

# Departmental Colloquium

Dr. Xiaomei Feng  
Yun Cheng University, China

August 20, 2018  
2:00p.m., HH-3017

*Modelling and Analyzing Virus Mutation Dynamics of Chikungunya Outbreaks*

## Abstract :

Chikungunya fever, caused by chikungunya virus (CHIKV) and transmitted to humans by infected *Aedes* mosquitoes, is now a global public threat after major outbreaks in several countries of the Americas in 2015. Recent evidence from La Réunion, Italy and China indicates the existence of a new variant of CHIKV, but the role of this new variant on the spread of chikungunya locally and globally is unclear. Here, we introduce a compartmental model that incorporates the virus mutation dynamics, and we fit the model to the 2007 epidemic data in Italy to re-examine the transmission dynamics. We conclude that earlier studies might have underestimated the basic reproduction number and hence the outbreak potential. Our estimation shows that the basic reproduction number of the considered Italy outbreak was  $R_0 = 2.035$ .

We use our model and some sensitivity analyses to examine the impact of two characteristics of the virus mutation dynamics, and our analysis shows that the shortened extrinsic incubation period has no significant influence on  $R_0$ , but the probability of transmission from mosquitoes with the mutant strain to humans does. A substantial mutation rate, combined with a high probability of mosquito-to-human transmission, gives significant potential to cause and sustain chikungunya fever outbreaks.

# Departmental Colloquium

Dr. Etienne Farcot  
University of Nottingham, UK

August 23, 2018  
2:00p.m., HH-3017

*From gene networks to cyber-security*

## Abstract:

In this talk one will hear about a class of piecewise-linear differential equations, introduced by Leon Glass to model gene regulatory networks. They have also been known to provide a description of some electronic circuits built using logical gates.

After describing the typical form of these equations and their biological interpretation, one will discuss some of their known general properties. The focus will be put on how a purely discrete approximation can be used as coarse-grained description of the underlying dynamics. Then, one will discuss more in detail an example of electronic circuit, which has been designed to serve as true random number generator. One will see how this system presents a symmetric form of chaos which can indeed be used to generate unpredictable series of integers.