DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
UNIVERSITY OF SOUTHERN DENMARK, ODENSE

Mathematics seminar

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The importance of mathematical analysis in the multiscale modelling of biological systems

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IMADA seminar room

Abstract

Biological systems, by their very nature, are multiscale entities. To be able to use mathematics to help in understanding such systems, guide experimentation and assist in the development of new therapeutics, modelling needs to encompass the effect of subcellular scale process (such as the genetic synthesis of proteins) right through to variation at the population cohort scale. The recent advent of large scale so called Systems Biology models of cellular processes (commonly systems of nonlinear ODEs) with many 10's or 100's of variables makes this a daunting task. Even more so when we are often tasked with extrapolating dynamic processes across a wide range of length- and time-scales. In this talk I will demonstrate the importance of combining model reduction with mathematical analysis and agent based modelling to show how understanding processes at one scale (in this case the cellular scale) can be used to guide and inform results at the higher population scale (the multiscellular scale). Whilst the example system here will focus on understanding bacterial systems and their response to the external environment, the overall approach is applicable to other biological systems. I will thus close by demonstrating such an approach in other areas of recent work including the modelling of fat metabolism. The talk will be accessible to both a theoretical and life science audience.

Host: Martin Svensson