

**Title : Some extents of the phase-field method for the
multiphase modelling of biological entities**

by

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Abstract : Phase-field method has becoming significantly popular for modeling multiphase flow while ensuring a thermodynamic coherence of the modeled system. In mathematical biology, this method is all the more justified since the interphase separating entities is not always well defined, and its thickness can be effectively measured. However, these active systems are still challenging to compute accurately with the desired physic. In this study, we propose several improvements to the classical phase-field method. Firstly, a non-wetting condition is implemented using the mixed finite-element method which stays accurate even in complex geometry while showing very good numerical stability. Secondly, the method is extended for non chemically pure entities such as cell aggregates, which requires to re-evaluate the original expression of the chemical potential as originally derived by Cahn and Hilliard. Mathematical developments are presented, and associated relevant examples are discussed.