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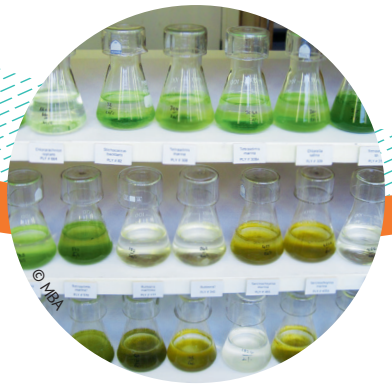
European Marine Biological Research Infrastructure Cluster

Discovery **Pipelines**



Carbohydrate **Pipeline**

Discovery and exploitation of novel marine products and biomolecules

Carbohydrates are ubiquitous and one of the four fundamental classes of macromolecules that comprise living systems, along with nucleic acids, proteins, and lipids, and are made up of individual sugar units linked to one another in a multitude of ways. Understanding the structures and functions of carbohydrates is central to understanding biology. They play diverse roles, including critical functions in the areas of cell signalling, molecular recognition, immunity, and inflammation.

However, while the 'language of sugars' is constantly being untangled concerning the carbohydrates occurring in humans, domestic animals or land plants of agricultural importance, our understanding of marine specific carbohydrates is only at the beginning. Thus, the marine environment is a largely untapped source of functional sugar-based biomolecules. The myriad of sugar structures in marine environments, that often mimic human, medically relevant glycans, provide more opportunities to develop high-value industrial chemicals than molecules extracted from terrestrial plant biomass.

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Developing an enzymatic toolbox for marine carbohydrates

A major reason why our knowledge about the sugar structures and diversity is lacking behind those of other biomolecules, is the lack of polysaccharide sequencing methods to decipher naturally occurring carbohydrates. A key to developing new methods to overcome these hurdles is the utilization of Carbohydrate Active Enzymes (or CAZymes). The diversity of these enzymes reflects the diversity of carbohydrates: each new bond, or nature of sugar, or modification requires a specific enzyme. They can thus efficiently be used to create polysaccharide sequencing methods.

Fingerprint profiling of marine cell wall extracts

Using specific CAZymes, the setup of a rapid method to qualitatively characterize marine cell wall extracts is required to be able to identify where and when significant differences occur in polysaccharide structure, composition or abundance. Promising results will be followed up with in-depth analyses.

The enzymatic degradation of marine glycans needs to be coupled to technical platforms for MS, NMR and FT-IR for chemical structure elucidation.

Production of marine oligosaccharide standards

Access is needed to already identified marine oligosaccharides and glyco-compounds with known analytical signatures and chemical structures, thus allowing rapid identification of novel chemical entities.

Molecular probes for marine carbohydrate characterization

Marine polysaccharide specific monoclonal antibodies and binding modules are developed for in situ identification and microarray screening methods.

Visibility in European Carbohydrate Databases

Quality control of discovered carbohydrates and incorporation into European carbohydrate libraries.

Current Bottlenecks

- Missing knowledge on structural and biological functions of marine carbohydrates
- Limited access to specific services for bioassaying of marine carbohydrate isolates
- Access to marine specific oligosaccharides either for glycol-arrays or for use as standards in MS, NMR and other methods of characterization

Solutions

- Build comprehensive libraries and facilitate access to existing data
- Establish network of experts, institutions and organisations that offer assistance for the characterisation and production of marine carbohydrates

Contact person for questions and inquiries

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