Marine Biotechnology in the European Research Area:
Challenges and Opportunities for Europe

Concluding remarks: main highlights and key messages of the conference

There's an old adage that says, "You need to look backwards before moving forwards". As far as shaping the future of marine biotechnology is concerned, there's no need to go back further than May 2006, the time of the EC marine biotechnology policy think-tank meeting in Bremen. And if we were to reflect on the outcomes of that meeting, there would be a broad agreement that subsequent actions have advanced the vision of marine biotechnology and raised the profile of the wonderful scientific, economic and societal opportunities which marine biotechnology research stimulates.

Indeed Bremen was a catalyst that advanced policy at national, regional and even global levels. Importantly, Bremen both stimulated the interest and captured the attention of the Commission at that time, who laid down a challenge, to which European researchers, industry and policy agencies enthusiastically responded, by delivering the marine biotechnology scoping paper under the auspice of the *EU KBBE NET Co-ordinated Working Group on Marine Biotechnology*.

Fast-forwarding the evolution of Marine Biotechnology, we see tremendous advances have been made in European policy and research related areas. Over the past 12 months, there's been the launch of the EU Bioeconomy Strategy and Action Plan; Blue Growth was published; and last month Dublin hosted the EU Bioeconomy conference - *Achievements and Directions for the Future*. Marine biotechnology and the potential it holds to address challenges of food security, sustainable management of natural resources, climate change and lessening Europe's dependency on non-renewable resources, is a core element of future strategy. Reflecting the importance attached by the EC to marine biotech; the Dublin conference hosted a dedicated marine biotechnology session that explored the use of marine resources for new market opportunities and concluded that there were many in areas such as aquaculture, food and health related products, novel production processes and even cosmetics.

The visibility and positioning of marine biotech in European policy ensures on-going support for Marine Biotechnology research and value creation, particularly where such activities lead to economic and societal benefits. Such developments continue to advance; and whilst some nations developed dedicated marine biotechnology programmes: Europe, through FP7 and the work of the KBBE supports an array of marine biotechnology projects, some of which we have heard about from speakers at our conference yesterday and today.

It is quite clear that actions highlighted as necessary by the Bremen "think-tank" to underpin the development of marine biotechnology, are being addressed. The awareness and visibility of marine biotechnology has been raised and continues to grow; there is continued support for basic scientific research excellence and a recognition of the importance of multi-disciplinary research in marine biotech; there are on-going efforts to improve and integrate research infrastructures and there are already a number of cross-cutting programmes that support the commercialisation of research outputs.

What is even more encouraging is that these issues are being addressed at national, regional and European levels, as marine biotech continues to demonstrate its potential to contribute to our overall well-being.

Anyone attending the Bremen meeting could hardly have imagined an event as this conference taking place. And they certainly would not have anticipated the hugely positive indications from Commissioner Máire Geoghegan-Quinn to the conference, regarding support from the EC to advance and deliver on the promise that marine biotechnology holds. This conference should note not only the enthusiastic participation of Commissioner Geoghegan-Quinn, but the extent of support for marine biotechnology she outlined, including the imperative of maximising its potential to contribute to economic growth and job creation; its role in enhancing the competitiveness of European industry; safeguarding our environment and as the source of new products and process that will enhance the welfare and well-being of Europe's citizens and that of future generations of Europeans.

This conference, whilst building on the foundation of past successes, the clear vision for marine biotechnology as reflected in the ESF/Marine Board paper 15 published in 2011 and delivering on the expectations of the Commission; is both forward looking and imaginative. It has encouraged creativity and stimulated innovative discussion. Instead of looking for reasons why, it is asking why not? Instead of seeking to build protective barriers, it is looking to you to find ways of preventing them from ever being thought of, never mind built; and rather than being exclusive, its focus is very much on finding ways to sustain a fully inclusive marine biotechnology community, through co-operation and collaboration and with a unity of purpose.

These principles were clearly reflected by the Commissioner in her address; five different DGs participated in and signed-off on Europe's strategy for the Bioeconomy; Horizon 2020 has adopted a strategic, coordinated approach to marine and maritime research as connected to marine biotechnology; advancing research and innovation in marine biotechnology can be achieved by aligning and linking national research efforts with European research collaborations; and most importantly for this conference, the Commissioner expects the results of this conference to feed into the preparation of a future ERA-NET in Marine Biotechnology that will help to establish common priorities and research agendas in this field.

Before we all go home, it might be useful to reflect how well this conference has advanced the concept of a marine biotechnology ERA-NET? The CSA MarineBiotech, as you know, built upon previous works which identified a range of priority areas such as exploring marine biodiversity for novel chemical entities; ensuring researchers have access to infrastructures and research tools with which to explore marine environments and organisms; applying biotechnologies to feed and food production as well as disease control; and the creation of production systems to generate biomass as the starting point for many products. This conference sought to gain further insights to the various European marine biotechnology research, policy and coordination initiatives; to witness the progress made and understand the capacity to engage in marine biotechnology research and development, and finally, to inform future policy and coordination effort on how best to ensure we can continue to make progress in an efficient and effective manner towards delivering on the grand challenges.

Key highlights: CSA MarineBiotech Final Conference, 11-12 March 2013, Brussels, Belgium

The partners involved in the CSA MarineBiotech recognised that no single country or region operating alone has the necessary capacity, knowledge or resources to fully exploit research and innovations from the marine environment. From the outset, the CSA MarineBiotech sought to prepare the foundation for an ERA-NET in the area of marine biotechnology as an important element in advancing European marine biotech research and development.

The opening session confirmed the progress made by the CSA, not only in profiling European marine biotech support mechanisms and activities but more importantly, the CSA has started to build a sustainable network of funding agencies supporting marine biotechnology which will be beneficial long past the life-span of the ERA-NET. The concurrent activities of delivering on the objectives of the CSA while building an expanding collaboration of European funding agencies to scope out a submission to establish the ERA-NET is an impressive response. It is above all a tribute to the vision, leadership and creativity of the partners within the CSA MarineBiotech.

During the conference we have been treated to some amazing insights to current European marine biotechnology research. The keynote speakers and the panellists confirmed the excellence of scientific leadership that Europe can draw upon. More importantly though in the context of the future of European marine biotechnology research and development, the poster session confirmed the emergence of the next generation of scientific excellence. We have every reason to be optimistic regarding the ability of Europe's marine biotech scientific community to continue to demonstrate creativity in what they do and in their ability to deliver the kind of innovations that are expected of them. We can clearly see there is a strong connectivity between the vision for marine biotechnology and the demonstrated capabilities of the marine biotechnology research community. Significant progress is being achieved; though there are areas where performance can be improved upon. We should be confident that the ERA-NET and any follow-on activity will continue to allow marine biotechnology capabilities to be deployed in support of scientific and economic goals and for the betterment of Europe's citizens.

So what messages should the CSA MarineBiotech project take away from this conference, and how should it do so in ways that maximise your inputs to shaping both the ERA-NET and the subsequent support network? To clarify the challenges faced in developing the ERA-NET, the CSA partners posed three questions at the start of this conference .

The first concerns the **alignment and linking of national research efforts with European research collaborations – specifically what are the challenges and how can this area be advanced?** Responses from the participants to this question are summarised below.

Any activity should add value to what already exists. Developing synergies with other initiatives will make the ERA-NET relevant across Europe. Building on existing bi-lateral agreements between member states is a possible starting point for the initiative. In addition, whilst there are possibly a number of administration issues (IP, direct and in-kind funding, etc.) that could slow down the involvement of North American and other non-European countries, the ERA-NET may benefit from wider international participation; exploring the scope for such collaboration is certainly worthwhile.

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When seeking to build programmes that utilise marine biotech to exploit marine biological resources, the need to protect marine environments should not be overlooked. The exploration of marine environments is at an early stage. Sea-mounds, deep ocean troughs and other geological features are recognised as biodiversity hot-spots. With little known of the full extent of marine biological diversity, these sites may be vulnerable to exploration.

Biodiversity and marine areas need to be protected, (including Areas Beyond National Jurisdiction (ABNJ)), when exploring the marine environment. Indeed marine biotechnology research is likely to contribute new knowledge of relevance to the European policy framework for maritime spatial planning and integrated coastal management. The adoption of best practices in marine spatial planning, contribute to the conservation of marine biodiversity and enable sustainable economic development.

Relatively high levels of national investment in marine biotech exist. Up to 85 percent of all European investment in marine biotech is made by national governments. Few of these national programmes and projects are linked and some have little visibility outside national boundaries. Against this background, enhancing or facilitating coordination of national efforts, whilst possibly an opportunity, may not always be desirable. Even within regions there may not be a desire on the part of the researchers for coordination; it could threaten independence of research; weaken the competitive positioning of teams; or even add an unnecessary administrative burden to projects. Where there are industry partners in national projects, contractual frameworks may limit the scope for collaboration, or even prohibit it totally.

A common problem, to which ERA-NETs offer a solution, is enabling research that a single country could not undertake. The synergies from such interaction could be of interest to firms in the private sector, since access to a broader skill base is possible and there is a scale effect that enhances credibility of the project. However, within such projects, some firms may prefer to remain anonymous for competitive reasons.

Irrespective of their duration, it is essential that projects remain clearly focused on specific deliverables. Open ended or vague projects offer little to attract the involvement of firms. A challenge remains, concerning where or what areas to focus upon. Processes which involve firms in setting goals for ERA-NET projects are preferable to those which fail to include firms, since they are more likely to include a commercial perspective. The early involvement of firms in research projects creates the potential to develop a market focus or a utility aspect.

There is a need to clarify what is meant by “marine biotechnology”. Concerns exist regarding the scope of marine biotechnology and the extent to which the marine biotechnology community risks confusing future stakeholders and the marketplace regarding the scope of marine bio.

The visibility of marine biotechnology is increasing. This is desirable at a time when there is a need to draw attention to the potential that marine environments hold as a source of novel materials, and in seeking to attract expertise from across the science spectra to work on marine materials.

For some researchers, gaining access to new research consortia is a challenge. Where consortia target new funding opportunities, they can typically rely on experiences gained on past projects as the basis for the "new" research team. The ERA-NET opens the possibility for researchers to develop strong linkages and demonstrate scientific capabilities that could lead to further collaboration within for example future Horizon 2020 calls.

Within a broad network as proposed by the marine biotechnology ERA-NET maintaining open and clear communication is a challenge. Marine biotechnology stakeholders, whether of scientific, policy or industry origins, are likely to reflect a diversity of sectorial backgrounds. Delivery mechanisms and messages from the ERA-NET should therefore remain accessible and relevant to a diverse stakeholder group over the entire duration of the project.

National and EU funds have supported many projects, some of which generated huge amounts of data. An opportunity exists for the ERA-NET to make the results generated through public funds more easily accessible and more widely available. Indeed, the ERA-NET could draw attention to the need to create mechanisms which enable researchers and industry to understand the extent of data generated by the many European marine biotechnology related projects. An integrated marine biotechnology data repository would ensure access to such datasets and possibly eliminate duplication of effort by future research projects.

Secondly, **what lessons can we learn from Academic-Industry interaction that can be built into future marine biotech – academic-industry collaboration?** The following issues were highlighted during the discussion sessions:

The expectations of the marine biotechnology community for continued funding and an increasing high profile of the area are high. A number of projects supported with national or European funds have failed to deliver on the initial promises. In their enthusiasm to deliver high impacts, researchers can at times over commit when defining project deliverables and outcomes. Traits as this can result in the credibility of the research team being questioned. Industry seeks clarity on project risk, a degree of certainty and realistic outcomes at all stages of a project from initiation to completion. A failure by projects to retain a realistic outlook on deliverables can lead to the credibility of the marine biotech research being challenged.

The ERA-NET provides an opportunity to initiate a diversity of research activity. Such diversity is to be encouraged, since a wide range of industry sectors are likely to benefit from marine biotechnology research. There remains a necessity however, when supporting new research areas, to ensure that the research is relevant to new market opportunities and/or enhancing the competitiveness of existing products and processes.

Researchers are involved in the knowledge generation business. The research continuum spans basic research to near to market product development. Not all research results will be of immediate benefit to industry or relevant to commercial applications. The research community is becoming more adept at understanding the market relevance of its work. Greater emphasis on an early assessment of market relevance and potential market opportunities provides industry with the confidence it requires before it

will fully engage with marine biotechnology research. Such engagement will be helpful in defining where marine biotechnology projects start.

New knowledge generation offers exciting and unfettered opportunities to the research community. Engaging with industry on research requires a focus that relates to market opportunity; whether that is near or long-term. Supporting the development of an improved understanding of competitive analysis and the marine biotechnology value chain, would be beneficial in enhancing industry academic interaction.

Capturing and embracing the potential of SMEs as the engine of growth is required. Developing insights to the challenges faced by these firms would be beneficial in targeting priorities to be addressed by the ERA-NET. Whilst a long-term vision is required, so too is a focus on areas that offers scope for short or near term successes. The successful targeting of "low-hanging fruit" by the ERA-NET would demonstrate how the initiative can assist industry to improve its understanding of the potential of marine biotechnology and identify further research/knowledge needs.

Industry seeks clarity and an understanding of project risk. Misconceptions exist regarding industry views on research contracts, ownership of results and intellectual property (IP). Positive research outcomes are not a certainty and hence not all research will lead to revenue from the licensing of IP. In the eyes of industry, the expectations of research performers are not always realistic. Industry seeks greater clarity of the research offer by way of formal agreements. Contracts between industry and research providers help industry to assess risk. Rather than fear such contracts, industry welcomes them since they clarify what will be delivered, who owns what and the conditions attached to the exploitation of research outputs and address ownership.

New emerging areas such as marine biotechnology contain areas of uncertainty. Outcomes may not always be apparent or clear from the outset. Industry is used to dealing with and managing risk. In furthering marine biotechnology interaction between industry and academia, researchers have to become more comfortable in working with imperfect information and changing situations. The ability of researchers to work with grey areas, as opposed to complete clarity, is an asset valued by industry.

Relationships are important to industry. Great efforts are made by industry in culturing relations with customers, regulatory authorities, suppliers and research providers. The "right" team for industry might not always comprise the most recognised or highest ranked researchers. Researchers that are able to understand, and fit within the culture of a firm, can be more attractive to the firm than research "experts". Industry values researchers who are able to demonstrate a wide understanding of industry needs and appreciate the various challenges firms face in securing market opportunities.

Gaps are known to exist between industry needs and funded research activity. There is a clear place for more demonstration type projects since they offer a possible solution to bridging the academia – industry divide. Similarly, researchers would be better placed to relate to firms by developing a deeper understanding of the entire value chain; this increased understanding could also lead researchers to make contributions along the entire marine biotechnology value chain.

And finally, you were asked to **reflect on pan-European science policy and coordination in the context of marine biotechnology research and development.** The discussion noted the following:

The ERA-NET can assist institutions to work together on issues of common interest. Some of the JPIs and ERA-NETs already are engaged in areas relevant to the Marine Biotechnology ERA-NET. Understanding the content of these initiatives is the first step in clarifying the scope and potential for the Marine Biotech ERA-NET to build more formal linkages to them.

A wealth of learning experiences are available from the many marine biotechnology related networks that exist in Europe. Whether these are science oriented or focused on furthering regional development opportunities, they are a rich source of knowledge for the ERA-NET. They offer a diversity of insights to how networks function and the influence of different cultures on the performance of collaborative activities.

The ERA-NET should strive to achieve a diversity of participation and a balance of regional representation. By remaining open to new participants, the ERA-NET is well positioned to attract and build upon regional strengths. Capturing new disciplinary expertise and competencies; opening access to infrastructures; and drawing from specific regional experiences in marine biotechnology, will all enhance the ERA-NET and the projects it supports.

Despite the efforts of other marine biotechnology related projects, barriers to participation and difficulties in accessing data generated by them exist. Establishing an ERA-NET on the basis of clear goals and expectations that are informed by an extensive and early stakeholder engagement are desirable attributes. These attributes, as well as the promotion and operation of an open communication culture, are visible in the CSA, thus providing it with a solid foundation to build upon. However, a challenge facing the CSA is to ensure these successes are embraced by the future ERA-NET.

With the emergence of many overlapping areas of interesting scientific opportunities, the ERA-NET is likely to be challenged in making decisions regarding priorities. Efforts that give greater focus to areas where Europe has already established unique competencies, or by exploiting natural resources that offer exceptional potential and opportunities for member states are likely to offer long-term success. The impact of this approach, particularly where opportunities are relevant to economic and societal challenges is considered to be of greater value, than a purely scientific oriented one.

It is clear to me that your contributions at this conference in Brussels, coupled with the feedback the CSA received at earlier stakeholder events in Portugal and Germany will:

- Guide and shape the new ERA-NET in Marine Biotech;
- Drive national, regional and pan-European science policy initiatives and developments, and improve coherence between them;
- Help the ERA-NET to address major challenges such as, capturing new opportunities and bridging gaps; eliminating barriers to progress;
- Enable the transfer of experiences between countries, regions and pan-European coordination and science policy and other initiatives.

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This has been a remarkable event. That it was hosted at a royal learned society for promoting science and the arts, is symbolic of what the CSA set out to achieve and which the ERA-NET appears likely to deliver. The conference brought together decision makers from the academic, industry and policy sectors. It provided a forum that fostered productive discussions and generated insights to scientific, economic and societal impacts of marine biotechnology. In this respect, this conference, just like the other CSA stakeholder events, has helped shape a future ERA-NET that will support the creation and translation of innovative ideas into actionable solutions for the benefit of citizens.

In conclusion, the message that could be delivered to the Commissioner is; her expectations are being met. The CSA has already informed and contributed to the planned ERA-NET and appears likely to shape the future of marine biotechnology well into, and possibly past the life of Horizon 2020.

Before the conference formally closes, and on behalf of the organisers – the CSA partnership, I would like to thank the participants who over the past couple of days have engaged in enthusiastic and positive debates. In doing so, they have both challenged and shaped how the ERA-NET in Marine Biotech will evolve. The sessions chairs, moderators, keynote speakers and panellists expertly guided the proceedings. Together they delivered helpful and provocative contributions and insights, leading to the frank and open discussion. The poster session provided further evidence of the scientific expertise and the nature of collaboration, which exists within European marine biotech. To you all, a big thank you and a safe speedy journey home.

Dermot Hurst (Marine Institute, Ireland) for the European Marine Board and the CSA MarineBiotech

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