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A MULTISCALE MATHEMATICAL MODEL FOR GLIOMA SPREAD WITH PROLIFERATION AND THERAPY

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The invasion of tumor cells into healthy tissue is a highly complex process involving several scales, from the microscopic to the macroscopic level. Furthermore, most of the events taking place on the various scales are still not completely understood.
In this work we focus on glioma, a particular invasive brain tumor, that, owing to the peculiarities of the underlying nervous tissue geometry, shows highly heterogeneous patterns and anisotropic diffusion.

We formulate a multiscale model for the glioma cell migration and proliferation, taking into account a possible therapeutic approach, in the line of well-established approaches in this field [1, 2, 3] and with the aim of comparing different models already present in literature and investigating new aspects not yet considered.

Starting with the description of a process taking place on the subcellular level, we formulate the equation for the mesoscopic level, from which we derive the macroscopic partial differential equation using a parabolic limit and the Hilbert expansions in the moment system.
After the model set up and the study of the well posedness of this macroscopic setting, we focus on the calibration of the parameters and the coefficient functions involved in the equations [4]. In particular, we first consider the fiber density function, comparing different possible choices in order to understand which approach could better describe the actual fiber density and orientation. Then, we analyze the Tumor Diffusion Tensor, deducing a realistic estimation of its coefficients from experimental data of glioma cells' migration in an aligned tissue.
Joint work with M. Groppi (University of Parma) and L. Preziosi (Politecnico di Torino).

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