Summer School in Mathematical Biology Kathmandu, Nepal June 17-26, 2019

Instructors/mentors:

Stanca Ciupe, Viginia Tech, USA Jeremie Guedj, French National Institute of Health and Medical Research, France Jane Heffernan, York University, Canada Libin Rong, University of Florida, USA Elissa Schwartz, Washington State University, USA Robert Smith?, University of Ottawa, Canada Naveen Vaidya, San Diego State University, Canada Lindi Wahl, Western University, Canada Gail Wolkowicz, McMaster University, Canada

Scientific program and structure:

<u>Course 1</u>: Discrete and Continuous Population Dynamics (**Vaidya and Wolkowicz – 6 hours lecture**)

In this course, we will cover basic techniques of developing discrete models and continuous models of population dynamics. Mathematical analysis, including equilibria analysis, stability analysis and bifurcation analysis, of these systems of difference equations and systems of differential equations will be discussed in the context of population biology. Furthermore, computational methods will be explored to solve the model systems. Both single species and multiple species will be considered.

<u>Course 2</u>: Mathematical Epidemiology (Smith? and Schwartz – 6 hours lecture)

The objective of this course is to present a detailed introduction to modelling infectious diseases. We will discuss disease modelling at the population level, as these models represent some of the most classical results. We will cover a variety of topics on the mathematical modelling of infectious diseases (HIV, malaria, human papillomavirus, West Nile virus, measles, anthrax and smallpox). Topics will include vaccines, drug resistance, the basic reproductive ratio, bioterrorism and networks. Theoretical tools will include differential equation models, uncertainty/sensitivity analysis, Latin Hypercube Sampling and impulsive differential equations.

<u>Course 3</u>: Within-host Modeling (**Rong and Heffernan – 6 hours lecture**)

Within-host models have made significant contributions to the understanding of pathogenhost interactions, drug treatment and immune responses. We will introduce various models (ordinary, delay, and partial differential equations), and computational and data analysis methods used to study different virus infections (HIV, hepatitis, influenza etc).

Course 4: Evolution and Genetics (Wahl – 3 hours lecture)

An introduction to mathematical modelling in evolution and genetics will be offered. Topics will include theoretical population genetics, evolutionary dynamics and game theoretic approaches. Case studies from the evolution and genetics of infectious disease, with particular applications to developing countries, will be highlighted.

<u>Course 5</u>: Biological Data and Model Parameters (Guedj and Ciupe – 6 hours lecture)

We will cover topics from biostatistics as well as teaching methodology of biostatistics in the context of modeling biological systems. We particularly focus on parameter estimation in linear and nonlinear mixed-effects models, genomics, sensitivity analyses, model selection. **Research project:** Students will be divided into groups (4-5 students) to work in a research project. Instructors will act as mentors in the group projects. The project proposal will be presented and the actual projects will be designed during the first day of the school. Results obtained from the project work will be presented as posters during AMNS-2019 conference in Pokhara (June 27-30, 2019).

Schedule:

<u>June 17</u>:

08:30 – 09:30	-	Breakfast
09:30 - 10:00	-	Registration
10:00 – 10:30	-	Opening
10:30 – 10:45	-	Break
10:45 – 12:15	-	Vaidya + Wolkowicz
12:15 – 01:30	-	Lunch
01:30 - 03:00	-	Vaidya + Wolkowicz
03:00 - 03:30	-	Break
03:30 - 05:00	-	Research Project + Computer Lab
		[Project proposal and discussion]

<u>June 18</u>:

08:00 - 09:00	-	Breakfast
09:00 - 10:30	-	Vaidya + Wolkowicz
10:30 – 11:00	-	Break
11:00 – 12:30	-	Vaidya + Wolkowicz
12:30 – 02:00	-	Lunch
02:00 - 05:00	-	Research Project + Computer Lab

<u>June 19</u>:

08:00 - 09:00	-	Breakfast
09:00 - 10:30	-	Smith? + Schwartz
10:30 – 11:00	-	Break
11:00 – 12:30	-	Smith? + Schwartz
12:30 - 02:00	-	Lunch
02:00 - 05:00	-	Research Project + Computer Lab

<u>June 20</u>:

-	Breakfast
-	Smith? + Schwartz
-	Break
-	Smith? + Schwartz
-	Lunch
-	Research Project + Computer Lab
	- - - -

June 21:

08:00 – 09:00	-	Breakfast
09:00 – 10:30	-	Rong + Heffernan
10:30 – 11:00	-	Break
11:00 – 12:30	-	Rong + Heffernan
12:30 – 02:00	-	Lunch

02:00 – 05:00 - Research Project + Computer Lab

<u>June 22</u>:

08:00 – 09:00	-	Breakfast
09:00 – 10:30	-	Rong + Heffernan
10:30 – 11:00	-	Break
11:00 – 12:30	-	Rong + Heffernan
12:30 – 02:00	-	Lunch
02:00 – 05:00	-	Free

<u>June 23</u>:

08:00 - 09:00	-	Breakfast
09:00 – 10:30	-	Wahl
10:30 – 11:00	-	Break
11:00 – 12:30	-	Wahl
12:30 - 02:00	-	Lunch
02:00 - 05:00	-	Research Project + Computer Lab

<u>June 24</u>:

08:00 - 09:00 09:00 - 10:30 10:30 - 11:00 11:00 - 12:30 12:30 - 02:00	- - -	Breakfast Guedj + Ciupe Break Guedj + Ciupe
12:30 – 02:00	-	Lunch
02:00 - 05:00	-	Research Project + Computer Lab

<u>June 25:</u>

08:00 - 09:00	-	Breakfast
09:00 - 10:30	-	Guedj + Ciupe
10:30 – 11:00	-	Break
11:00 – 12:30	-	Guedj + Ciupe
12:30 - 02:00	-	Lunch
02:00 - 05:00	-	Project Presentation

<u>June 26</u>:

08:00 - 09:00	-	Breakfast
09:00 - 10:00	-	Closing
10:00	-	Departure for Pokhara (AMNS-2019 Conference)