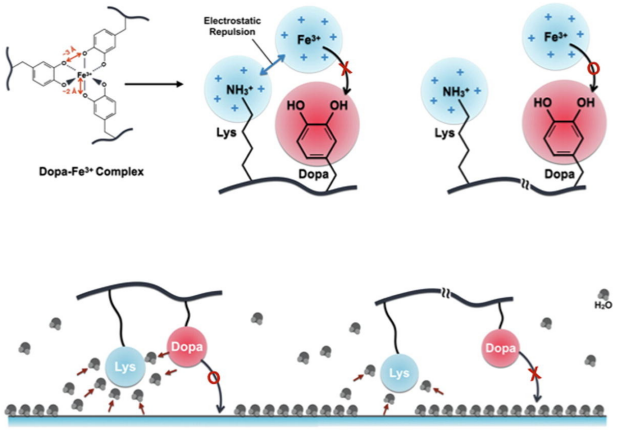
world market for pharmaceuticals, is expected to $1.3 trillion by 2022

Benefits from the sea: *Biomaterials*

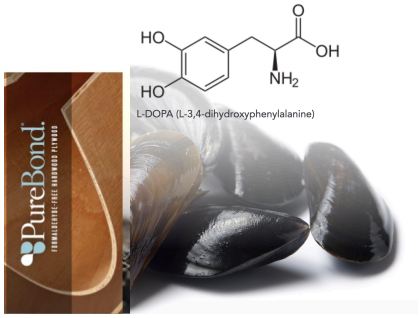
The global biomaterials market size is projected to reach USD 47.5 billion by 2025

Bioinspired adhesive formaldehyde-free





Shin et al 2020

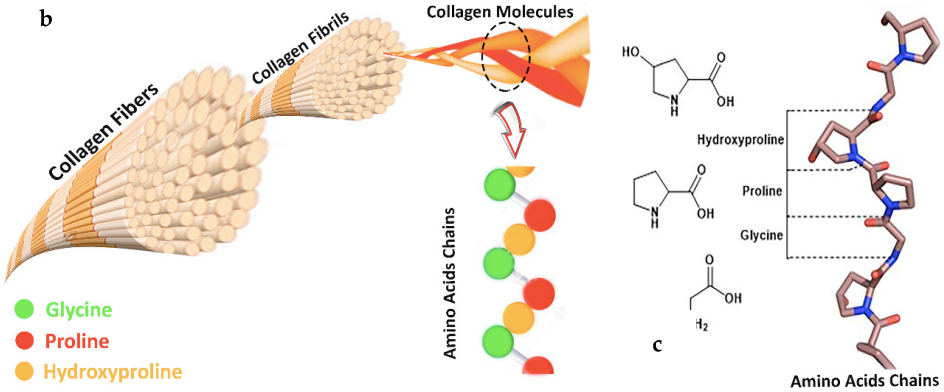


Biomimicry

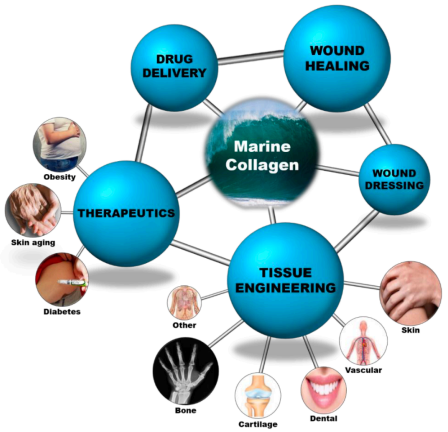
Collagen

Source: fish, seaweeds, sponges, and jellyfish → waste valorization

water-soluble, safe, resistant, biocompatible, biodegradable, versatile, high yield, low cost



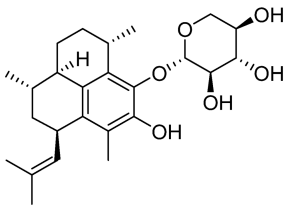
Jafari et al. 2020



Lim et al. 2019

Benefits from the sea: *Cosmetics*

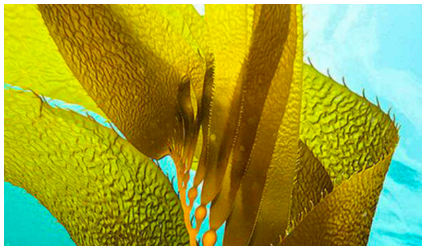
Pseudopterogorgia elisabethae



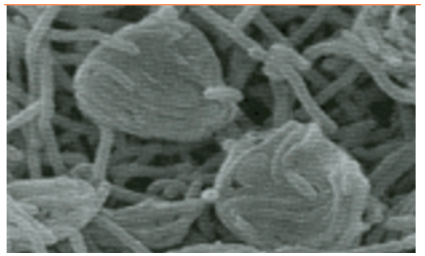
PsA

pseudopterosin

cosmetics industry (valued at $231 billion in 2005)



Durvillea antarctica



Thermus thermophilus

Cocktail antioxidant enzymes

Marine Bacteria and Biotech the renewable bioresource

In 8L of seawater there are as many bacteria as people on the earth and they preserve a huge amount of genetic information for the most part underexplored

PROCESSES

- Waste treatment
- Bioremediation
- Biobleaching
- Bioleaching
- Biofiltration
- Biocatalyses

http://www.oceansatlas.org

PRODUCTS

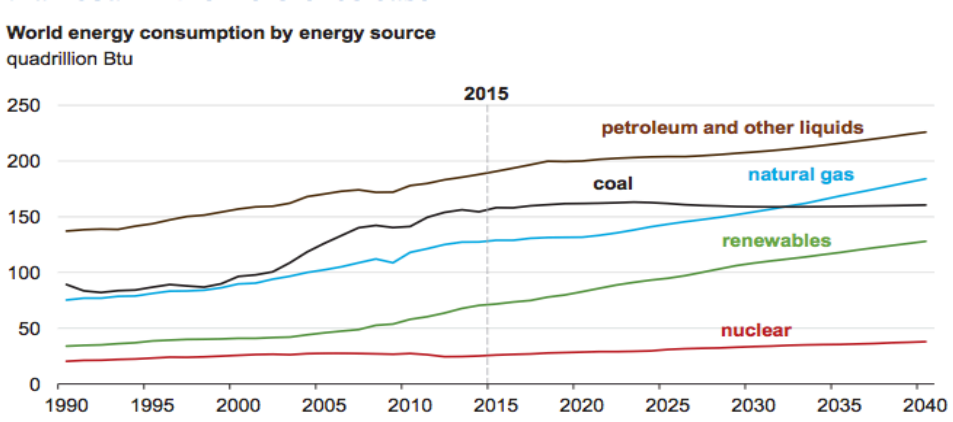
- Enzymes
- Food additives
- PAH
- Antibiotics
- Toxins
- Antifouling agents
- Biosensors
- Fungicides

From A. Kuo and G.M.Garrity 2002 Exploiting Microbial Diversity,
In Biodiversity of Microbial Life, J.T. Staley and A-L Reysenbach, ed, John Wiley

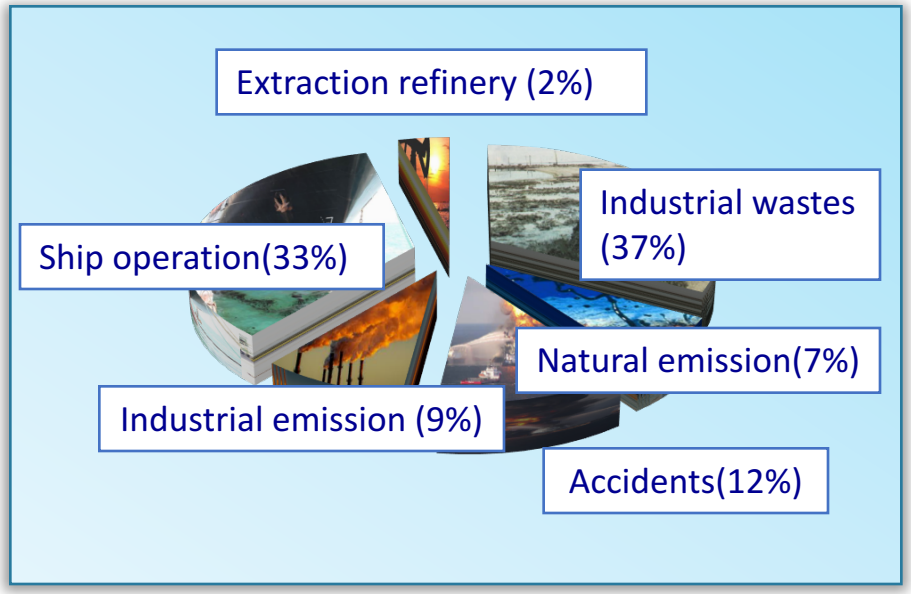
Benefits from the sea: Services

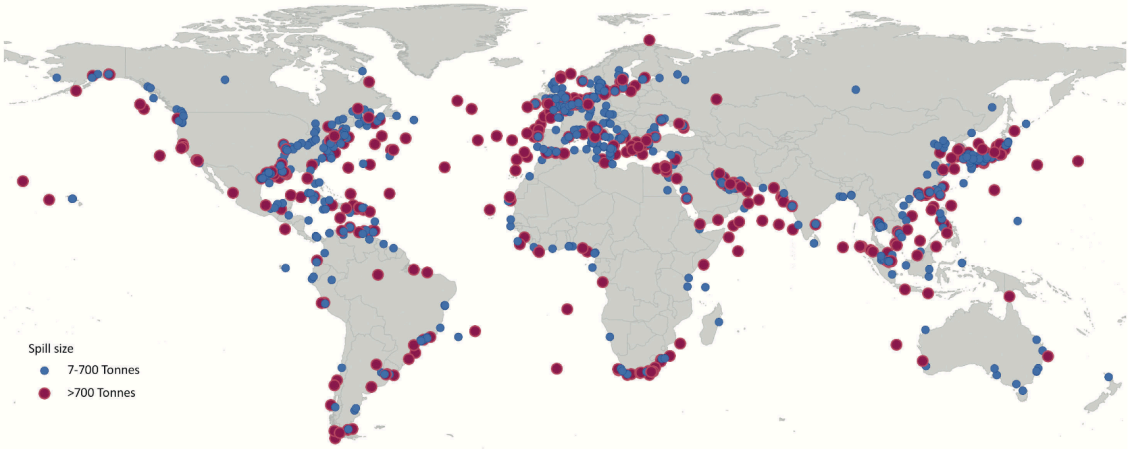
Bioremediation:
processes that use natural occurring microorganisms to either restore or clean-up contaminated sites.

Petroleum a global issue



2040 petroleum, one of the most utilized energy source in the world (IOE 2016)





- BIODIVERSITY
- FISHERY AND AQUACULTURE
- HUMAN AND ANIMAL HEALTH
- MARINE INDUSTRIES
- RECREATIONAL ACTIVITIES
- CULTURAL AND NATURAL BENEFITS

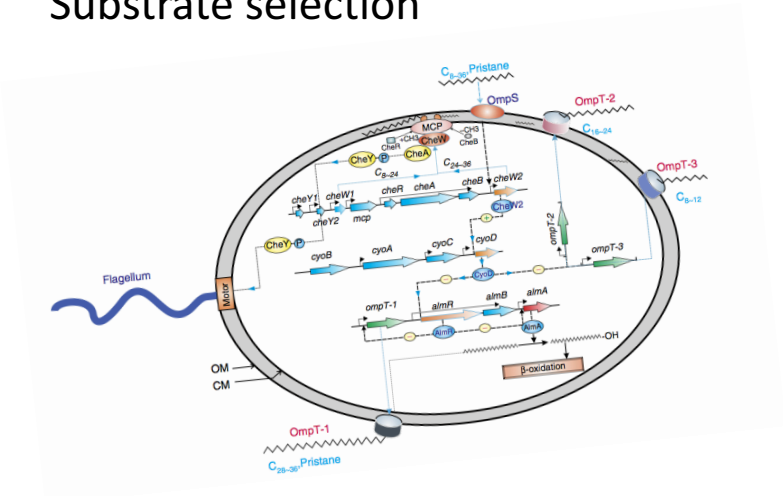
Over the last 50 years, the frequency of spills greater than 7 tonnes per year decreased by over 90 percent.

(ITOPF 2020)

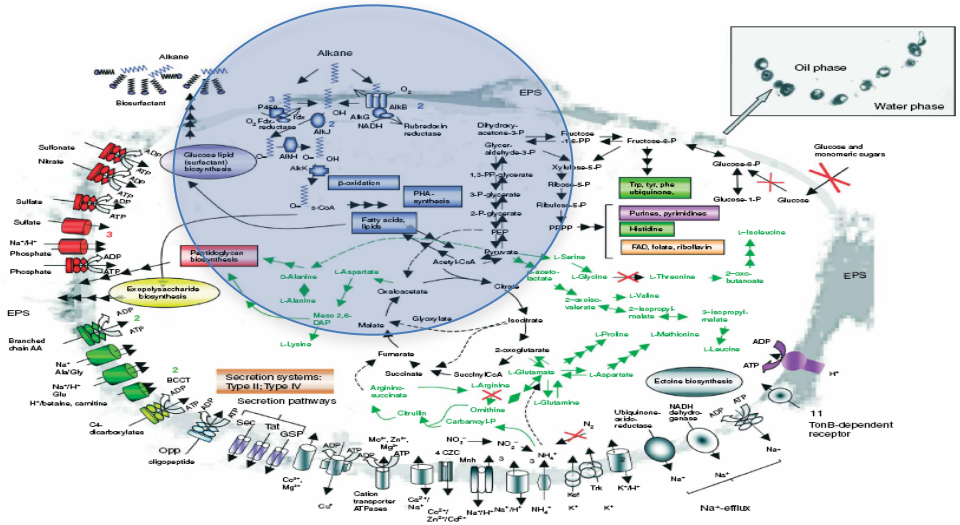
Marine hydrocarbons-degrading bacteria the **specialists of oil clean-up**

The model *Alcanivorax sp*

Substrate selection



oil slick adhesion

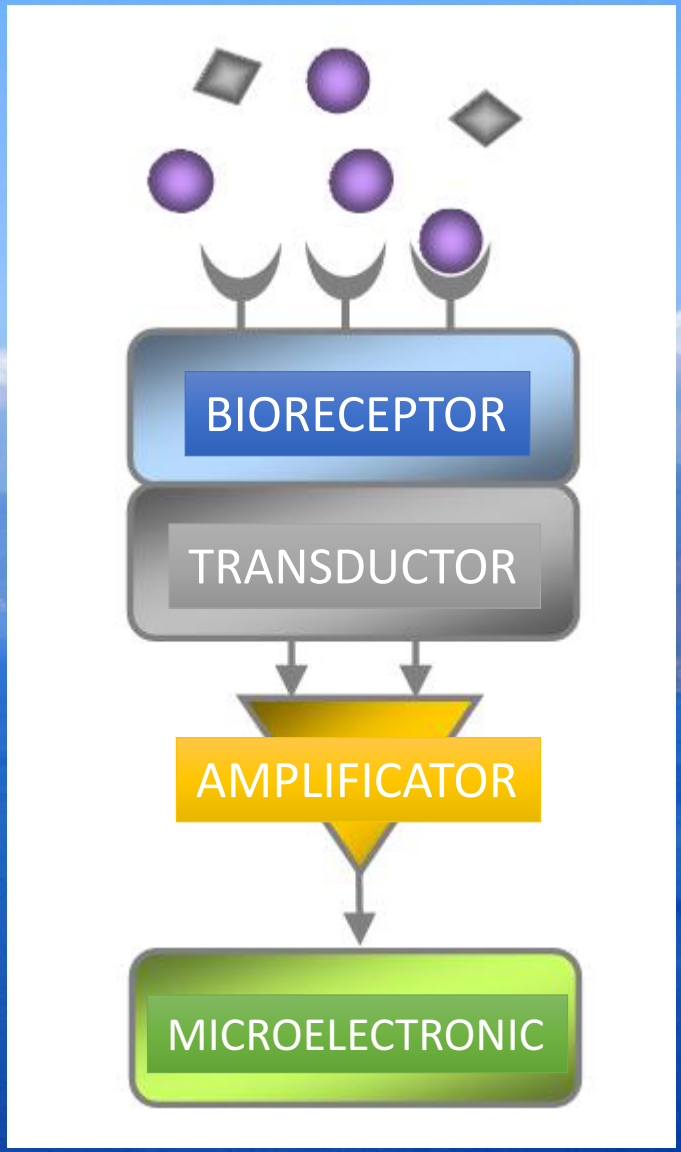


Pollutant degradation

Schneiker et al (2006) *Nature biotechnology*

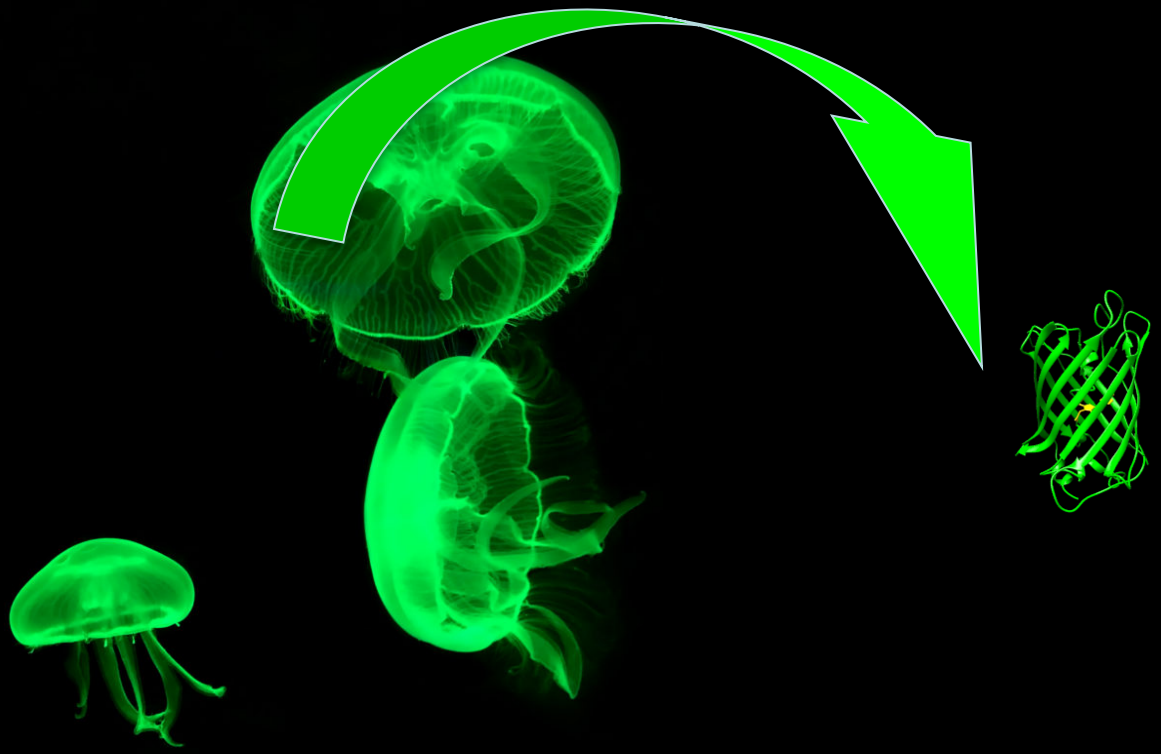
Specialised bacteria for environmental monitoring a multidisciplinary approach

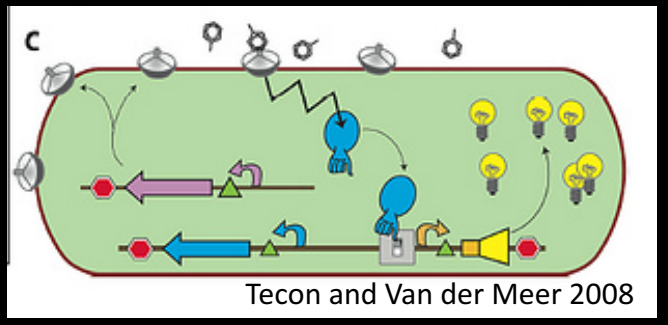
Biochemistry
Genetic
Devise designer
Microelectronics
Oceanography
Chemistry
Physic
Biology
Microbiology
Molecular Biology



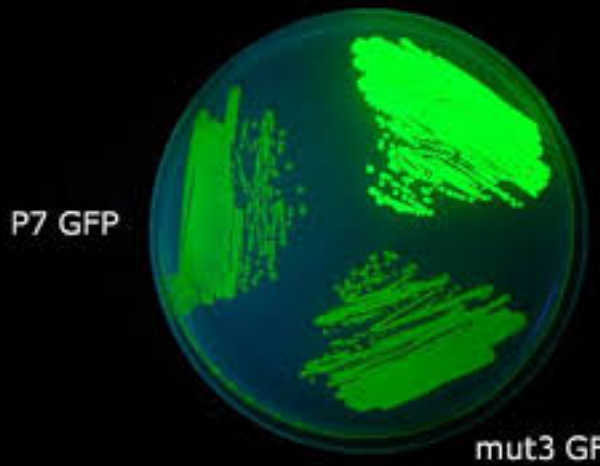
Aequorea victoria

Bacteria



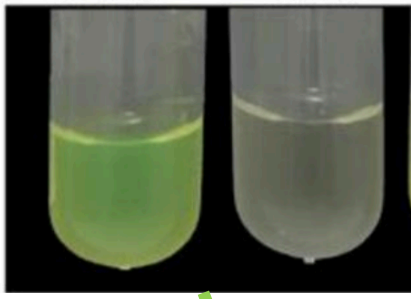


Tecon and Van der Meer 2008

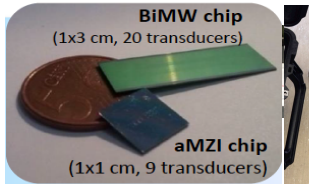


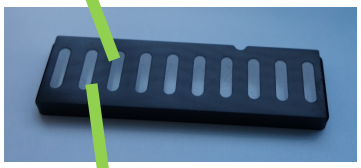
BRAAVOO
biosensors for real time monitoring of marine contaminants

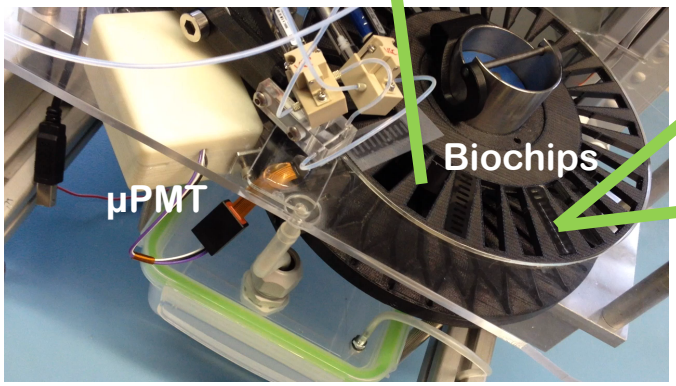
BACTERIAL BIOREPORTERS



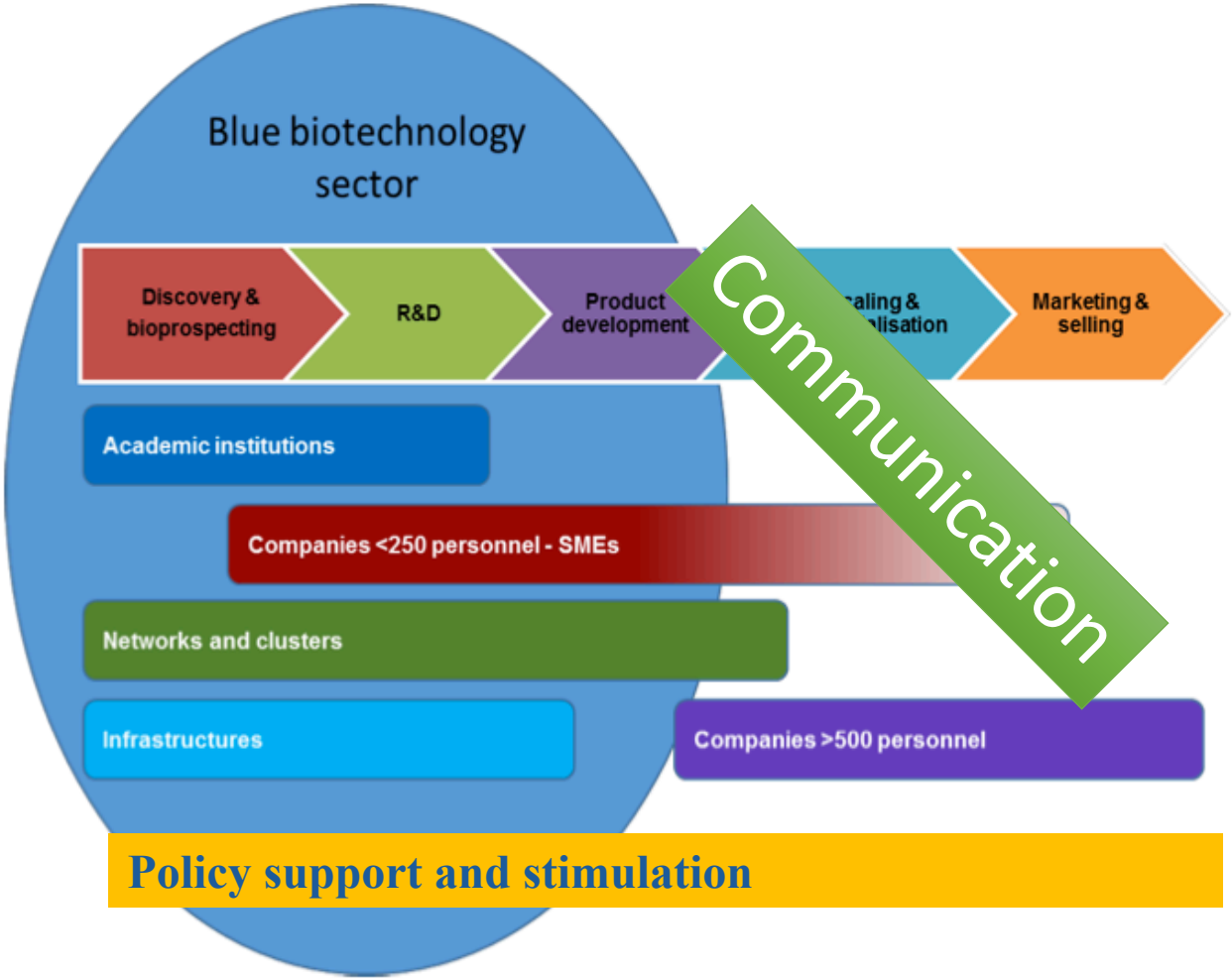
Remote monitoring







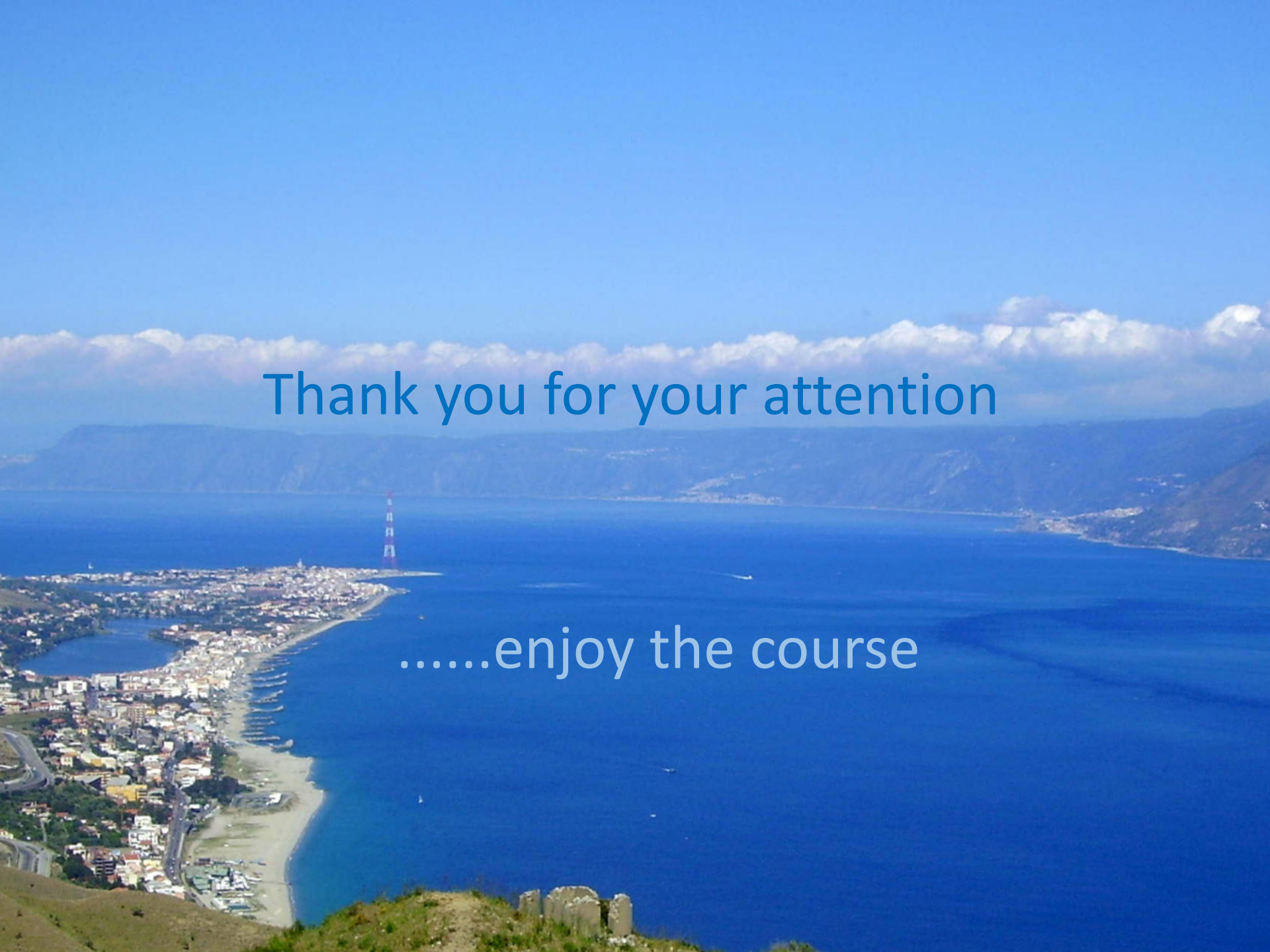
Multi-task approach inspired the course program



Report FWC MARE/2012/06 – SC C1/2013/03 modified

The Program

Module 1 **General introduction on Marine Biotechnology and future perspectives**	Module 2 **Pipeline of Marine Biotechnologies and related tools**	Module 3 **Practical approach, showcasing marine biotech inspiring experiences**	Module 4 **Management in Marine Biotechnologies**	Final Day
9.15 Bioprospecting of marine resources and international protocols for protection, *by Susana Gaudencio, UCIBIO FCT- NOVA & Fernando Reyes, Fundación MEDINA*	**9.15** Isolation and structure characterization of novel marine compounds chemical and biochemical tools, including High-throughoutput technology platforms, *by Angelo Fontana, CNR*	**9.15** Bioprospecting biomass valorization, company experience/1, *by Giuseppe Falini (CASEAWA) and Øystein Arlov (PlastiSea & SNAP)*	**9.15** Knowledge and Technology transfer, research results values, *by Roberto Cimino, Italian Cluster BIG*	**9.15** Brainstorming case study: researcher, company, stakeholders, endusers, *by Technology Cluster BIG (Roberto Cimino), Pole Mer Mediterranée (Colin Ruel), Consorzio Italbiotech (Diego Bosco), Hweta-oil Start-up (Sonia Ben Rejeb)*
10.15 Global market, potential of marine biotechnology, *by Gaia Raffaella Greco, CNR*	**10.00** Omics approach (metagenomics, metaproteomic, metabolomics), *by Peter Golyshin, Bangor University*	**10.15** Bioprospecting biomass valorization, company experience/2, *by Ingrid Bakke (RASbiome) and Arne Malzahn (SIDESTREAM)*	**10.00** Marine bioeconomy and biotechnologies, *by Hjörleifur Einarsson, University of Akureyri*	
11.45 Infrastructures and blue-biobanks, *by Ilaria Nardello, ERAMARIS*	**11.30** Bioinformatics tools, gene mining, *by Giuseppe D'Auria, FISABIO*	**11.45** Exploring, development, exploiting natural products, a model approach: Resources from Urban Bio-waSte (ResUrbis), *by Francesco Valentini, Ca' Foscari University of Venice*	**11.30** Challenges for researchers, IP and legal aspects, *by Alessia Naso, CNR*	**11.30** Reflections/1 Blue biotechnologies: bioethics and international biolaw profiles, *Cinzia Caporale and Ilja Richard Pavone, CNR- Interdepartmental Center for Research Ethics and Integrity*
		12:15 And the winner is…	**12.00** Developing business: interaction between research and private companies, *by Alexia Massa-Gallucci, AquaBioTech Group*	**12.00** Reflections/2 Coronavirus and the food chain: the contribution of innovative aquatic food products, *by Saloua Sadok, INSTM*
15.00 Q&As to the Pipelines (recordings of the lessons shared in advance): 1. Microbiome in the aquaculture setting, *by Gianmarco Luna, CNR* 2. Bioproducts and biomaterial: Algae biorefinery, *by Matteo Francavilla, UNIFG* 3. Services; bioremediation, *by Michail Yakimov, CNR*	**15.00** Virtual hands-on time: demonstration on upscaling practical approach (micro-mesoscale systems facilities), *by Simone Cappello, CNR*	**15.00** Targeting actions: the SOPHIE Strategic Research Agenda for Oceans and Human Health, *by Sam Dupont,* University *of Gothenburg, SOPHIE Expert Group and Scientific Advising Committee* **15.30** Roundtable "Opportunities beyond research: the role of coordination actions", *Ocean4biotec (by Ana Rotter), BlueBio (by Kristin Thorud), BlueMed (by Margherita Cappelletto), B-Blue (by Cristian Chiavetta)* interviewed by trainees	**15.00** LivingLab Game on BlueBiotech COMM strategies, *by Ana Rotter, Ocean4Biotech*	**13:00** End of the course
17.00 Participatory classroom deadline	**17.00** Participatory classroom deadline	**17.00** Participatory classroom deadline	**17.00** Participatory classroom deadline	
		19.00 Aperitif time! Wonder.me informal brokerage event		


Thank you for your attention
.....enjoy the course