ONLINE COURSE: ONE HEALTH MODELLING FOR EMERGING INFECTIOUS DISEASES

Organized by: Jane Heffernan (York University), Mike Kallos (University of Calgary), and Mark Lewis (University of Victoria) & Deirdre Haskell (The Fields Institute)

PART 1 | FALL 2022 | OCT 11- JAN 27

This course introduces students to the mathematical modelling of infectious diseases in One Health. Infectious diseases models are developed to track infection and transmission in animal, plant, and human populations. Particular attention is paid to infections that can be transmitted between humans, animals and the environment. Public health mitigation, as well as animal and environmental pathogen control are discussed, and the models are extended to include vaccination, drug therapies and population contact control strategies in public health and healthcare. Students will learn to formulate, analyze, parameterize, and validate quantitative models for infectious disease processes and data. Applications include SARS-CoV-2, MERS-CoV, avian influenza, bacterial diseases and antibiotic resistance, and fungal pathogens and antifungal resistance. Approaches involve computer simulation, differential equations, individual-based models, least squares, likelihood, matrix equations, Markov processes, and stochastic processes. Computing labs cover simulation and programming methods in specific software programs that are popular in the field of Infectious Disease Modelling. Course discussions in model evaluation and appraisal of current literature include opportunities for reflection and communication. Students will have opportunity to collaborate with their course colleagues on group projects.

DEADLINE TO REGISTER: OCTOBER 17, 2022

PART 2 | WINTER 2023 | FEB 6- MAY 19

This course is an extension of One health Modelling for Emerging Infectious Diseases Part I. This course introduces students to mathematical modelling of infectious diseases in One Health, including vector borne diseases, livestock diseases, and waterborne diseases.
Infectious diseases models are developed to track infection and transmission in animal, plant, and human populations. Particular attention is paid to infections that can be transmitted to humans in animals from their environment, including insects, livestock, and affected water sources. Public health mitigation, as well as animal and environmental pathogen control are discussed, and the models are extended to include vector control, treatment and immunization of livestock, other vector and livestock control disease control mechanisms (i.e., culling), and environmental treatment. Students will learn to formulate, analyze, parameterize, and validate quantitative models for infectious disease processes and data. Applications include malaria, zika virus, west nile virus, lyme disease, foot and mouth disease, avian influenza, cholera, Hepatitis A virus, and typhoid fever. Approaches involve computer simulation, differential equations, individual-based models, least squares, likelihood, matrix equations, Markov processes, and stochastic processes. Computing labs cover simulation and programming methods in specific software programs that are popular in the field of Infectious Disease Modelling. Course discussions in model evaluation and appraisal of current literature include opportunities for reflection and communication. Students will have the opportunity to collaborate with their course colleagues on group projects.

DEADLINE TO REGISTER: FEBRUARY 13, 2023

MEET YOUR INSTRUCTORS!

JULIEN ARINO

Professor and Faculty of Science Research Chair in Fundamental Science with the Department of Mathematics at the University of Manitoba

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HUAIPING ZHU

Professor of Mathematics at the Department of Mathematics & Statistics and York Research Chair (YRC Tier I) in Applied Mathematics

Director of the One Health Modelling Network for Emerging Infections (OMNI-RÉUNIS), the Laboratory of Mathematical Parallel Systems at the York University (LAMPS), and the Canadian Centre for Diseases Modelling (CCDM).

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REBECCA TYSON

Associate Professor in Mathematical Biology at the University of British Columbia

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WOLDEGEBRIEL ASSEFA WOLDEGERIMA

Assistant Professor in the Department of Mathematics & Statistics at York University

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MARINA FREIRE-GORMALY

Assistant Professor in Mechanical Engineering Department at the Lassonde School of Engineering at York University

READ MORE

PEI YUAN

Postdoctoral fellow in the Department of Mathematics and Statistics at York University, Canadian Centre for Disease Modelling and One Health Modelling Network for Emerging Infections (OMNI-RÉUNIS).

READ MORE

REGISTER HERE!

DEADLINE TO REGISTER: FEBRUARY 13, 2023

PLEASE NOTE THAT THE COURSE INSTRUCTORS ARE ABLE TO OFFER SUPPORT IN BOTH ENGLISH AND FRENCH

Please contact the Program Manager of OMNI-RÉUNIS **Natasha Ketter** (nketter@yorku.ca) if you have any questions.

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science | YORK UNIVERSITÉ UNIVERSITY

CDM Centre for Disease Modelling | CMM Centre de la modélisation des maladies

OMNI | RÉUNIS
One Health Modelling Network for Emerging Infections | Réseau une seule santé su modélisation des infection

FIELDS INSTITUTE FOR RESEARCH IN MATHEMATICAL SCIENCES

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PART 2 | WINTER 2023 | FEB 6- MAY 19

Modules	Instructor	Lesson week of:
Introduction: Part II		
Review of the basic models of diseases transmission and immunity (2 hours)	Rebecca Tyson	FEB 6-10
Review of the models of animal, plant and human population growth (2 hours)	Rebecca Tyson	FEB 13-17
Theme 1: Vector-borne diseases		
Introduction to malaria, west nile virus, lyme disease (2 hours)	Marina Freire-Gormaly	FEB 20-24
Introduction to mathematical models of vector life stages – mosquitoes and ticks (2 hours)	Huaiping Zhu	FEB 27-MAR 3
Introduction to the mathematical modelling of vectorborne diseases without vector lifecycle model structure (2 hours)	Huaiping Zhu	MAR 6-10
Extension of vectorborne diseases models to include simple models of the vector lifecycle (2 hours)	Huaiping Zhu Pei Yuan	MAR 13-17
Discussion of vector control (1 hour)		
Group work and presentations (3 hours)	Huaiping Zhu Marina Freire-Gormaly Pei Yuan	MAR 20-24
Theme 2: Livestock diseases		
Introduction to foot and mouth disease, avian influenza (1 hour)	Julien Arino	MAR 27-31
Introduction to livestock modelling (2 hours)	Julien Arino	APR 3-6
Introduction to mathematical modelling of foot and mouth disease and avian influenza in livestock (2 hours)	Julien Arino	
Extension of the livestock models to include livestock movement (markets, trading between farms, selling for meat processing (3 hours)	Julien Arino	APR 10-14
Discussion of disease control within the livestock movement environment (1 hour)	Julien Arino	APR 17-21
Group work and presentations (3 hours)	Julien Arino	
Theme 3: Waterborne diseases		
Introduction to cholera, hepatitis A, and typhoid fever (2 hours)	Assefa Woldegerima	APR 24-28
Introduction to environmental contamination modelling (2hours)	Assefa Woldegerima	MAY 1-5
Introduction to the mathematical modelling of waterborne diseases (2 hours)	Assefa Woldegerima	MAY 8-12
Extension of the models to include public health mitigation (1 hour)		
Group work and presentations (3 hours)	Assefa Woldegerima	May 15-19

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