PLENARY SPEAKER

EPIDEMIC MODELS STRUCTURED BY PARASITE LOAD AND IMMUNE LEVEL

Andrea Pugliese

andrea.pugliese@unitn.it

Dept. of Mathematics, University of Trento

Keywords: immunoepidemiology, evolutionary epidemiology, immunity boosting and waning.

ABSTRACT

A growing number of researchers are developing models that link within-host infection dynamics to population-level epidemic dynamics [2].

Multiscale immunoepidemiological are relevant, for instance, in evolutionary epidemiology [4] where they also naturally allow for host heterogeneity [5], or for describing the dynamics of infections with temporary immunity [1] more accurately than SIRS models. Another area of likely interest are infections, such as varicella/zoster [3] where severe disease depends on immunological status.

The development of useful multiscale immunoepidemiological models poses strong mathematical and numerical challenges. Within this broad area, I will present some simple models whose analysis have led to interesting biological insights, and discuss some instances where a feedback arises from epidemic to within-host processes resulting into new dynamical features.

References

[1] W.F. de Graaf, M.E.E. Kretzschmar, P.F.M. Teunis, P. F. M., O. Diekmann. *A two-phase within-host model for immune response and its application to serological profiles of pertussis.* Epidemics 9, 1–7.

[2] J. R. Gog *et al.* (2015). *Seven challenges in modeling pathogen dynamics within-host and across scales*, Epidemics 10, 45–48.

[3] G. Guzzetta *et al.* (2013). *Hope-Simpson's progressive immunity hypothesis as a possible explanation for Herpes Zoster incidence data.* Am. J. Epidemiol. 177, 1134–1142.

[4] N. Mideo, S. Alizon, S., T. Day. (2008). *Linking within- and between-host dynamics in the evolutionary epidemiology of infectious diseases.* TREE 23, 511–517.

[5] A. Pugliese (2011). *The role of host population heterogeneity in the evolution of virulence.* J. Biol. Dyn. 5, 104–119.