

# Career Connection: Dr. Chris Whitfield & Dr. Eric Brown

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## Background

Carbohydrates play a pivotal role in virtually all biological processes, which makes them key to solving many health issues. Glycomics—the study of sugars in biological systems—has led to the commercialization of several carbohydrate-based drugs, including ones that fight influenza, blood clots, diabetes, seizures and migraines. Building on a half century of glycomics research and a growing biotech sector, Canada is ideally positioned to take advantage of this emerging golden age of glycomics. A national, multidisciplinary effort is now bringing researchers and health scientists together with industry, government, and international partners to translate this opportunity into results that improve patient health, and grow Canada’s biotech and pharma sectors.

The Canadian Glycomics Network (GlycoNet), which includes more than 150 researchers from across Canada, focuses on finding solutions to infectious diseases, cancer, neurodegenerative diseases, and chronic diseases. GlycoNet provides researchers and industry partners with access to core services in carbohydrate synthesis, complex structure analysis, and high-throughput screening of new drug candidates.

Among these researchers are Dr. Chris Whitfield, Professor and Canada Research Chair from the University of Guelph, and Dr. Eric Brown, Biochemistry and Biomedical Sciences Professor from McMaster University. They will outline their academic backgrounds and their current research within the GlycoNet, and describe what they think high school students should know about carbohydrate research.

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## Dr. Chris Whitfield

### Current Position:

Canada Research Chair in Molecular Microbiology  
Professor, Department of Molecular and Cellular Biology at the  
University of Guelph

### Education:

B.Sc. University of Newcastle-upon-Tyne  
Ph.D. University of Edinburgh



### Describe your career path:

I became interested in microorganisms through a first year course as an undergraduate and switched majors into an honours program in Bacteriology. On graduation, I was offered a place in a PhD program and had to choose between it and a UK government job (Ministry of Agriculture). I have had no regrets. I started working in microbial glycobiology during my PhD on a project supported by Shell (oil) who wanted to exploit microbial polymers in oil recovery. Postdoctoral work is the logical next step for anyone interested in further research or an academic career and I had always been interested in working outside the UK, so I moved to California, where I could learn more about the biochemistry of polymer synthesis. I was then offered a position in Calgary that gave me some independence to start looking at other systems and that created the platform for some of the work still in progress. I started to look for something more permanent when we started our family and chose Guelph after receiving a few offers from institutions in Ontario, Alberta and Québec. I started my own research program in microbial glycobiology and we have worked on a range of organisms asking different research questions with a variety of different experimental approaches and tools.

### Describe your current research:

Our research efforts focus on the broad area of prokaryotic glycobiology, with specific interests involving the structure and assembly of bacterial cell surfaces. Complex molecular machines coordinate the synthesis and export of cell-surface macromolecules and our goal is to understand their structure and function. This represents a fascinating challenge for experimental research, involving the application of a range of experimental strategies that span the disciplines of biochemistry, microbiology, molecular biology, and structural biology. These research topics are of fundamental importance in understanding the physiology and pathogenesis of bacteria and they may yield new therapeutic strategies for intervention in bacterial infections.

### Outside academia, who do you think is interested in your research and why?

Vaccine companies are interested in the variations in glycan structure and means of assembly with a view to generating recombinant systems for vaccine production. Pharmaceutical companies are always interested in potential new targets for antibacterial drugs and glycan-assembly reactions are good targets.

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**What are some of the rewards and challenges involved with your research?**

Deciphering cellular processes is a complex puzzle. The ability to answer some of the questions are limited by the organism itself – its size and the small amounts of some of the critical components. As experimental methods improve new opportunities arise, so we are now able to answer questions I wondered about 30 years ago! Staying at the forefront requires access to emerging technologies and the engagement of research collaborators who have different skillsets. The rewards are the excitement at solving a complicated problem and interaction with a constant flow of bright students who pass through my lab.

**What do you want students in high school to know about carbohydrate research?**

Complex carbohydrates are crucial in cellular recognition events and interactions. They are critical in cellular development and are important in abnormal developmental processes such as cancer. In bacterial pathogens, these molecules protect the cell from some elements of our immune system but they also create a signaling dialog with the immune system that ultimately determines whether the pathogen is successful or not.

**Dr. Eric Brown****Current Position:**

Professor in the Department of Biochemistry and Biomedical Sciences and member of the M.G. DeGroot Institute for Infectious Disease Research at McMaster University.

**Education:**

B.Sc. University of Guelph, Guelph, ON  
M.Sc. University of Guelph, Guelph ON  
Ph.D. University of Guelph, Guelph ON

**Doctor Brown's Accomplishments:**

Dr. Brown has been the recipient of a number of awards including the Canadian Society of Microbiologists Murray Award for career achievement, the Canadian Society for Molecular Biosciences Merck Frosst Prize for new investigators and a Canada Research Chair in Microbial Chemical Biology.

Dr. Brown is a former department Chair (2008-2013) and has served on advisory boards for a variety of companies as well as national and international associations, including a term as President of the Canadian Society of Biochemistry, Molecular and Cellular Biology, member of the Medical Review Panel of the Gairdner Foundation and member of the Institute of Infection and Immunity of the Canadian Institutes of Health Research.

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**Describe your current research:**

My research interest is in the complex biology that underlies bacterial survival strategies. My research team and I aim to understand and subvert these systems in drug resistant superbugs. To this end we are using tools of chemical biology and molecular genetics to probe poorly understood aspects of bacterial physiology. The overriding goal of these studies is to contribute fresh directions for new antibiotics. Indeed, we have made remarkable advances in recent years developing avante garde chemical screening assays that have yielded exciting new probes of bacterial cell systems. In the future, we are working toward the implementation of sophisticated drug discovery platforms that will yield breakthrough lead compounds for the next generation of antibiotics.

**Outside academia, who do you think is interested in your research and why?**

Scientists in the pharmaceutical industry are interested in the approaches that we are taking. We are focused on learning the fundamental science that underpins bacterial systems that are under study. This work is leading to new and unconventional platforms for antibacterial drug discovery. It's the sort of innovation that could ultimately be applied in a pharmaceutical company setting but only if it works.

**What are some of the rewards and challenges involved with your research?**

Bacterial cell systems have enormous complexity and we have only begun to understand what makes these simple organisms tick. Learning something that solves a longstanding paradox or solving a new puzzle that is a part of that understanding is simply a rush that is easy to get addicted to.

**What do you want students in high school to know about carbohydrate research?**

Carbohydrates have tremendous importance in human health and the more we learn about them, the more effectively we can treat various diseases. For example, in my own research area, antibiotics often target the formation of bacterial cell wall which is composed of carbohydrates.

**Career Connections Questions**

1. Do you think the study of Glycomics is important? Create a list of applications that Glycomics research may provide to society.
2. All research isn't without its challenges. Outline some of the challenges that the professors described with regards to carbohydrate research.
3. The Canadian Glycomics Network initiative involves over 150 researchers from across Canada. How is this collaborative approach beneficial, and what are the drawbacks?
4. Use this article, the Internet, or other resources to generate a list of careers and positions available in the field of microbiology. Choose one and elaborate on its requirements.

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