



PhD in MODELLI E METODI MATEMATICI PER L'INGEGNERIA / MATHEMATICAL MODELS AND METHODS IN ENGINEERING - 40th cycle

**THEMATIC Research Field: MATHEMATICAL MODELING OF GLIOBLASTOME
MULTIFORME AND PERSONALISED COMPUTATIONAL TOOLS INTEGRATING
NEUROIMAGING DATA**

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
<p>Motivation and objectives of the research in this field</p>	<p>The thesis work will concern personalized modeling of the evolution of glioblastoma multiforme, an aggressive and extremely deadly brain tumor, based on clinical data and of neuroimaging (MRI and DTI) of patients who have given consent to a clinical study at the IRCSS Carlo Besta Institute. The final aim is to carry out a mechano-biological model and personalized simulations of tumor evolution and response to adjuvant therapy in some representative cases, testing the predictive efficacy of the model for helping decision making on the clinical management of the patient, quantifying clinical risk factors whenever possible.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The candidate will develop partial differential diffuse interface models coupled with reaction-diffusion equations and/or constitutive models of active fluids with elastic terms, to be resolved in computational domains reconstructed from available clinical data of neuroimaging. Beyond the state of the art of previous research activities in this field, we aim to refine a model based on the physics and biology of tumor invasion, incorporating the mechano-biological characteristics of cellular mobility at the tumor level, the phenotypic variability of the tumor, the glymphatic transport mechanisms of the central nervous system and the active supracellular behavior of tumor</p>



	system and the active supracellular behavior of tumor aggregates. The candidate will also develop adequate numerical techniques for solving the corresponding models, possibly integrated by complexity reduction techniques to obtain an effective and computationally inexpensive numerical approximation applied to computational domains reconstructed from available neuroimaging data.
Educational objectives	This research focuses on innovative biomathematical models and methods facing translational and interdisciplinary challenges in the context of personalised medicine of brain tumours.
Job opportunities	The research activity addresses innovative topics at the frontier of Applied Mathematics and Personalised Medicine. The PhD candidate will develop mathematical and translational skills that will open to both industrial and academic research opportunities.
Composition of the research group	2 Full Professors 0 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Proff. Pasquale Ciarletta e Paolo Zunino

Contacts

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Additional support - Financial aid per PhD student per year (gross amount)

Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad

Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Educational activities (purchase of study books and material, funding for participation to courses,



summer schools, workshops and conferences): financial aid per PhD student per year

1st year: max 1.902,40 euros

2nd year: max 1.902,40 euros

3rd year: max 1.902,40 euros

The PhD students are encouraged to take part in activities related to teaching, within the limits allowed by the regulations. 1 individual PC per student + several shared PC.

Access to one cluster with 32 processors and 384 GB RAM, and to several multi - processor servers.