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Towards quantitative individual-based and continuum models of tumor multicellular aggregates

Recent development of experimental techniques permits the measurement of an increasing number of parameters necessary to parameterize quantitative models of tumor growth and cancer development.On the one hand, Individual-cell Based Models (IBMs) allow to incorporate a lot of details of cell-level behavior but are limited to the millimeter scale. On the other hand, continuum models are well adapted to larger scales but do not permit such a detailed description. Building a hybrid continuum/discrete model is a promising way to describe the multiscale behavior of tumors from the single cell up to centimeter scale. However, it requires that both approaches lead to the same predictions. Recently, Byrne and Drasdo (J. Math. Biol. 2009) studied continuum models able to capture important aspects of either compact or very diluted tumor aggregates of a previously introduced IBM that has been shown to reproduce the typical growth kinetic of monolayers and multi-cellular spheroids (Drasdo et al., J. Stat. Phys. 2007) . Here we extend this concept towards a continuum model that describes the intermediate range of phenotypes by representing the different aspects of the IBM in more detail. The growth dynamics predicted by these two models are quantitatively compared.