Mathematical modeling of metastasis: Predicting the invisible

Dr. Sebastién Benzekry, Institut de Mathmatiques, University of Bordeaux

Abstract

Metastasis and associated complications is the main cause of death from cancer. To address this issue, early detection is fundamental with the hope to detect the primary tumor before systemic spread occurred. Nevertheless, metastasis are often present (but invisible) when a localized disease is diagnosed. Mathematical modeling represents then an invaluable tool to predict, in a patient-specific way, the extent of the disease, based on the available information. Moreover, while anticancer agents are mostly evaluated for their action on a single tumor in preclinical studies, in the clinic they are mostly used at the systemic level and therapeutic effect can diverge between anti-primary and anti-metastatic effects. In this talk, I will present a mathematical modeling approach of the metastatic process and confront the model simulations and predictions to empirical data ranging from post-surgical development of metastasis in clinically relevant (ortho-surgical) animal models, tumor-tumor growth interactions and clinical data of either probability of metastasis (population level) or personalized prediction of metastatic development (individual level).