Talks

Waning immunity and state-dependent delays

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When the body gets infected by a virus (e.g., measles, rubella, ...), the immune system develops a certain resistance against it. As a matter of fact disease-induced immunity tends to wane and, long time after recovery, an individual might become again susceptible to the virus. Exposure to the pathogen boosts the immune system, thus prolonging the time in which the individual is immune.

In this work we focus on the feedback mechanism which makes possible for certain individuals to have lifelong immunity, being regularly exposed to the infection. The mathematical model is based on a system of differential equations with state-dependent delay. We shall consider the effects of waning immunity and immune system boosting on epidemics outbreaks.

Modeling the climate envelope of some European vector species

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Climate Envelope Modeling (CEM) – also known as correlative modeling – is a Species Distribution Modeling (SDM) method assuming that the climatic envelope of the studied species, calculated in the reference period from the species distribution, is static. This assumption enables the extrapolation in temporal terms. By statistical methods or Artificial Intelligence (AI) algorithms, the model can find the correspondence between the climatic environment and the species distribution and draw the potential distribution in the reference period or in the future. A simple Climate Envelope Model was run to examine whether the climate of Europe in the 21st century will be suitable for some important Diptera vectors. Several *Phlebotomus* species (sand flies) are able to transmit the *Leishmania infantum* protozoa, causative agent of the zoonosis called leishmaniasis. *Aedes albopictus* (tiger mosquito) is one vector of the *Dirofilaria immitis* nematode (roundworm), agent of the zoonosis called dirofilariasis. The distribution map of these species were obtained from the European Centre for Disease Prevention and Control (ECDC) and REMO regional climate model (RCM) was used for acquiring the climatic data of the reference and prediction periods. The model results showed remarkable future potential expansion. The future (and in some case the present) climate of Southern Hungary seems to be suitable for *Phlebotomus ariasi, Ph. neglectus, Ph. perfiliewi, Ph. perniciosus, Ph. tobbi*, and *Aedes albopictus*. The model proved the first lethal canine dirofilariasis case in Southern Hungary (Pécs, April 2013).