Theoretical epidemiology: Outcomes and issues of the researches on infectious disease spread by population dynamic models

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The relationship with pathogens is a critical issue to all organisms including humans. Disease and parasitism are one of the most interesting aspects from ecological viewpoint. Especially, to humans, they are also important from the viewpoint of public health. These may be the leading reasons that theoretical researches of infectious disease spread have been forming a large area of research in mathematical biology, and also are the goals of research. Moreover an advantage of research on human diseases is an accumulation of records of the spread of infectious diseases in human populations. Although they are stored under the motivation of public health, they are quite helpful in drawing and verifying hypotheses by mathematical and statistical models.

In this session, first the overview of development of mathematical models of infectious disease spread was presented. Mathematical models of infectious disease spread have developed to cover various problems modifying the classic SIR model. In the analysis of the effect of vaccination, model studies guided policy making of prevention. Using an age structured model, age specific vaccination strategies can be analyzed. Heterogeneity is focused especially in sexually transmitted infection. From an evolutionary viewpoint, the evolution of virulence was focused and analyzed in various aspects. Recently, to simulate more realistic and complex society, individual based models became often used. Mathematical models in epidemiology are still facing to the challenges of emerging infectious diseases such as pandemic influenza. More effort is required to achieve the goal.

According to some of the above aspects, following three articles were suggested for voluntary review by the participants. Haegenaars et al. investigated implication of spatial heterogeneity to persistence using a meta-population model. Alexander et al. studied the effect of booster (second dose vaccination) to eradicate infectious disease completely. Finally Choo et al. discussed the evolutionary consequence of host mortality to parasite virulence.

Excellent reviews were performed and found very helpful to deeply understand the models in epidemiology. The author appreciates the cooperation of all the participants and the organizing staff.

References