ABSTRACT

"A Cahn-Hilliard-Keller-Segel model with generalized logistic source describing tumor growth"

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In this talk we propose a new type of diffuse interface model describing the evolution of a tumor mass under the effects of a chemical substance (e.g., a nutrient or a drug).

The order parameter, representing the local proportion of tumor cells is assumed to satisfy a suitable form of the Cahn--Hilliard equation with mass source and logarithmic potential of Flory--Huggins type (or generalizations of it). The chemical concentration satisfies a reaction-diffusion equation where the cross-diffusion term has the same expression as in the celebrated Keller--Segel model. In this respect, the model we propose represents a new coupling between the Cahn--Hilliard equation and a subsystem of the Keller--Segel model.

We believe that, compared to other models, this choice is more effective in capturing the chemotactic effects that may occur in tumor growth dynamics (chemically induced tumor evolution and consumption of nutrient/drug by tumor cells). Note that, in order to prevent finite time blowup of $¥sigma$, we assume a chemical source term of logistic type. Our main mathematical result is devoted to proving existence of weak solutions in a rather general setting that covers both the two-and three- dimensional cases. Under more restrictive assumptions on coefficient and data, and in some cases on the spatial dimension, we prove various regularity results. Finally, in a proper class of smooth solutions we show uniqueness and continuous dependence on the initial data in a number of significant cases.

This is a joint work with Giulio Schimperna and Andrera Signori.