

# Three Talks on Population Dynamics

**Tuesday July 6th 2010 - 13.30 until 16.15**

**Utrecht University - Buys Ballot Laboratory Room 0.83**

## Program

**13.30 - 14.15 Angel Calsina** (Universitat Autònoma de Barcelona)  
Modelling population interaction of bacteria and bacteriophages within animal intestine

**14.20 - 15.05 Ricardo Borges** (Universitat Autònoma de Barcelona)  
Equilibria and oscillations in a cyclin structured cell population model

**15.05 - 15.30** Tea and coffee break

**15.30 - 16.15 Sebastiaan Janssens** (Universiteit Utrecht)  
The Circulator, a hybrid discrete-continuous time model for size-structured semelparity

## Abstracts

### **Modelling population interaction of bacteria and bacteriophages within animal intestine**

A nonlinear model for the population interaction of Salmonella bacteria and their bacteriophages viruses taking into account convection along intestine and infection age structure of the bacteria will be presented. For the case of negligible latency time, following the lines of [1] which considers the spread of bacteria inside intestine, and generalizing results of [2], steady states and their stability will be addressed.

### References

- [1] Boldin B. Persistence and spread of gastro-intestinal infections: the case of enterotoxigenic Escherichia coli in piglets, Bull. Math. Biol. (2008) 70:2077- 2101
- [2] Zafar S. Mathematical modeling and analysis of the interaction of populations of bacteria and bacteriophages within chicken intestine, Master thesis, UAB, 2009

## **Equilibria and oscillations in a cyclin structured cell population model**

We consider a nonlinear cyclin content structured model of a cell population divided into proliferative and quiescent cells. Under suitable hypotheses, existence and uniqueness of a steady state of this model is proved by using positive linear semigroup theory. In addition, for particular values of the parameters, we show existence of solutions that do not depend on the cyclin content. We also make numerical simulations for the general case.

## **The Circulator, a hybrid discrete-continuous time model for size-structured semelparity**

In population biology a species is called semelparous if individuals reproduce exactly once during their lifetime and die immediately thereafter. Age-structured semelparous population models typically take the form of a non-linear matrix recurrence, as in the work of J.M. Cushing, N. Davydova and others.

In this talk we consider a situation in which size rather than age determines the moment of semelparous reproduction. Following up on a paper of W. Huyer from the mid-nineties, we consider a hybrid discrete-continuous time model which essentially takes the form of a time-T map pertaining to an ordinary differential equation composed with a map modeling the reproductive event. We focus on the existence, stability and bifurcation of single cohort solutions, i.e. Dirac measures. In our attempts to "lift" Huyer's finite-dimensional results to the infinite-dimensional setting of positive measures, we encounter several functional analytic and measure theoretic difficulties when trying to justify our numerical observations. Possible routes toward resolution will be discussed.