CarboMet

Metrology of Carbohydrates for Enabling European BioIndustries

A Horizon 2020 Coordination & Support Action 2017-2021

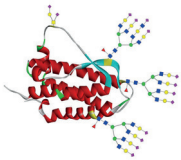
About CarboMet

Carbohydrates constitute the largest source of biomass on Earth and their exploitation will be crucial if we are to reduce our dependence on fossil fuels and create a Circular Bioeconomy. However, to understand and ultimately exploit carbohydrates, a carbohydrate metrology and measurements 'toolbox' is essential to drive new research and innovation practices in glycoscience.

CarboMet will facilitate engagement between key players and stakeholders to ensure full engagement of the glycoscience community across Europe to identify the current state of the art and in particular future innovation and technological challenges in carbohydrate metrology. **Four BioIndustry Sectors** have been identified as of immediate interest for CarboMet where the exploitation of carbohydrates will have huge impact:

1. Biopharmaceuticals including vaccines, antimicrobials, antibodies and hormones

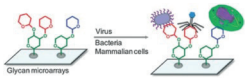
The number of pharmaceuticals based on glycans, glycan targets and glycosylated products is rapidly increasing both in number and market share. Products such as heparin, cyclodextrin, carbohydrate-based vaccines, and vancomycin have been on the market for a long time. Recent examples include Tamiflu and Relenza, which were developed to treat the 'bird flu' virus. With the advent of biopharmaceuticals such as human erythropoietin and therapeutic antibodies, glycoconjugates will continue to increase. As the degree of molecular complexity increases so does the range of analytical techniques required. Glycosylated biopharmaceuticals such as glycoproteins provide particular challenges in R&D and quality control during production.



Erythropoitein (EPO) – a glycoprotein hormone that stimulates the production of red blood cells and is used as a therapeutic agent for the treatment of anaemia.

2. Diagnosis of disease at a personal level for the development of precision medicines

All cells, including human cells, have carbohydrates on their surface, known as the glycocalyx. This coating of glycolipids and glycoproteins controls a variety of fundamental biological processes, for example fertilization, immunology and infection. The makeup of the glycocalyx is sensitive to genetic mutations, changes in gene activation or silencing, or environmental and personal habit factors such as diet, alcohol consumption or smoking. This makes the glycocalyx a useful target for personalised medicine, including finding new disease biomarkers for diseases such as cancer, and for patient stratification during clinical trials. Novel instrumentation that can rapidly and accurately measure individual patient's condition in real time are needed. There are also opportunities to develop lower-cost and better targeted products for the diagnostics market.



Glycan arrays are an important tool for studying carbohydrate interactions.

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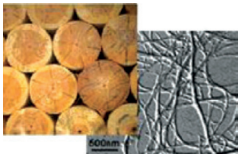
3. Healthy lifestyles from good food and personal care, including for healthy ageing

Sugars are important components of everyday foods and an understanding of polysaccharide production in plants is of the utmost importance for improved food security and production, including crop protection. The importance of sugars as dietary components and their nutritional value and potential in functional foods is becoming more and more apparent and they are increasingly being appreciated for their health giving effects for the benefit of society, reducing the burden on health services and improving quality of life.

Beta-glucans, found in oats, are complex polysaccharides, a source of soluble fibre and have cholesterol lowering properties. Non-digestible polysaccharides can help promote a healthy gut microbiome, important for infant health and healthy ageing.

4. Carbohydrates as the sustainable materials for the future

The development of sustainable biorenewables will facilitate the move towards a more sustainable bio-based chemicals industry. Natural polysaccharides such as cellulose, hemicellulose, starch, chitin and xyloglucan all have properties that make them useful for a variety of industrial applications. Their modification (chemical, mechanical, biological) can further expand their properties and functionalities. New analytical tools are required to support the generation of highly-defined innovative bio-based materials.



Cellulose is the most abundant natural polymer on earth. Modified cellulose is used in plastics, inks, adhesives, and more.

Enabling Technology Areas

There are a number of challenges in technological, manufacturing and regulatory aspects of carbohydrates, in particular in three **Enabling Technology Areas** which need to be addressed to ensure full exploitation of the opportunities identified.

1. Measurements & Analytical

Techniques for quantitative, structural characterisation of carbohydrates thus ensuring technical specifications for manufacturing and regulatory requirements are met.

2. Synthesis of Standards

Defining the range of standards and reference materials required, and their specifications, will present major synthetic challenges in their production.

3. Bioinformatics & Databases

To provide reference data, to understand the complex activity structure relationships of carbohydrates and to act as viable alternative tools for in vitro testing.

CarboMet will facilitate engagement between key players and stakeholders in each Enabling Technology Area and BioIndustry Sector to ensure full engagement of the glycoscience community across Europe.

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A Coordination and Support Action (CSA) funded by Horizon 2020 FET-OPEN (Grant agreement no. 737395).