Michael Smith Laboratories

Harry Brumer

Professor

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OFFICE

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LAB

Name  Brumer Lab
Building  MSL
Room Number  263

PROFESSIONAL

Associated Departments  Department of Chemistry (Information for prospective graduate students)
Department of Biochemistry and Molecular Biology (Associate Member)
Department of Botany (Associate Member)

Professional Profile  Apr. 2015 - present: Associate Member, Department of Biochemistry and Molecular Biology,
University of British Columbia
Jul. 2014 - present: Associate Member, Department of Botany, University of British Columbia
Research Area  
**Fundamental and applied carbohydrate enzymology**

The focus of our Carbohydrate Enzymology Research Group is to understand the way in which particular enzymes act to alter the structure of polysaccharides found in biomass (especially plant cell walls and wood fibers), and to harness these enzymes for applications. We are primarily interested in the carbohydrate-active enzymes (CAZymes) which synthesize, re-arrange, and degrade glycosidic bonds. Studies of carbohydrate oxidases involved in polysaccharide functionalisation comprise another primary research area.

In the biological context, we aim to elucidate the molecular details of polysaccharide synthesis and deconstruction in:

- biogenesis of plant cell walls
- recycling of biomass in the global carbon cycle
- breakdown of dietary fibre (non-starch polysaccharides) by the **human gut microbiota**

[An excellent popular science overview of our research in this area, including an animated video and an audio interview with Prof. Brumer, has been produced by UBC SCIE300 students - click here to check it out.]

The discovery and characterisation of new enzymes involved in these processes provides a foundation for the development of enzyme technology for the improved use of renewable biomass resources in the forest products, agricultural, and textile industries.

**Outreach**

We routinely work with teachers and students to convey the importance of the research we do to non-specialists. Some examples include:

- A [blog post and video](#) on the digestion of dietary fiber by human gut bacteria, produced by UBC SCIE300 students.

**Research tools and methods**

**We employ a wide variety of techniques** to learn more about enzymes relevant to biomass utilization and fiber modification:

**Organic chemistry and chemical biology**

Synthesis of modified substrates as probes of enzyme mechanism or to introduce specific chemical functionality into carbohydrate polymers.

Representative publications: [Pub. 1](#) | [Pub. 2](#) | [Pub. 3](#) | [Pub. 4](#)

**Molecular phylogeny, molecular biology, and heterologous protein expression**

Identification, cloning, and recombinant expression of genes encoding enzyme targets with unique biological/biochemical function and/or application potential.

Representative publications: [Pub. 1](#) | [Pub. 2](#) | [Pub. 3](#) | [Pub. 4](#)

**Protein biochemistry**

Purification and basic biochemical characterization of native and heterologously expressed enzymes.

Representative publications: [Pub. 1](#) | [Pub. 2](#)

**Mechanistic enzymology**

Thorough examination of enzyme mechanisms using specifically designed substrates and detailed kinetic analyses.

Representative publications: [Pub. 1](#) | [Pub. 2] | [Pub. 3] | [Pub. 4]

**Enzyme engineering**

Rational modification of enzymes for various applications using knowledge of protein structure and enzyme mechanism.

Representative publications: [Pub. 1](#) | [Pub. 2] | [Pub. 3]

**Protein/enzyme structure-function analysis**

Via collaboration with world-leading protein crystallographers, we use the above tools to develop a better understanding of how protein structure dictates enzyme catalytic properties.
Carbohydrate-based materials development
Synthetic chemistry and enzyme technology are combined to develop chemo-enzymatic technologies to expand the performance of polysaccharides and cellulosic fibers.

For a complete publication list, please see this page. Interested in graduate studies? Please see this information page at UBC Chemistry. As an Associate Member, Prof. Brumer also routinely co-supervises graduate students in the Department of Botany.

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