2 Doctoral Candidate Positions for MSCA Doctoral Network INTRABRAIN

Funded by
the European Union

- Applications are invited for two full-time Doctoral Candidate (DC)/PhD student positions within **MSCA Doctoral Network, Intrabrain-** "Nanoplatforms and Oncolytic viruses for novel cancer immunotherapy strategies". The project is funded by the EU (Agreement number 101227308).
- **The salary** is competitive and complies with the MSCA Work Programme (Living and Mobility allowance). A conditional Family allowance can be added to the salary.
- **Intrabrain** is an **innovative multinational, multisectorial, and multidisciplinary research and training programme** that aims to create more efficacious vaccines using polymeric nanoparticles and self- assembled nanoplatforms in combination with modified oncolytic viruses to be used in glioblastoma.
- **The Intrabrain project comprises 14 (DCs) positions** with individual research projects focused on developing efficacious immunotherapy strategies to eradicate glioblastoma.
- The **two DCs** at UNITOV will be based at the Department of Biomedicine and Prevention at the University of Rome Tor Vergata. They will support the following **INTRABRAIN** activities:

- The **DC10** will focus on the preclinical development and validation of an innovative nanomedicine-based therapeutic strategy for glioblastoma (GBM).
  The overall goal is to support the development of a translational therapeutic strategy for glioblastoma, bridging preclinical validation and future clinical application. The project will investigate whether nanoparticle-encapsulated recombinant adenoviral vectors expressing IL-12 (NanorADV-IL-12) can achieve enhanced therapeutic efficacy when administered through the intranasal route, a minimally invasive approach with strong translational potential for brain tumour therapy.

  The main objective will be to design, optimise, and validate a delivery strategy capable of increasing the concentration of nanoencapsulated rADV-IL-12 in brain tumours using preclinical rodent models of GBM. The candidate will evaluate therapeutic efficacy, tumour targeting, biodistribution, safety, and biological response following intranasal administration. A central component of the project will be the use of focused ultrasound (FUS) to transiently permeabilise the blood-brain and blood-tumour barriers, thereby improving vector delivery to the tumour site. The candidate will optimise key ultrasound parameters, including acoustic pressure, duty cycle, and frequency, to maximise delivery efficiency and therapeutic outcome.

  The work will include in vitro and in vivo validation studies, including the assessment of nanoparticle-virus systems in cellular and animal models of GBM,

analysis of tumour response and immune activation, evaluation of immunogenic cell death and cytokine production, and investigation of toxicity and biocompatibility in relevant neural and tumour models. The candidate will also analyse systemic biomarkers, including circulating microparticles and antibodies in plasma, to characterise biological responses to treatment.

The candidate will benefit from **international secondments (SEC)** aimed at acquiring complementary and interdisciplinary skills, including:

- **SEC1:** HELSINGIN YLIOPISTO (HEL), Helsinki, Finland (PI:Vincenzo Cerullo). Purpose: Study MPs/Abs in plasma in the preclinical models in which rADV-IL-12 is tested. Timing: 3 months, m19-21.
- **SEC2:** TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD (TRDF), Haifa, Israel (PI:Shai Berlin). Purpose: Hands-on experience about IN delivery strategy of ADVs. Timing: 3 months, m34-36.
- **SEC3:** IMAGE GUIDED THERAPY SA (IGT), France (PI: Erik Dumont). Purpose: Learn about FUS technology for blood–brain and blood-tumour barrier permeabilisation. Timing: 3 months, m38-40.

Required Background

Applicants should have a master's degree in biotechnology, Biology, Neuroscience, Biomedical Sciences, Pharmacology, Biomedical Engineering, or related disciplines, with a strong experimental background and motivation to work in translational neuro-oncology.

Required skills and experience:

- Hands-on experience in laboratory work under sterile conditions, including work in a cell culture hood.
- Experimental thesis or equivalent research experience in neuroscience, cancer biology, molecular biology, biotechnology, pharmacology, or a related field.
- Familiarity with molecular and cellular biology techniques, including at least some of the following: Immunohistochemistry (IHC), Immunofluorescence (IF), Western Blot (WB). Cell viability, cytotoxicity, or immune-response assays.
- Ability to work accurately with biological samples and preclinical experimental protocols.
- Strong motivation to work in an interdisciplinary environment combining neurobiology, nanomedicine, viral vectors, ultrasound-mediated delivery, and cancer immunotherapy.

Preferred Experience:

The following will be considered a strong advantage:

- Experience with animal experimentation and in vivo disease models.
- Experience with glioblastoma, brain tumour, or neuro-oncology models.
- Stereotaxic surgery or other neurosurgical procedures in rodents.
- Development, maintenance, or characterisation of animal models.
- Therapeutic ultrasound, focused ultrasound, or neural stimulation systems.
- Electrophysiology or functional assessment of neural systems.
- Experience with viral vectors, especially adenoviral vectors.
- Experience with nanoparticles, drug delivery systems, or biomaterials.

Additional Desirable Skills:

Given the interdisciplinary nature of the project, the following competences will be positively evaluated:

- Basic knowledge of immunology, tumour immunology, and the tumour microenvironment.
- Familiarity with cytokine and chemokine analysis, for example ELISA, multiplex assays, or flow cytometry-based methods.
- Exposure to advanced in vitro models, including co-cultures, neuron-glia cultures, organoids, or patient-derived tumour models.
- Experience with imaging-based quantification, histological analysis, or biodistribution studies.
- Data analysis skills using tools such as ImageJ/Fiji, GraphPad Prism, Python, R, MATLAB, or similar platforms.
- Interest in translational research and in the development of innovative therapeutic strategies for brain tumours.
- Good organisational skills, ability to work independently, and willingness to collaborate across international academic and industrial partners.

- The **DC14** will work on the development of advanced computational approaches for the integration and analysis of multimodal imaging data in glioblastoma.

  The project aims to generate high-resolution quantitative maps of tumour characteristics and therapeutic response by combining data from multiple imaging modalities and spatial biology platforms. The overall goal is to create a computational framework capable of supporting image-guided evaluation and optimisation of therapeutic strategies for glioblastoma.

  The candidate will design and implement an integrated computational pipeline combining advanced MRI, PET imaging, optical fluorescence imaging, and spatial biology approaches, including multiplex immunofluorescence (mIF). This framework will enable detailed spatial and temporal mapping of tumour microenvironment features, including pH, protein and lipid composition, apoptosis, and oncolytic virus biodistribution.

  A central component of the project will be the development of advanced artificial intelligence models for multimodal data integration. These will include physics-informed neural networks (PINNs), multitask learning frameworks, and potentially transformer-based encoder-decoder architectures for modelling spatial and temporal dependencies across imaging modalities. The candidate will also work with synthetic datasets, including MR fingerprinting simulations based on Bloch-McConnell equations, incorporating noise, field inhomogeneities, and biological variability to improve model robustness and generalisation.

  The project will further focus on the validation of imaging biomarkers by correlating multimodal imaging outputs with molecular and spatial biology data. Particular attention will be given to investigating oncolytic virus-induced apoptosis mechanisms by linking imaging markers, including cleaved caspase-3, with virus biodistribution and biochemical changes in the tumour microenvironment.

  The candidate will benefit from **international secondments (SEC)** to strengthen interdisciplinary expertise, including:

  - **SEC1:** UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II (UNINA), Naples, Italy (PI: G. Condorelli) Purpose: to learn about spatial biology imaging tools in pathology. Timing: 1 months, m14.
  - **SEC2:** TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD (TRDF), Haifa, Israel (PI: Shai Berlin). Purpose: Apply advanced MRI techniques and integrate these with other imaging modalities for comprehensive analysis. Timing: 3 months, m20-m22.
  - **SEC3:** HELSINGIN YLIOPISTO (HEL), Helsinki, Finland (PI: Vincenzo Cerullo). Purpose: Validate fluorescence-tagged oncolytic virus efficacy and correlate optical imaging and PET-derived molecular maps. Timing: 3months, m30-33.

  Required Background:

  Applicants should have a Master's degree in Medical Physics, Biomedical Engineering, Computer Science, Data Science, Applied Mathematics, Physics, Bioengineering, Computational Biology, Neuroscience, or related disciplines, with a strong quantitative and computational background.

Required skills and experience:

- Strong programming skills, preferably in Python, MATLAB, or similar scientific computing environments.
- Experience with data analysis, numerical modelling, machine learning, or image processing.
- Familiarity with biomedical imaging, medical image analysis, or quantitative imaging methods.
- Good understanding of statistics, model validation, and reproducible data analysis.
- Ability to work with complex datasets and to develop structured computational workflows.
- Strong motivation to work in an interdisciplinary environment combining artificial intelligence, biomedical imaging, spatial biology, and neuro-oncology.

Preferred Experience
The following will be considered a strong advantage:

- Experience with MRI data analysis, quantitative MRI, MR fingerprinting, or MRI physics.
- Familiarity with PET imaging, optical fluorescence imaging, or multimodal imaging datasets.
- Experience with medical image registration, segmentation, feature extraction, or radiomics.
- Experience with machine learning or deep learning frameworks such as PyTorch, TensorFlow, JAX, or similar tools.
- Knowledge of physics-informed neural networks, multitask learning, transformer models, Bayesian modelling, or uncertainty quantification.
- Experience with synthetic data generation, simulation-based learning, or modelling of noise and imaging artefacts.
- Familiarity with Bloch equations, Bloch-McConnell modelling, or other biophysical modelling approaches.
- Experience with Linux, version control, high-performance computing, or reproducible research workflows.

Additional Desirable Skills

- Given the interdisciplinary nature of the project, the following competences will be positively evaluated:
- Basic knowledge of cancer biology, glioblastoma, tumour microenvironment, or immunotherapy.
- Familiarity with oncolytic viruses, viral biodistribution, or therapy-response modelling.
- Exposure to multiplex immunofluorescence, spatial biology, digital pathology, or microscopy image analysis.
- Experience integrating imaging data with molecular, histological, or spatial omics data.
- Knowledge of biomarker validation and cross-modality comparison.
- Interest in translational imaging and in the development of computational tools that can support preclinical and clinical decision-making.
- Strong communication skills and willingness to collaborate with experimental, clinical, and computational partners across the INTRABRAIN network.

Selection process

Applicants candidates interested in Intrabrain's Doctoral Candidate (DC) positions are kindly requested to fill and submit the application form via email. Please send **a single PDF file** containing your application to the main supervisor Prof. Nicola Toschi at nicola.toschi@uniroma2.eu

MSCA-DN eligibility requirements:

- **Doctoral Candidate requirement**: The applicant must not be in possession of a doctoral degree on the first day of employment. Researchers who have successfully defended their doctoral thesis, but who have not yet been awarded the doctoral degree are not eligible.

- **Mobility rule:** At the time of recruitment by the recruiting beneficiary (University of Rome Tor Vergata), researchers must not have resided or carried out their main activity (e.g., work and studies) in the country of their recruiting beneficiary (Italy) for more than 12 months in the 36 months immediately prior to their recruitment. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status under the Geneva Convention are not considered.
- **English language:** Network fellows (DCs) must demonstrate that their ability to understand and express themselves in both written and spoken English is sufficiently high for them to derive the full benefit from the network training.
- Prior experience in working with nucleic acids and cancer cells is considered a plus.

The application must contain the following documents as a single pdf, all provided in English:

- Filled INTRABRAIN DC application form
- Curriculum Vitae (max 2 pages)
- Cover letter (max 1 page): Indicate your motivation to apply for the specific DC position and your skills that are specifically adapted to the chosen topic, providing support evidence to your arguments.
- Certificate of Master's Degree (or equivalent) with transcript of records.
- Proof of English proficiency
- Contact details of 2 previous supervisors or employers who can give recommendation letters
- List of publications, if applicable.
- Manuscript of listed publication, if applicable.
- Work/research experience certificates, if applicable.
- All official certificates should be provided in their original European language or associated official English translation for non-European documents. If you are applying for a country different from your native country, an English supplement of the certificates with transcripts should also be provided.

We appreciate your attention to this requirement and look forward to reviewing your application.

The deadline for application is **04/06/2026.**