Mathematical Biology Seminar

Monday, April 15, 2024

3 pm MDT - 457 CAB (in person)

Join Zoom Meeting

https://ualberta-ca.zoom.us/j/98497695684?pwd=SG5pcUVRS0xucW5xd0xBTm1VVCtEUT09

Meeting ID: 984 9769 5684
Passcode: 32123

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Spatial Particle Modeling of Immune Processes

Surface Plasmon Resonance (SPR) assays are a standard approach for quantifying kinetic parameters in antibody-antigen binding reactions. Classical SPR approaches ignore the bivalent structure of antibodies, and use simplified ODE models to estimate effective reaction rates for such interactions. In this work we develop a new SPR protocol, coupling a model that explicitly accounts for the bivalent nature of such interactions and the limited spatial distance over which such interactions can occur, to a SPR assay that provides more features in the generated data. Our approach allows the estimation of bivalent binding kinetics and the spatial extent over which antibodies and antigens can interact, while also providing substantially more robust fits to experimental data compared to classical ODE models. I will present our new modeling and parameter estimation approach, and demonstrate how it is being used to study interactions between antibodies and spike protein. I will also explain how we make the overall parameter estimation problem computationally feasible via the construction of a surrogate approximation to the (computationally-expensive) particle model. The latter enables fitting of model parameters via standard optimization approaches.