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AGENT-BASED MODELLING TO SIMULATE CELL- AND MULTISCALE PROBLEMS IN BIOLOGY

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ABSTRACT

Agent-based models are stochastic modelling procedures, whose most notable characteristic is to be rooted on the specification of local rules attached to the simulated objects –hence "*agent based*"– informing in turn the computed behaviours (i.e., movement, interaction, replication, death, transformation, etc.). Adoption of agent-based modelling (ABM) in biomedicine and life sciences has seen a rapid growth in the last decades, first and foremost, because ABM is very appropriate to simulate systems about which researchers have accumulated parcelled local knowledge of datasets acquired by a variety of modalities, and that are interested in exploring how to relate to emerging behaviours. Furthermore, ABM is a rule-based approach that is well-suited to integrate multiple spatio-temporal scales (e.g., intracellular processes, microenvironmental remodelling, multicellular population dynamics, cell-to-tissue and tissue-to-cell interactions, angiogenesis, immuno-surveillance, etc.).

The purpose of this minisymposium is to act as a forum for investigators to present the *state of the art* in ABM in biology and life sciences, with a focus on pathophysiology of chronic (e.g., neuro-developmental and neurodegenerative disorders, cancer, diabetes, chronic inflammation) and communicable diseases (viral infections, parasitic disorders, etc.). Together, we aim to foster the exchange of knowledge and ideas across multiple disciplines: mathematics, physics, computer science, engineering, biology, medicine.

We welcome contributions addressing challenges related to mathematical and computational modelling using ABM with particular emphasis in:

- cross-scale (from organ to tissue, cell, protein and molecular level) ABM simulations;
- challenges in numerical techniques –including high-performance computing procedures– for single scale or/and multiscale agent-based models;
- benchmarking and calibration of ABM in problems related to systems biology;
- simulations that integrate *in vitro* and/or *in vivo* laboratory experiments for ABM initialization, parametrization and/or validation;
- prognostic ABM in drug delivery, nanomedicine, immunotherapy, and radiation treatment, with special focus on optimisation of trials and *in vivo*/*ex vivo* models substitution/ complementarity.