# BLOG

# Five Things We Learned at Café Mathématique

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On November 26, a full room of curious minds at the Fields Institute was ready to discover the intersections between math and the modern world. Why is this so important? Sponsored by ORION, Café Mathématique (http://www.orion.on.ca/news-events/events/cafe-mathematique/) provides a chance to dispel some common myths about mathematicians. Building a bridge between the general public and the mathematical modelling community, the event also introduces people to an area of study and work they might not be familiar with.

Café Mathématique is a community-based seminar and discussion panel of leading experts in the field of mathematical modelling of infectious diseases. The panel featured Julien Arino of the University of Manitoba and BlueDot; Troy Day, Canada Research Chair in Mathematical Biology and Queen's University professor; Amy Greer, Canada Research Chair in Population Disease Modelling and Guelph University professor; Jianhong Wu, Canada Research Chair in

Industrial and Applied Mathematics and director of York Institute for Health Research; and moderator Jane Heffernan, York Research Chair, Multi-Scale Models for Evidence-Based Health Policy, and director of the Centre for Disease Modelling.

Here are the key themes we learned from the event:

## The hub for Canadian Infectious Disease Research

The Canadian Centre for Disease Modelling (CDM) supports research of the spread of infectious disease in a population using innovative mathematical methods and statistical analysis. It strongly encourages collaboration between various Canadian institutions and international organizations, as well as interdisciplinary research as applied to mathematical modelling. As the result, there is new knowledge accumulated in the fields of epidemiology and virology, which can be used to understand the spread of infectious diseases and inform health policy-makers' decisions.

## A model for each scale

A vast range of differently scaled models can capture processes as minute as in-vitro dynamics of infection, as well as large-scale population epidemic dynamics. Some examples of these models are stochastic, deterministic, spatial and agent-based. These models can be analyzed by the tools provided by various mathematical streams, including algebra, calculus, graph theory, stochastic processes and statistics.

## Collaboration is key

Mathematicians have to work with specialists from other fields, so that the models are well-informed and relevant to the current issue of interest, indicate hypotheses and experiments that need to be conducted and provide useful insights for health policy-makers, vaccine and drug manufacturers and the general public. Therefore, for a successful use of mathematical modelling, a constant interdisciplinary feedback loop should be maintained.

## Modelling supports informed predictions

The world we live in changes dynamically, and so the diseases and their spread patterns are changing as well. Therefore, it is not enough to learn and understand previous epidemiological events; we must also be able to model the processes underlying present infection spread. As a result of successful modelling, we can learn the expected speed and patterns of an infectious disease spread, as well as the most sensitive contributing factors. We can understand the kinetics of vaccine blunting and antibiotics resistance. This knowledge can help policy-makers to come up with strategies that will reduce morbidity and mortality and their effects in the population.

## Challenges to scale

Common challenges modellers face are knowledge translation, data collection and mining; appropriate model creation; and subsequent analysis. In order to properly analyze mathematical modelling of infectious disease, a wide range of mathematical fields need to be applied.

As Jianjong Wu showed us, mathematics tries to find essential features of the processes and translate them into mathematical models of the disease. This can be used to predict the evolution of the disease spread. For all its greater implications to improve outcomes in human health, mathematics are often under-represented – we often don't imagine that math can benefit so many various fields. Next time you hear about an infectious disease in the news, consider how math and modeling may have played a role.

*Interested in learning more? Visit the CDM website (http://www.cdm.yorku.ca/) for news and updates on the world of infectious disease modelling.*



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